Ethnobotany of *Agave lecheguilla* and *Yucca carnerosana* in Mexico's Zona Ixtlera[1]

SAM SHELDON[2]

In the drylands of northcentral Mexico campesinos known as ixtleros *or* talladores *gather ixtle, a hard fiber derived from the uncultivated plants lechuguilla (*Agave lecheguilla *Torr.), and palma samandoca (*Yucca carnerosana *[Trel.] McKelv.). Ixtleros sell most of the fiber they collect, and the region in which ixtle is currently exploited for commercial purposes is called the Zona Ixtlera. Unsold fiber is converted into rope and brushes in ixtlero communities and used for a variety of purposes. Various parts of lechuguilla and palma samandoca are also employed to meet local construction, cleansing, and dietary needs.*

Mexico's longstanding tradition of desert plant use and desert plant industries is particularly significant today in the country's northcentral drylands where a large rural population continues to rely on uncultivated plants for part of their existence. The utilization of these plants and plant derivatives remains an integral part of day-to-day living in the area for 2 reasons: the plants are used for a variety of utilitarian purposes in rural communities, and a select few are exploited for their commercial value. The most notable plants in this latter category include: candelilla (*Euphorbia antisyphilitica* Zucc.), valuable because its leafless stems exude a white wax used as a hardener for soft waxes in candles, polishes, chewing gum, and leather goods; guayule (*Parthenium argentatum* Gray), a shrub whose roots and stems contain a latex that closely resembles that extracted from the rubber tree *Hevea brasiliensis*; and lechuguilla (*Agave lecheguilla* Torr.) and palma samandoca (*Yucca carnerosana* [Trel.] McKelv.), from which a hard fiber, ixtle, is extracted that has widespread application in the brush industry. This paper details the commercial significance and domestic usage of *Agave lecheguilla* and *Yucca carnerosana* in a region of northcentral Mexico known as the Zona Ixtlera.

HISTORICAL BACKGROUND

Lechuguilla and palma samandoca have been significant components of the material culture of Mexico's dryland inhabitants for millennia. Archaeological evidence indicates that lechuguilla fiber was used in northcentral Mexico as early as 8080 B.P. (Crane and Griffin, 1958, p. 1120). Excavations at Frightful Cave in central Coahuila state unearthed large quantities of ixtle cordage and sandals, and burial sticks made from *Agave lecheguilla* and *Yucca carnerosana* flower stalks have been discovered at numerous sites in the Coahuila complex (Taylor, 1966, pp. 73–74; 1972, p. 171). When the Spanish arrived in northern Mexico in the sixteenth century they encountered nomadic hunters and gatherers (the Chichimeca) making arrow shafts from *Agave* flower stalks and bow strings from

[1] Submitted for publication 12 March 1980; accepted 1 July 1980.

[2] Assistant Professor of Geography, St. Bonaventure University, St. Bonaventure, New York 14778.

Economic Botany, 34(4), 1980, pp. 376–390

ixtle (Griffen, 1969, p. 106; Mason, 1893, p. 645). Rural folk who currently gather uncultivated plants in the Zona Ixtlera are therefore perpetuating a centuries old way-of-life that has, in part, been reinforced by the commercialization of ixtle.

PLANT DESCRIPTION

Although found in similar environments, *Agave lecheguilla* and *Yucca carnerosana* are markedly dissimilar in appearance. Lechuguilla consists of a rosette of 25–50 green leaves radiating from the ground without an exposed trunk (Fig. 1). The leaves are thick, stiff, 3–4 cm in width, and 30–50 cm in length. Each leaf terminates in a sharp spine 25–40 mm long, and its margins are bordered with hooklike barbs 3–8 mm long, 20–40 mm apart. Outer leaves of the lechuguilla plant are hard, coarse, and difficult to work. Younger, more tender leaves, grow in a tightly formed cluster, or *cogollo,* at the plant's center. It is from this central bud of unopened leaves that the commercially viable fiber (ixtle de lechuguilla) is extracted. Lechuguilla's lifespan is contingent upon the time and frequency of the cogollo's removal. At approximately 6 yr of growth, the center bud contains a marketable fiber. If the plant is not harvested, the cogollo grows into a 2–3 m high stalk (*garrocha*) bearing light-yellow flowers, and shortly thereafter the plant dies. Conversely, if the cogollo is removed during the sixth year of growth, and periodically cut thereafter, the plant may live 15–20 yr before dying (Patoni, 1917). The time required to regenerate new cogollos after cutting varies with rainfall conditions. If precipitation occurs in sufficient quantities, a new center bud can be ready for harvesting in 6 mo. During drought periods, regeneration may require as long as 1 yr (González C. and Scheffey, 1964, p. 42). *Agave lecheguilla* reproduces vegetatively, with young shoots (*hijuelos*) being emitted by the rhizomes of the mother plant. Field studies conducted at experimental stations in northcentral Mexico indicate that the greater the exploitation of the cogollo, the more rapid the increase in the number of new hijuelos (Campa and Barragán, 1974, p. 34).

Lechuguilla frequently grows in such dense clusters on rocky soils along limestone slopes that human and animal mobility is impeded. Plant densities as high as 770/100 m^2 have been recorded by the Instituto Nacional de Investigaciones Forestales (INIF) at its experimental station in La Sauceda, Coahuila (Pérez Rosales, 1964, p. 24).

Unlike lechuguilla, *Yucca carnerosana* is arboreal (Fig. 2). The plant develops initially as a rosette of long, narrow leaves radiating from the ground, but eventually the rosette surmounts a trunk 1.5–6 m high. Trunks are rarely branched, a characteristic that helps distinguish palma samandoca from other species of *Yucca* growing in the region. Leaves that crown the trunk are a dark, dull green, 60–110 cm long, 6–8 cm wide, and 4–8 mm thick. They are concave, rigid, and terminate in a sharp point, with coarse, brown, curled fibers projecting out of the margins near the point. As with lechuguilla, exterior leaves are hard, and fiber (ixtle de palma) is extracted from the younger, more tender leaves of the cogollo. Palma samandoca's meter-long flower stalk is crowned with a dense cluster of cream-white flowers. In contrast to lechuguilla, the plant does not die after flowering, and under favorable rainfall conditions the same plant may flower twice a

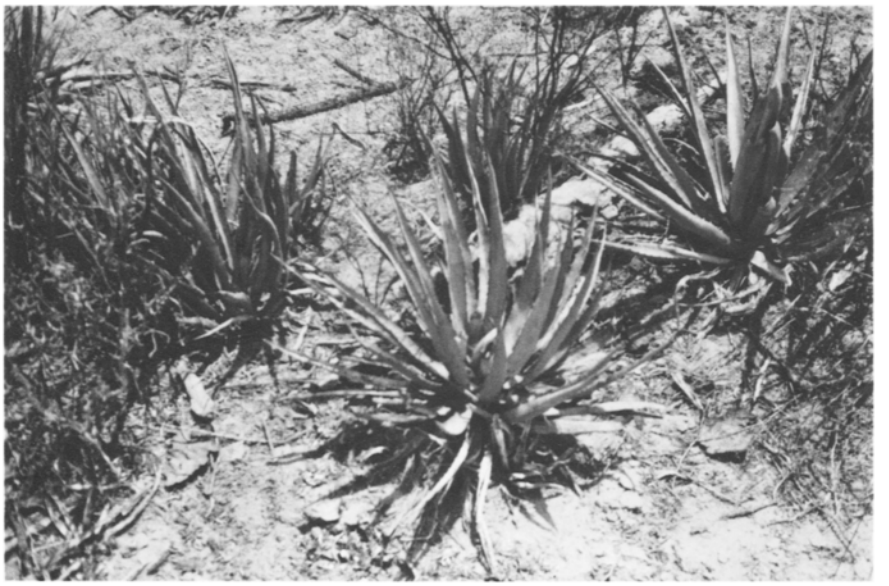

Fig. 1. *Agave lecheguilla* in the countryside near Concepción del Oro, Zacatecas. All photos by author.

year. Palma samandoca's life-span is 50–75 yr, reproducing either vegetatively or from seed (González C. and Scheffey, 1964, p. 51).

Yucca carnerosana extends from valley bottoms to the crests of sierras at ca. 3,000 m elevation in northcentral Mexico, but it grows in greatest profusion on alluvial fans at the base of limestone mountains. Even in its most abundant state, densities of palma samandoca are considerably lower than those for lechuguilla. Maximum densities recorded for *Yucca carnerosana* at INIF's experimental station at La Sauceda are 45/100 m^2 (Pérez Rosales, 1964, p. 26).

PLANT DISTRIBUTION AND THE ZONA IXTLERA

Within Mexico the spatial distribution of *Agave lecheguilla* and *Yucca carnerosana* is coincident with the location of calcareous soils and rocks in the central and eastern sections of the Mesa del Norte and in sedimentary formations along the western foothills of the Sierra Madre Oriental. Limestone is the prevalent material in these regions, and the slow weathering of limestone rocks in an arid environment produces shallow soils and stony surfaces on which lechuguilla and palma samandoca thrive.

Lechuguilla covers a surface area of 11,020,000 ha in Coahuila, Nuevo León, San Luis Potosí, Tamaulipas, Zacatecas, Chihuahua, and Durango, and palma samandoca is spread over 10,970,000 ha in the same 7 states (Martínez and Maldonado, s.f., pp. 20, 25). However, the area within which ixtle is exploited for commercial purposes is considerably more restricted than the areal distribution of the two plants. For example, Marroquín and associates (1964, p. 162) inventoried flora in northcentral Mexico and reported that in Chihuahua, Coahuila, Durango, Zacatecas, and San Luis Potosí, *Agave lecheguilla* covered 142,115

Fig. 2. *Yucca carnerosana* on rocky limestone slopes southwest of Saltillo, Coahuila.

km², of which only 41,035 km² (28.8%) was harvested. Corresponding figures for *Yucca carnerosana* were 61,185 km², 31,420 km², and 51.3%.

Commercial harvesting of fiber from lechuguilla and palma samandoca is currently restricted to sections of Coahuila, Nuevo León, San Luis Potosí, Tamaulipas, and Zacatecas. This region is known locally as the Zona Ixtlera (Fig. 3). Rural folk, or campesinos, who collect and market fiber in the Zona Ixtlera are called *ixterlos* or *talladores*. Most of the fiber collected by ixtleros is sold to La Forestal, F.C.L. (Federación de Cooperativas Limitadas), a government-subsidized organization empowered with exclusive control over the purchase, processing, and export of ixtle.

The Zona Ixtlera has experienced a marked spatial contraction during the past 3 decades. In the 1950 Mexican agricultural census, a total of 79 municipios in the states of Coahuila, Nuevo León, San Luis Potosí, Tamaulipas, and Zacatecas are cited as ixtle producers (Secretaría de Economía, 1957). The 42 municipios that comprise the present-day Zona Ixtlera represent about half of the 1950 total (Fig. 4). Diminution of the Zona Ixtlera is explained by the emergence of economic alternatives in former fiber-producing communities, and by La Forestal's

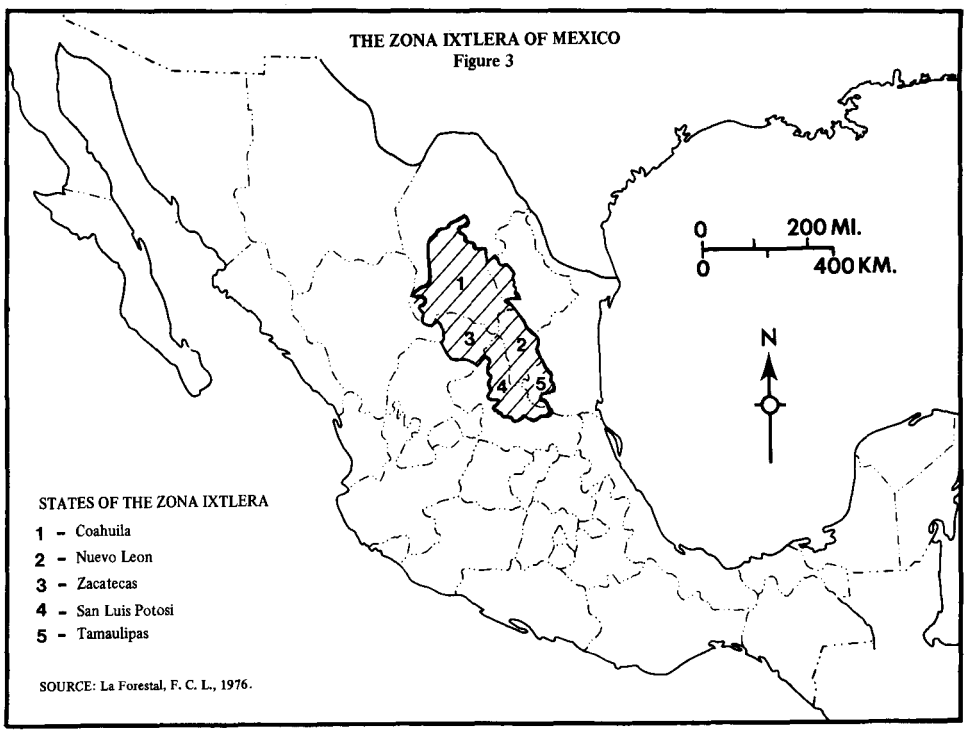

Fig. 3. Map of Mexico with the Zona Ixtlera.

attempts to increase the efficiency of their operations. Municipios in which production was limited because campesinos devoted most of their energies to other activities have been abandoned by La Forestal. The company has also relinquished control in outlying areas where excessive transportation costs have reduced, or altogether eliminated, profit margins. In effect, the current Zona Ixtlera represents an institutionally defined area within which La Forestal has chosen to maximize its economic operations. Lechuguilla and palma samandoca continue to be exploited for their fiber beyond the Zona Ixtlera, but ixtle is no longer sold commercially, or it is not done so legally, because La Forestal maintains a monopoly over the purchase of fiber, and the company is not operating outside the Zona Ixtlera at the present time.

Although the spatial dimensions of the Zona Ixtlera have contracted since 1950, the number of communities associated with La Forestal has steadily increased. When La Forestal first incorporated in 1940, only 79 ixtlero villages affiliated with it. By 1967 the number of settlements economically linked to La Forestal exceeded 1,000, and in 1978 the agency was purchasing fiber from 1,761 communities. The type of community to which the majority of ixtleros belong is the *ejido,* a collective land-holding unit whose immediate existence dates from the Agrarian Revolution of 1910. Within each ejido cooperativas organized and operated by ixtleros function as the vehicle by which they share in the benefits of La Forestal's profits and socio-economic programs. Cooperative members also act as a collective body when purchasing foodstuffs and agricultural necessities from government agencies.

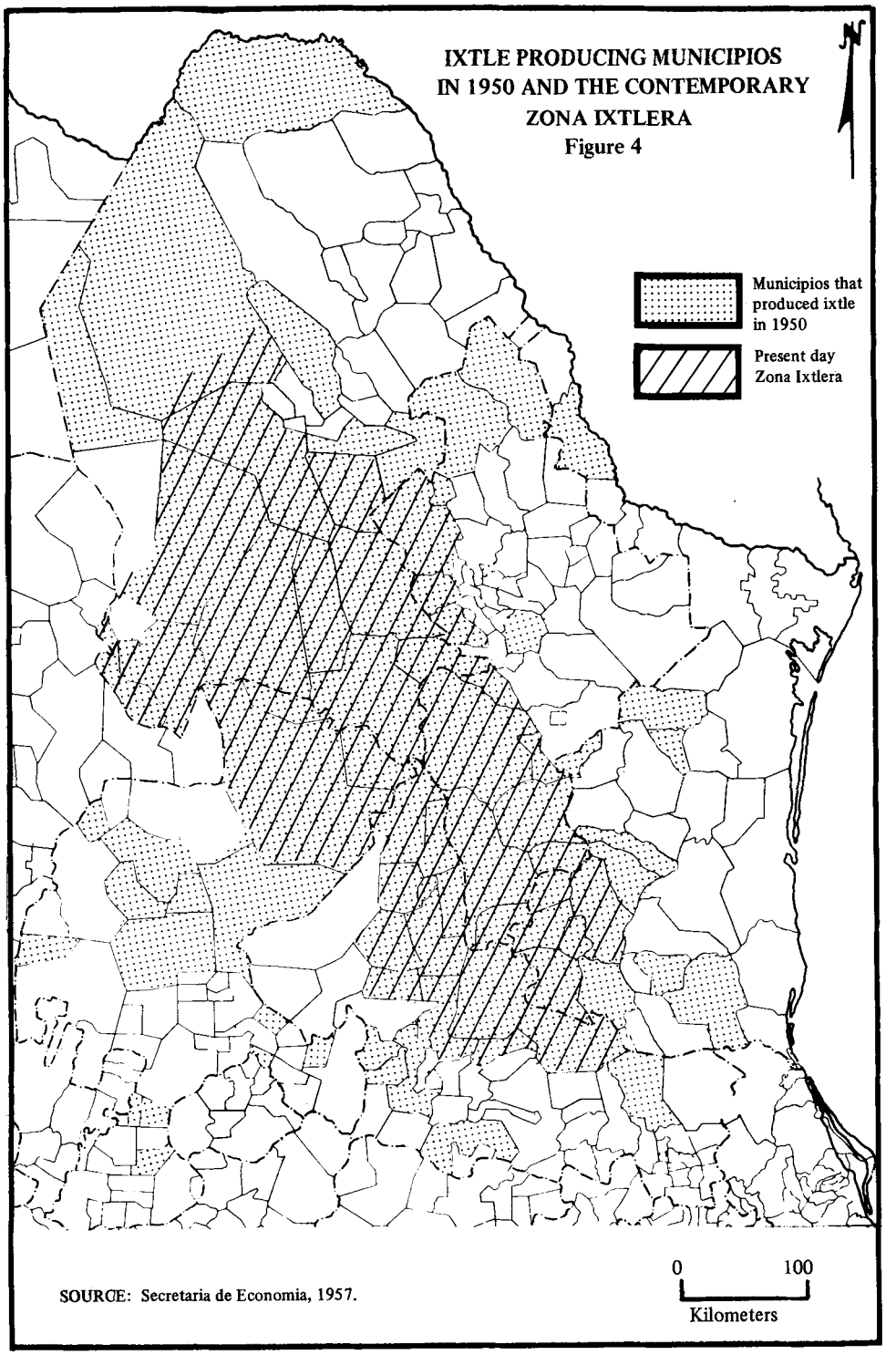

Fig. 4. Map of the ixtle-producing municipios in 1950 and the contemporary Zona Ixtlera.

The number of campesinos whose livelihood is dependent upon fiber collected from lechuguilla and palma samandoca in the Zona Ixtlera varies annually according to rainfall conditions, and the attendant situation for agriculture. When precipitation occurs in sufficient quantities ixtleros readily abandon the arduous task of collecting fiber for the less strenuous and more remunerative labors of crop cultivation. Conversely, when rainfall is limited and farming difficult or impossible, the number of people who collect and sell ixtle increases. Furthermore, it is impossible to identify what percentage of the ixtlero population is wholly dependent on the fiber because many talladores supplement their income by selling agricultural and livestock products in neighboring urban marketplaces. Analysis of the IX Censo General de Población, 1970, coupled with individual and Mexican government agency estimates indicates that the ixtle-gathering population fluctuates from 400,000 during "good" agricultural years, to 650,000 during years when farming is limited and the only assured source of income is from the sale of fiber (Quillares Lona, 1971; La Forestal, 1976, p. 26; Instituto Nacional Para el Desarrollo de la Comunidad Rural y de la Vivienda Popular, s.f., p. 1).

IXTLE'S COMMERCIAL APPLICATIONS

Although domestic utilization of ixtle is a folk-tradition of long standing in Mexico, the fiber's commercial history dates only from the nineteenth century (Kirby, 1950, p. 245). Ixtle's durability makes it ideally suited for incorporation into a variety of manufactured items, and by 1900 large quantities were being marketed both domestically and internationally. In Mexico ixtle de palma became a significant constituent in the sack industry, while ixtle de lechuguilla was utilized in a diverse array of brush types by growing numbers of foreign buyers. Lechuguilla fiber emerged as a particularly important commodity in international trade by the late nineteenth century. Between 1890 and 1896, for example, Mexico annually exported 6 mill kg of the fiber to overseas markets (Romero, 1898, p. 164).

Market demands for ixtle have oscillated dramatically during the twentieth century, but a succession of government-supported organizations have sustained the industry by purchasing fiber from local residents at fixed prices. La Forestal is the most recent of the government-subsidized organizations charged with the responsibility of maintaining the ixtle industry in Mexico's northern drylands. The agency pays a set price for fiber collected by talladores, and its fleet of over 100 trucks collects ixtle from ejido cooperatives at periodic intervals and transports it to one of 30 regional storage centers, or *agencias recopiladoras*. Fiber is sorted and rebundled at the regional centers prior to being transferred to one of 4 La Forestal factories situated in the Zona Ixtlera. There, the fiber is semiprocessed and shipped by rail and truck to Mexican ports for exports to overseas markets, most notably the United States and Western Europe.

Ixtle remains an important item of international commerce because the fiber possesses particular qualitative aspects of resiliency, texture, and water absorbency that make it a superior fiber for some applications, and an indispensable one for others. It is commonly converted into power-driven cylinder brushes and used for a variety of cleaning and buffing purposes in steel mills and metal fabricating plants. Ixtle has not been satisfactorily replaced in either industrial or

home-type rotary floor scrubbers and polishers, and it is still widely employed in its pure state, or in combination with horsehair, in floor sweeps, counter dusters, calcimine brushes, roofing brushes, pastry brushes, and to some degree in scrub and bowl brushes. Most manufacturers of household, maintenance, or industrial brushes use some quantity of ixtle fiber in products that parallel brushes made from plastic fibers (Bailey, 1976, personal correspondence).

DOMESTIC UTILIZATION OF LECHUGUILLA AND PALMA SAMANDOCA

The financial benefits accruing from the collection and sale of ixtle are meager, but they represent the only assured source of revenue available to the tallador. Consequently, the well-being of most rural families in the Zona Ixtlera rests on their ability to exchange ixtle for cash and goods. But the significance of *Agave lecheguilla* and *Yucca carnerosana* to Zona Ixtlera residents transcends a purely economic role. Different parts of both plants are variously employed in ejidos of northcentral Mexico, and their utilitarian value is evident in the material culture of the tallador and his family.

Fiber

The most commonly utilized part of the 2 plants is the fiber. Tallador families use a variety of ixtle products (Fig. 5), but the most ubiquitous application of the fiber is its incorporation into cordage. Ixtle rope (*mecate*) is used to hold, carry, support, and bind objects ranging from babies to burros. It is employed for clotheslines, saddle cinches, carrying harnesses, bridles, and animal tethers, and is fabricated into sacks, brooms, baskets, and a wide assortment of children's paraphernalia.

Fiber from both lechuguilla and palma samandoca is utilized as cordage throughout the Zona Ixtlera, but most campesinos prefer the former because it is cleaner and easier to work. Lechuguilla is also believed to be more durable, a feeling substantiated by tensile strength tests conducted in laboratory-controlled situations (Mesa A. and Villaneuva V., 1948, p. 220).

Converting fiber to rope is a simple procedure, but the process requires the efforts of 2 people. One man sits in front of a Y-shaped wooden frame implanted in the ground. Lodged between the forked ends of the Y is a metal spindle secured by means of bolts located on the outside of the frame. The individual seated beside this apparatus entwines a small length of ixtle rope around the spindle and sets it in motion by rapidly working the rope back and forth with his hands. Fiber destined to become rope is initially prepared by sorting the strands and shaking out particles of dirt and dried leaf pulp. It is then consolidated into loose bundles from which a few threads are tied to the bolted end of the spindle. As the spindle is rotated by the seated worker his accomplice walks backward, slowly releasing small amounts of fiber from the ixtle bundle he carries in his hands (Fig. 6). The gyrating spindle unites the loose strands into a slender rope of increasing length. After this initial filament is fashioned, the procedure for making rope of greater thickness varies. One method involves doubling and redoubling the original strand until the desired width is achieved. More common is the practice of making distinct multiple strands and combining them into a single rope. Mecates

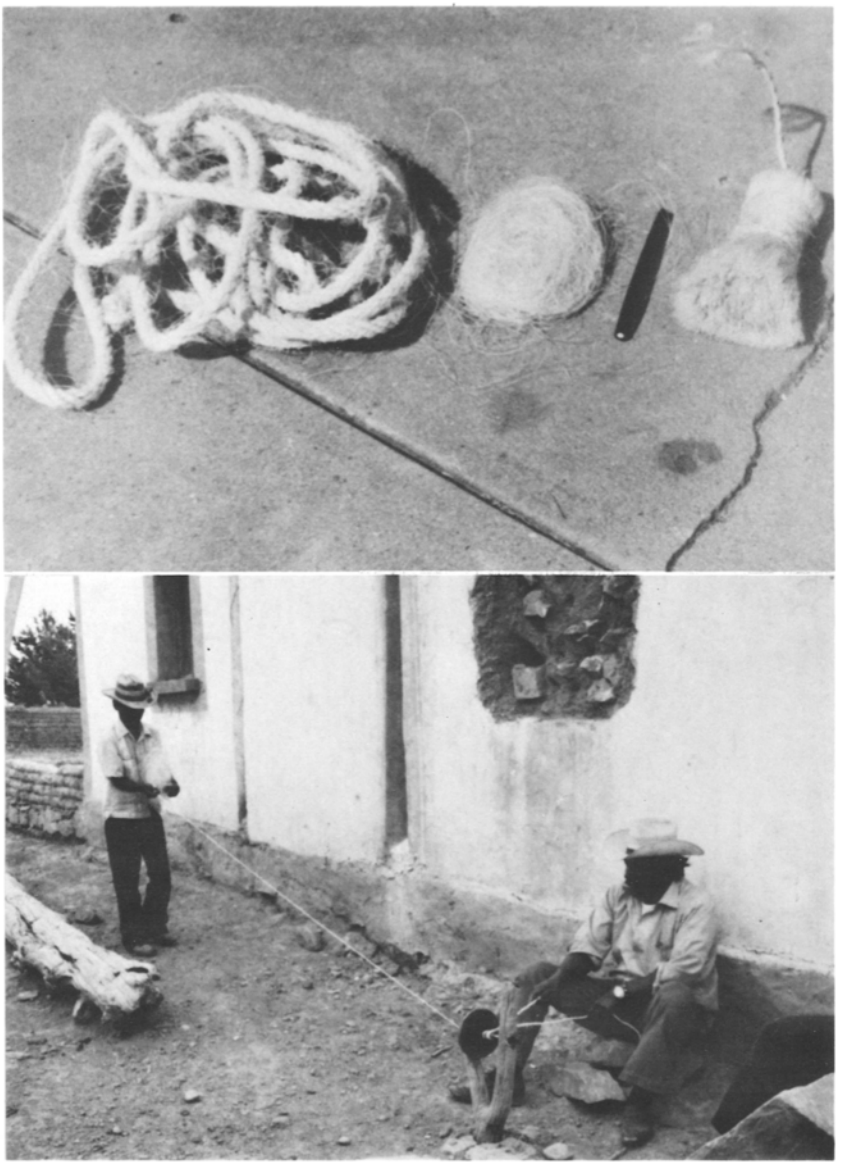

Fig. 5. Three common uses of ixtle fiber in the Zona Ixtlera. From left to right: rope (*mecate*); scrub pad (*estropajo*); brush (*peine*). All 3 items are made of lechuguilla fiber.

Fig. 6. Loose ixtle bundle being converted into rope in Independencia ejido, Coahuila. The ixtleros transformed the unconsolidated fiber into a rope 4 m long in less than 15 min.

require little time to make. Two workers can transform a one-half kilo bundle of ixtle de lechuguilla into a rope 5 m long and 5 cm in diameter in 20 min.

Brushes made of ixtle are commonplace items in the talladores household inventory. These brushes, called *peines* (Fig. 5), serve a dual purpose in the live-

lihood of Zona Ixtlera residents. In ejidos they are used for a variety of practical purposes, and as a marketable commodity in nearby urban communities they provide a source of supplemental income to ixtlero families. In both countryside and city, peines are employed as kitchen utensil cleaners, paint brushes, floor scrubbers, and curry combs for animals.

Making a peine is a relatively simple procedure. A small quantity of ixtle is sorted out, doubled into a compact unit, and tightened by wrapping a slender rope around its middle. Brush ends are made uniform by severing loose strands with a knife. Peines come in a variety of sizes, but most are 15 cm in length and 10–15 cm in width.

The incorporation of ixtle into rope, and its conversion into a diverse array of brush-types, is prevalent throughout the Zona Ixtlera. Less frequent is utilization of the fiber as a scrub pad, or *estropajo* (Fig. 5), used in combination with soap to cleanse the human body. Estropajos are loose strands of ixtle de lechuguilla kneaded into hand-sized circular pads. Their use varies considerably from community to community. In some ejidos estropajos are employed as a cleansing aid by almost all the residents while in other settlements they have been replaced by sponges and other less abrasive items. One of the factors mitigating against greater utilization of the estropajo is its rustic crudeness. Store-bought items have supplanted estropajos in many communities merely because they connote a measure of "progress" to ixtleros.

Rootstock

Agave lecheguilla rootstocks (*amoles*) are widely exploited for their cleansing properties in the Zona Ixtlera. Rootstocks of living plants are high in sapogenin content, and the soapy solution that forms when root fragments are placed in water and agitated effectively eradicates dirt. The utilization of rootstock soap as a clothes cleaner has been reported for other parts of northern Mexico (Pennington, 1957, p. 96; 1963, p. 212; Latorre and Latorre, 1977, p. 356), but within the Zona Ixtlera it is primarily used as a shampoo. Older women in some ejidos remember when soap from lechuguilla was employed to wash fabrics, but in recent years commercial detergents have become the preferred cleaning agents.

Sapogenins are found only in the amoles of living plants. Amoles are kicked or dug out of the ground, and a few basal leaves are separated from the rootstock prior to its being severed from the remainder of the plant (Fig. 7). The freshly decapitated amole is cleaned by removing peripheral roots, soil, and other extraneous matter. A heavy blunt object (usually a stone) is employed to crush the rootstock, and segments of the fleshy interior are soaked in water for 5–10 min. The soapy lather that results from stirring this mixture retains its cleaning effectiveness for as long as 2 wk.

Although amole soap is used almost exclusively as shampoo in ixtlero villages, the degree to which it is applied for this purpose varies from community to community. In some ejidos, no other cleaning agent is used. In others, the amole solution has been replaced by commercially produced soaps. In general, its use is most prevalent in the poorest ejidos, or in those farthest removed from outside influences.

Leaves

Lechuguilla leaves contain the same saponaceous properties found in the rootstock of the plant, and they therefore possess similar cleaning capabilities. During decortication the primary goal of the tallador is to extract and accumulate the commercially redeemable ixtle. But in the process of separating fiber from leaf, a sizable quantity of residual leaf pulp and loose border spines, *guishe,* is also amassed. This combination of soapy leaf pulp and abrasive spines makes guishe an efficient cleanser, a fact long recognized in Mexico. Almost a century ago Newberry (1887, p. 43) observed the use of guishe in Mexico and the southwestern United States and remarked, "the most effective soap plant of this region is the lechuguilla, of which the parenchyma of the leaves is thought by inhabitants of the country where it grows to be better than the best soap for washing." Contemporary residents of the Zona Ixtlera use guishe in the kitchen where small amounts of it are combined with water to scrub pots, pans, and dishes.

Decortication of both lechuguilla and palma samandoca leaves produces guishe, but the lechuguilla by-product is much preferred by ixtleros. An absence of lateral spines on palma samandoca leaves reduces the abrasiveness of guishe derived from the plant. More significantly, palma samandoca cogollos are steamed prior to decortication, an operation that reduces the potency of leaf saponins and renders guishe less effective as a detergent. Moreover, boiling imparts to the leaf fabric a brown color that makes palma samandoca guishe as dirty in appearance as the utensils it is designed to clean.

Fruits

Inhabitants of northcentral Mexico have long taken advantage of the nutritive properties of *Agave lecheguilla* and *Yucca carnerosana.* Cogollos of lechuguilla were boiled and served as a common staple, *mezcal,* by nomadic Indian bands who occupied the area prior to Spanish arrival in the New World (Leon, 1649, p. 20). Today, only the fruits (*dátiles* or *chevitos*) of palma samandoca remain a significant part of the ixtlero diet. Dátiles grow along the upper half of the *Yucca carnerosana* flower stalk. They are frequently detached from the stalk and consumed in the field by ixtleros during the work day. In the kitchen the pale green dátiles are used in combination with different vegetables to make salads, or they are mixed and cooked with such ixtlero staples as beans and tortillas.

Flower stalks and plant trunks

Of the numerous uses to which by-products of lechuguilla and palma samandoca are applied in ixtlero settlements, the most conspicuous is in the construction of rural dwellings and ancillary enclosures. Walls and roofs of residences and outbuildings are frequently constructed of palma samandoca trunks and lechuguilla flower stalks, and the fences that incorporate homesteads into discrete residential units make liberal use of *Yucca carnerosana* stems.

Of the two plants, palma samandoca has the greater potential as building material. The only part of the trunkless lechuguilla plant capable of being used in buildings and fences is the flower stalk. But sustained cutting of the cogollo from which the flower stalk grows prohibits its development. Conversely, palma sa-

Fig. 7. Ixtlero from ejido Alvaro Obregón, Tamaulipas, removing extraneous matter from *Agave lecheguilla* rootstock. After the rootstock is severed from the plant it is crushed, soaked in water, and the agitated solution is used as a shampoo.

Fig. 8. Jacal and fence constructed of local plant materials, including *Yucca carnerosana* trunks, near the ejido of Punta de Santa Elena, Coahuila.

mandoca trunks grow to heights of 6 m and attain diameters of 15–25 cm. These stems, in combination with the trunks of other arborescent species of *Yucca*, are significant building materials in the Zona Ixtlera.

The predominant rural house type throughout northcentral Mexico is the flat-roofed adobe dwelling. Adobe roofs are constructed of horizontal wooden beams over which short lengths of wood, called *latias* or *tabletas*, are diagonally placed (West, 1974, p. 114). Center stems of numerous dryland plants, including lechuguilla and palma samandoca, are employed as latias.

Agave lecheguilla and *Yucca carnerosana* are significant construction staples in the *jacal*, a rudimentary single-room dwelling whose composition closely reflects the availability of local plant material (Fig. 8). The jacal is scattered throughout the Zona Ixtlera, but is most evident in poorer and more isolated ejidos, and in the countryside where single homesteads prevail. One of the major components of jacal walls is the palma samandoca trunk, and lechuguilla flower stalks are used in roof construction.

The building of a jacal commences with excavation of a shallow trench whose dimensions coincide with the desired circumference of the house. Typically, a jacal measures 3–5 m in length and width, and 1.5–2 m in height. Palma samandoca trunks, stems of other locally available *Yucca* species, wooden beams, and loose boards are placed upright in the depression and secured by tamping earth at their base. The vertical stems and boards are bound together and reinforced by nailing or wiring slender wooden crosspieces to the structure. With one notable exception, the erection and composition of jacal roofs parallels that of the flat-roofed adobe house type. In contrast to the horizontal beams that span the wall tops of adobe homes, the initial roof support of jacales consists of *Yucca* trunks, including those of palma samandoca. Thereafter, the roof is completed in much the same fashion as that of the adobe: latias, including lechuguilla flower stalks, are laid across the support beams; and a layer of mortar, sod, or mud-grass mixture is placed atop the latticework frame.

One of the most widespread features of the Zona Ixtlera landscape is the stockade, a walled enclosure designed to contain livestock and ensure privacy. Materials used for fence walls include living columnar cacti, *Yucca* stems, and bushes or shrubs, and a single fence is oftimes a composite of many different plants. In areas of the Zona Ixtlera where palma samandoca abounds, the plant's trunk is a significant constituent in fence construction. The vertical trunks are wired together with other material, and, while the resulting enclosure may lack aesthetic appeal, it is quite functional.

CONCLUSIONS

The utilization of products from *Agave lecheguilla* and *Yucca carnerosana* in northcentral Mexico is a tradition that antedates the arrival of Europeans in the New World. For contemporary residents of the Zona Ixtlera the commercial and utilitarian value of these plants is of paramount significance. Money derived from the sale of ixtle de lechuguilla and ixtle de palma constitutes the single most important source of a talladores annual income, and parts of both plants are used in ixtlero settlements to meet a host of construction, cleansing, and dietary needs. Residence in a Zona Ixtlera ejido quickly reveals the persistent association be-

tween ixtleros and the plants lechuguilla and palma samandoca. The time devoted to gathering ixtle, the implements used to collect fiber, the material culture of community residents, and the appellation ixtlero all reflect a traditional folk-economy in which the link between man and plants is a time-honored and deeply-ingrained one.

ACKNOWLEDGMENTS

The research on which this paper is based was conducted in 1976 and 1977, and was partially funded by grants from Louisiana State University. During 7 mo of fieldwork in Mexico numerous individuals contributed to my understanding of ixtlero livelihood. A special debt of gratitude is owed Manuel Laborde and Dr. Jorge S. Marroquín of the Universidad Autónoma Agraria Antonio Narro, and Dr. Fernando Medellín-Leal, of the Universidad de San Luis Potosí. I am also grateful to Drs. Robert C. West and William V. Davidson of Louisiana State University for their comments and recommendations during the writing of this paper.

LITERATURE CITED

Bailey, E. C. President and Treasurer, E. B. & A. C. Whiting Company, Burlington, Vermont. Personal correspondence, 8 October, 1976.

Campa, J. A. de la Cruz, and M. Z. Barragán. 1974. El Campo Experimental Forestal de Zonas Aridas de la Sauceda, Ramos Arizpe, Coahuila. Inst. Nac. Invest. Forest., Bol. Divulg. #36, Mexico, D.F.

Crane, H. R., and J. B. Griffin. 1958. University of Michigan radiocarbon dates III. Science 128: 1117–1123.

González C., A., and A. J. W. Scheffey. 1964. Los recursos espontáneos y su economía. *In* E. Beltrán, ed., Las Zonas Aridas del Centro y Noreste de Mexico. Instituto Mexicano de Recursos Naturales Renovables, Mexico, D.F. pp. 29–95.

Griffen, W. B. 1969. Culture Change and Shifting Populations in Central Northern Mexico. Univ. Arizona Anthropol. Paper #13. Tucson, Arizona.

Instituto Nacional para el Desarrollo de la Comunidad Rural y de la Vivienda Popular (INDECO). s.f. Descripción del Programas. Mimeogr.

Kirby, R. H. 1950. Brush-making fibers. Econ. Bot. 4: 243–252.

La Forestal, F. C. L. 1976. Avances y Perspectivas de un Esfuerzo Común, 1968–1976. Mexico, D.F.

Latorre, D. L., and F. A. Latorre. 1977. Plants used by the Mexican Kickapoo Indians. Econ. Bot. 31: 340–357.

León, A. de. 1649. Historia de Nuevo León, con Noticias sobre Tamaulipas, Texas y Nuevo Mexico. Centro de Estudios Humanísticos, Univ. Nuevo León, Monterrey, Nuevo León.

Marroquín, J. S., G. L. Borja, R. Veláquez, and J. A. de la Cruz Campa. 1964. Estudio Ecológico Dasonómico de las Zonas Aridas del Norte de México. Inst. Nac. Invest. Forest., Publ. Espec. #2, Mexico, D.F.

Martínez, M. L., and L. J. Maldonado. s.f. Zonas Aridas (Recursos Vegetales). Dept. Divulg. y Promoción.

Mason, O. T. 1893. North American bows, arrows, and quivers. Annual Rep. Board of Regents, Smithsonian Inst. pp. 631–679.

Mesa A., M., and R. Villanueva V. 1948. La Producción de Fibras Duras en México. Monografías Industriales del Banco de México, S.A., Mexico, D.F.

Newberry, J. S. 1887. Food and fiber plants of the North American Indians. Popular Sci. Monthly 32: 31–46.

Patoni, C. 1917. La Lechuguilla y su Fibra. Secretaría de Agricultura y Fomento, Mexico, D.F.

Pennington, C. W. 1957. Tarahumar fish stupefaction plants. Econ. Bot. 12: 95–102.

———. 1963. The Tarahumar of Mexico. Univ. Utah Press, Salt Lake City.

Pérez Rosales, S. 1964. Los Suelos y la Vegetación del Campo Experimental "La Sauceda" en la Zona Arida de Coahuila. Inst. Nac. Invest. Forest., Bol. Técnico #16, Mexico, D.F.

Quillares Lona, D. 1971. Problemas de los Campesinos Ixtleros y Cereros del Norte del País. Matehuala, San Luis Potosí.

Romero, M. 1898. Geographical and Statistical Notes on Mexico. Putnam's Sons, New York.

Secretaría de Economía, Dirección General de Estadística. 1957. Tercer Censo Agrícola, Ganadero y Ejidal, 1950. Estados Unidos Mexicanos. Mexico, D.F.

Secretaría de Industria y Comercio, Dirección General de Estadística. 1973. IX Censo General de Población, 1970. Mexico, D.F.

Taylor, W. W. 1966. Archaic cultures adjacent to the northwestern frontiers of Mesoameria. *In* G. F. Ekholm and G. R. Willey, eds., Archaeological Frontiers and External Connections, Volume 4, Handbook of Middle American Indians, Univ. Texas Press, Austin pp. 59–94.

———. 1972. The hunter-gatherer nomads of northern Mexico: A comparison of the archival and archaeological records. World Archaeol. 4: 167–178.

West, R. C. 1974. The flat-roofed folk dwelling in rural Mexico. *In* H. J. Walker and W. G. Haag, eds., Man and Culture Heritage. School of Geoscience, Louisiana State Univ., Baton Rouge pp. 111–131.

Book Review

How to Know the Ferns and Fern Allies. John T. Mickel. 229 pp. illus. The Pictured Key Nature Series. Wm. C. Brown Company, Dubuque, Iowa, 1979. $5.95 (spiral).

A comprehensive work permitting easy identification of all North American pteridophytes has long been lacking. Dr. Mickel, in his lucid and often humorous style, provides us with a substantial contribution to fill a substantial void.

The treatment begins with a series of chapters on morphology, life history, hybridization, cultivation, and nomenclature of ferns. The author carefully avoids the morass that is familial classification of ferns today and prefaces the main body of the text with a master key to all genera of ferns in North America. The generic treatments that follow are in alphabetical order and include short descriptions as well as keys to species in the style of the series. Illustrations are provided as are distribution maps for the more widespread taxa. Extremely rare or local species are not embraced by the keys but are included as short descriptions following the species with which they are likely to be confused.

Although scattered errors are present, most are minor and do not substantially detract from an otherwise excellent text. It is not possible, for instance, to arrive at *Pilularia* from the first couplet of the master key where ferns are described as having broad leaves with forked veins. *Asplenium septentrionale* is incorrectly substituted for *A. ruta-muraria* in the parentage of *A.* × *clermontae*. In most remaining instances the errors are trivial, consisting mostly of misspellings and miscitations.

The most serious drawback to the text is the inaccuracy and sometimes poor reproduction of the distribution maps. In several cases, the maps contain gross errors. *Lygodium palmatum,* for instance, is depicted as occurring in Texas, Louisiana, and Mississippi, when in fact it does not. These problems could have been alleviated if greater care had been taken in checking the distributions of the taxa involved.

Designed for use in the field, the book should adequately serve this function. It is spirally bound and can be thus opened and folded back on itself without damage. The paper is of good quality and should hold up well even if wet. The size, 18 × 23 cm, makes the book, however, rather large for convenient field use.

As with other volumes in this series, the emphasis of the work lies in rapid and easy determination, and so the book is an ideal companion to any sort of nature study on the continent. Its wide scope, clear language, and reasonable price should afford it broad appeal to anyone with even a passing interest in these plants.

RAY CRANFILL, UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN 48109