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# The University of New Mexico Bulletin

Ethnobiological Studies in the  
American Southwest

I. *Uncultivated Native Plants  
Used as Sources of Food*



By EDWARD F. CASTETTER

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FOREWORD TO ETHNOBIOLOGICAL STUDIES IN THE  
AMERICAN SOUTHWEST

Ethnobiology is a field of investigation which, if properly and adequately pursued, is of great value not only in itself but equally so to the anthropologist and archaeologist in general, and to the ethnologist in particular. The matter of ascertaining the uses of specific plants and animals by various Indian groups, together with the Indian names for the plants, is in its own right a valuable field of research (19). The economic considerations of the subject constitute another very interesting and worthwhile phase of the problem, but as pointed out by Robbins and Harrington (33) ethnobiological investigation should strike more deeply into the conduct, thought and life of the people studied, gaining from them their conceptions of their whole environment. From this point of view it is a special line of ethnological investigation, the results of which must receive consideration in the ultimate analysis of the subject of primitive man himself.

This three-cornered problem is concerned with several important and significant questions, embodying: primitive concepts of living things; the relation between organic environment and the lives, practices, thoughts and outlook upon life, of the group studied; the uses (for food, medicine, ceremony, practical arts, etc.) to which living things are put by a given people; the degree of their knowledge regarding the structure, functions and activities of living things; the nature of their concepts regarding the classification of organisms; and what may be learned regarding the workings of the primitive mind by the study of its concepts and names for living things and their parts and functions.

It has not been possible to date to cover, among the peoples studied, all the aspects of ethnobiological investigation as outlined above, and it is realized that a large part of this

must await the accumulation of a much greater amount of data to make more detailed comparative studies possible. Most of the questions set forth above have been answered, at least in part, by Robbins and Harrington for the Tewa (33), Stevenson for the Zuni (37, 38), Russell for the Pima (33), the Zuni (38), and the Pima (34) had already been to mention others not strictly Southwestern. (The studies to be covered in the series of bulletins cover New Mexico and Arizona primarily.)

During the past five years the writer, assisted by graduate students, has studied the ethnobotany of some of the Indian groups of this region, more particularly the Pueblo Indians of New Mexico. Since the ethnobotany of the Tewa (33), the Zuni (38) and the Pima (34) had already been done, no effort has been made to duplicate this work; the Pueblo Indians studied by us are the Isleta, Acoma, Laguna, Cochiti, San Felipe, and the Jemez. For various reasons it has not been feasible to work with some of the Indian groups, hence this series of bulletins is not to be regarded as a complete record of Southwestern ethnobiology; and even in the case of the groups which have been studied no record of completeness is claimed, and this again for reasons which are obvious to those who have carried on ethnobiological investigation.

The projected series of bulletins on Southwestern ethnobiology, of which this publication is the first, is an attempt not only to report the work which we ourselves have done, but also to bring together under one heading the results of ethnobiological researches which have been done to date in the American Southwest. An effort has been put forth to make the work *comparative*, for it is strongly believed that the ethnobiology of one Indian group compared with similar studies of other groups, has a definite, far-reaching value. Obviously conceptions of plant and animal life differ among different peoples, or a given plant or animal may hold a significant place in the economy of one people and be relatively unimportant in that of another; therefore the writer

has grouped the organisms on the basis of use rather than any other consideration. This has made impracticable the segregation of results of our own original studies from those reported in the literature, so all have been indiscriminately blended in the text with regard to naught else than the best presentation of the material.

In the interest of brevity Indian names for the plants and animals listed have been omitted, except for those of our own investigation and even they are included only where reasonable accuracy was assured. The Indian name of a living thing is, however, most useful, often giving an insight into the tribe's conception and knowledge of the structure, function and classification of plant or animal life, as well as into their customs, religion and ways of working of their minds. For these Indian names the reader is referred to the literature listed in the bibliography.

All of our own work was done on the *plants* used by various Indian groups. The outstanding difficulties encountered in securing the desired information were: obtaining permission from the group itself, or more specifically its governing body, to carry on the work; and the certainty that the knowledge secured from informants was reliable. Our method was to take one or more Indian informants into the field, and an interpreter when necessary; whenever possible more than one informant was used in order to secure as much information as possible regarding the plants. When this could not be arranged different informants were taken on different trips. This was done for a double purpose—one informant often supplied data which another did not possess, and it minimized the possibility of inaccuracy and deception on the part of the Indians.

Best results were obtained when the informants were taken into the field and could see the plants growing in locations with which they were familiar. We found that wilted or herbarium specimens were rarely recognized by them, and often they had difficulty in recognizing fresh plants which had been taken from natural environments. Generally

speaking, however, the Indian does recognize differences between plants even to the extent of distinguishing between species if these be not too closely akin. There exists among them no definite systematic classification, their names for different species having reference to some outstanding or peculiar characteristic of the plant, to its use, its habitat, etc.

## ETHNOBIOLOGICAL STUDIES IN THE AMERICAN SOUTHWEST

### I. UNCULTIVATED NATIVE PLANTS USED AS SOURCES OF FOOD

Even before the coming of the Spaniards to the Southwest in 1540 some of the Indian groups cultivated certain crops—corn, beans, pumpkins, and cotton (33). Other nomadic tribes such as the Apache cultivated little if anything, depending upon the wild products of nature for their subsistence, and to some extent upon plunder; and Indian groups who did cultivate crops depended in part, and at times of successive crop failure entirely, upon wild products. The Pueblo Indians are and have been essentially an agricultural people, yet many are the wild plants and animals which supplement their diet, even today. The Pima likewise have had their culture rooted in the cultivated soil, depending upon the Gila, and subsisting upon a mixed diet in which vegetable foods predominate. Even these inveterate tillers of the soil, in times of failure of the water supply from the Gila in mid-winter, which in ancient times occurred about every fifth year (34), have been forced to depend upon a wild source of animal food supply including ducks, deer and antelope, and were driven far afield in search of such native plant products as the fruit of the sahuaro, the mesquite bean and the crown and root of the Agave, which they utilize to some extent today, even in times of an abundant cultivated crop.

The Papago to the southward of the Pima, on the other hand, never have been an agricultural people, depending entirely upon uncultivated products as their source of food supply (34). For example, they have from time immemorial utilized as food the sand-root, *Ammobroma sonorae*, which grows in very arid regions in their country. Both the Papago and the Mohave live, with reference to the difficulty of securing food, under conditions where a white man could not exist and it has been estimated that about 6000

Papago Indians live and obtain their food from an area where hardly 600 white men could hope to survive (42).

Thus at the time of the Spanish Conquest the native in the Southwest was cultivating certain crops; the Spanish colonists, however, considerably supplemented this list with wheat, oats, barley, chile, onions, chick-peas, peas, new varieties of beans, melons, peaches, apricots, cabbage, lettuce, radishes, carrots, cucumbers, etc. (4), while the English-speaking people introduced no plants of importance. Candolle (9) records, with reference to the plant life of the New World, that of 247 plants cultivated in America, 199 originated in the Old World, 45 in America, 1 in Australia, while the native habitat of 2 cannot be determined. From what the Spaniards recorded of early native Indian foods, however, it is evident that the white man has added little of particular value to the Indian diet with the exception of mutton and beef, which have largely replaced the flesh of game animals. From the discussion of the following list of 210 native uncultivated plants used by the Indians of the Southwest it is evident that all of these Indian groups possessed a diversified native food supply apart from Spanish supplementation.

There can be no doubt, however, that since the coming of the Spaniards the use of *native plants* among the natives of the Southwest is declining, but the rate of decline varies greatly with tribes, families and individuals. Indian groups which are in the main current of civilization's flow have been greatly influenced and the decline in the use of native foods is pronounced, while the more isolated and conservative groups have preserved remarkably well to the present day the traditional usage of native plants as food. Some Indian peoples have strongly resisted the introduction of foreign seeds and plants in their midst while others, such as the Hopi and the Santa Clara, are willing and anxious to secure these from other peoples, the Santa Clara considering it a mark of their own progressiveness to allow any kind of seed to be introduced (33).

Nevertheless Spanish introductions of food sources among the Indians of the Southwest could not have been accepted without considerable opposition. The bitter wars between the Spanish colonist and the Indian unquestionably left the latter with a pronounced resentment for everything Spanish. Even in Arizona, the haven of those Pueblo Indians who so bitterly detested and so vigorously opposed Spanish rule and influence, a number of plants of Spanish introduction eventually became accepted.

In the present publication on foods the plants are listed alphabetically according to scientific name. This name is followed first by the abbreviated name of the person who first described the species, next by the common name, if there be one, then by the Spanish or Indian name when these are available. (For Indian names of plants among groups other than the Pueblos studied by the writer and his associates, consult the original publications listed in the bibliography.) Since plants are listed alphabetically according to scientific name there is no need for an index as such. At the end of the bulletin appears an index of common English and Spanish names which should be of considerable value in locating plants which are known to the layman only under such name.

In the interest of comparative study the various plants are grouped in the text according to use. For example, under the pigweed, *Amaranthus retroflexus*, is discussed the use not only of this species, but a number of others, as greens. Not all plants used as greens, however, are discussed under this heading for in cases where there are a considerable number of species similarly used, it has made the text more readable to discuss them under several headings, associating under each heading those plants which are botanically closely related.

It is the pleasant privilege of the writer to acknowledge his obligations, first to the National Research Council for two grants-in-aid which made it possible to carry on some of the studies here reported; next to Sara Louise Cook, Vera

A. Hough, George W. Swank and Volney H. Jones, former graduate students who have done a considerable amount of the original work on the Pueblos mentioned. Special thanks are due Mr. Jones, now of the ethnobiological laboratory of the University of Michigan, for carefully reading the manuscript and checking the references. The writer is also indebted to Mrs. Nonabah G. Bryan, a Navajo Indian, instructor in weaving at the Charles N. Burke Indian School at Ft. Wingate, New Mexico, for some of the information regarding uses of plants among the Navajo; and to Miss Stella Young, also of that school, for making it possible to obtain this Navajo material. To Indian Commissioner, John Collier, I am indebted for a timely word to certain Pueblo Indian leaders to the end of allaying suspicion and instilling confidence in the purpose and value of the work. Finally I wish to thank my good friend, C. E. Faris, Superintendent of the United States Indian School at Santa Fe, and of the Northern Pueblos of New Mexico for his many courtesies in making it possible to carry on the investigation.

*Abronia fragrans* Nutt. Cf. *Phellopterus montanus*.

*Acacia greggi* A. Gray. Cf. *Prosopis glandulosa*.

*Acanthochiton wrightii* Torr. is cooked as greens by the Hopi, among whom it is known as the "Ancient Hopi food." It is gathered and strung into long bunches, and is to be found in almost every household. The Hopi say that it has more than once prevented famine among them (14, 23).

*Agastache neo-mexicana* (Briq.) Standl. Cf. *Monarda menthaefolia*.

*Agave americana*. Cf. *Agave parryi*.

*Agave parryi* Engelm. Century plant, *mescal*. A characteristic feature of the desert vegetation of southwestern United States is the stately Agave, commonly known as mescal or century plant, several species of which abound,

particularly *A. parryi*, which is the common mescal of the Southwest. Contrary to popular opinion the Agaves bloom in much less than one hundred years, although each plant does bloom only once after which the leaves wither and die. Around each dead plant, however, are usually to be seen a number of young plants which have formed from suckers of the parent plant.

The native Agaves provided one of the most important articles of food for the Apache as well as other Indian peoples such as the Papago, the Pima, the Mohave, the Yuma, the Ute, the Paiute and the Comanche, who prepared from them a food known as mescal. An extensive commerce in this product was formerly carried on, chiefly between the Apache and outlying tribes such as the Hopi and Pueblo Indians of the Rio Grande Valley (21). It is from the extensive preparation of this substance that the Mescalero Apache, who dwell in the White and Sacramento Mountains of New Mexico, derive their name.

According to Russell (34) the Pima gathered this favorite plant, particularly in times of famine; and it would have been more extensively used had it not been for their enemy, the Apache, who attacked them when they went on even short journeys from the villages. Upon reaching the hills where the plants grew, the Pima spent the first day seeking suitable digging sticks. The crowns of the mescal plants were then dug out with these sticks and the leaves trimmed off, save one or two which were used to tie the crowns in pairs so that they might be strung on a rope for transportation. Thin-leaved specimens were not gathered, as they were deficient in food value and also blistered the mouth when eaten. The crowns were placed in pits and, after the fires built in them had died down, small stones were placed on the embers. The crowns were then placed on these stones, covered with earth and roasted for twenty-four hours. If, upon examination, the mescal were found to be not fully cooked the pit was again closed for additional hours, and the incomplete roasting attributed to the incon-

tinence of some of the Indians. The centers of the roasted mescal heads were next removed from their encasing sheaths and dried in the sun, whereupon they were ready for immediate use or for storage. Roasted mescal is eaten by chewing the fibrous leaves and parts of crowns until the edible portion is removed, then discarding the fiber. The prepared mescal contains an abundance of sugar and is quite pleasing to the taste, being eaten alone or in combination with ground parched corn. The roasted mescal is sometimes boiled until the extracted juice forms a black sirup, the quality of which is regarded as inferior to the sahuaro sirup (Cf. *Carnegia gigantea*). Mescal is no longer prepared by the Pima themselves but they do obtain it by barter from the Papago.

The Apache were accustomed to make expeditions to regions where Agave grew in abundance, for the purpose of collecting the desired portions of this plant. These visits were usually made in early summer when the flower stalks were just beginning to grow out, although the plant can be used at any season. The crowns and succulent young leaves of the plant were gathered, brought home and roasted in pits in a manner similar to that described by Russell for the Pima. The pits were ten to fifteen feet in diameter and about three feet deep, and some may still be found in New Mexico in regions where the plant abounds.<sup>1</sup> Grass or weeds were then covered over the pits. The Apache continue to the present to prepare mescal, although to a more limited extent than formerly. A different species, *A. americana*, mescal or American aloe, is abundant in Mexico and is sometimes grown in southern New Mexico and Arizona, the roasted mescal being a common article for sale in the markets of Mexico. However, the leaves of this species are larger and provide a greater amount of food than do the species to the north (36).

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1. Mera, H. P. "Mescal pits"—a misnomer. *Science* 77:168-9, 1933. points out that what he has termed "middens circles" found in southeastern New Mexico and western Texas, are not to be regarded as mescal pits. They were not concerned especially with the preparation of mescal for food, but were found to be specialized refuse heaps.

In somewhat similar connection Marcy (27) made the following comment in the year 1849: ". . . we have this evening for the first time seen the Maguey plant, (probably *A. parryi*) which constitutes almost the only vegetable food that the Apaches and southern Comanches get for a great portion of the year. They prepare it by boiling it until it is soft, then mash it into a paste, and I am told that in this form it makes a very palatable, nutritious food."

The Apache residing on the head-waters of the Gila, as well as the Mescalero and Jicarilla Apache, according to Cremony (13), to Bourke (6), as well as Pattie (40), cultivated corn, pumpkins, squashes, and beans, but their chief native source of food was the root of mescal (probably *A. parryi*), which was collected in large quantities and roasted in pits for several days, after which it was pared and eaten with great eagerness. Thus roasted it had a sweet taste somewhat like that of the beet, although rather tough.

Bartlett (3) relates that the Indians on the Gila River as well as the Mexicans on the Rio Grande, baked in ashes the roots of *A. mexicana* for use as food after first removing the bark. He also saw Agave used as food by the Apaches, the Pimas, the Coco Maricopas, and the Diegenos on the shores of the Pacific. The White Mountain Apache of Arizona today similarly bake and eat the roots of *A. parryi* and say it is very sweet and delicious, tasting much like molasses; they are very fond of this food and it is utilized as long as the season lasts. Bancroft (1) also refers to the extensive use of *A. mexicana* as food by the Indians of New Mexico and of lower California.

Palmer (30a) mentions the similar use of *A. americana* in New Mexico, Arizona, and Sonora, and discusses in detail the method of mescal preparation by the Papago and Apache. He also records the use of mescal as an article of commerce among the Apache of Arizona, and the trading of the article to the Hopi by the Hualipais. Havard (20) also discusses the methods of preparation and uses of *A. americana* and *A. parryi*.

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2. Reports of the Secretary of War, 1850, p. 201.

In somewhat similar manner another desert plant, *Dasyliirion wheeleri*, commonly known as *sotol*, has been utilized as a source of food by some of the Indians of the Southwest. In this case, however, only the "heart" of the plant was used and this was secured when the young flower stalk was beginning to push up. The trunks of the plant were trimmed free of leaves, placed in pits and roasted just as was mescal (20). The stems of this species are rather hard and woody, only the youngest and most tender portions being edible.

Sotol is also utilized as an emergency food for stock in times of food scarcity. Hungry cattle will sometimes eat the plant as it stands in the field but the spiny-margined leaves make this a difficult task. During periods of protracted drought and food shortage the leaves are cut or burned away from the stems, which are then split in two and are devoured with great eagerness by starved cattle (36).

In somewhat similar manner the crowns and young leaves of several species of *Yucca* are occasionally baked and eaten by most of the Pueblo Indians of New Mexico, especially in times of food shortage. Several species, particularly *Y. bacchata*, commonly known as *datil*, *palmilla ancha* and soapweed, and *Y. glauca*, soapweed, or *amole*, are thus used as a source of food by the Zuni (38), Hopi (33), Jemez, Isleta, Cochiti, and San Felipe. In this same connection Bartlett (3) reports the upper tender portion of the stem of certain species of *Yucca* as being roasted and eaten as food in Mexico, while Bourke (6) refers to the extensive use of the young central shoot of the datil among the Mexicans of the Rio Grande Valley, who bake the shoots on live coals.

Cf. *Y. bacchata* for use of the *Yucca* fruit by Indian groups.

*Agave mexicana*. Cf. *A. parryi*.

*Allium cernuum* Roth. A synonym of *A. recurvatum*.

*Allium deserticum* (Jones) W. and S. Cf. *A. recurvatum*.

*Allium geyeri* S. Wats. Cf. *A. recurvatum*.

*Allium recurvatum* Rydb. Wild onion. The bulbs of this plant are eaten by the Isleta, either raw or boiled. At both Acoma and Laguna these bulbs, which are termed *tsina hatrani* (turkey onion), are used for food. Bulbs of *A. sabulicola*, *kashashi hatriani* (white onion) and *chamutse*, are by the same Pueblos used largely for seasoning.

The Mescalero Apache eat the bulbs of *Allium geyeri*, while those of *A. unifolium* are used as food by the Papago.

The wild desert onion, *A. deserticum*, is eaten by the Navajo who regard the mountain species as poisonous. They rub the bulbs in hot ashes to singe as well as remove some of the strong taste from them; they may then be eaten, or dried and stored for winter, when they are soaked and cooked with or without wild celery (*Phellopterus montanus*).

The Tewa of Hano and the Hopi know and use two species of wild onion. The "field onion" (*A. recurvatum*) grows on high ground and is eaten raw, commonly with wafer bread, broken and dipped in water; the other species (probably *A. deserticum*), known as "wind onion," is found at lower altitudes and is small and almost tasteless (33). The bulbs of a wild species of onion are also eaten by the Pima (34).

*Allium sabulicola* Osterh. Cf. *A. recurvatum*.

*Allium unifolium*. Cf. *A. recurvatum*.

*Amaranthus blitoides* S. Wats. Cf. *Chenopodium leptophyllum*.

*Amaranthus graecizans* L. Cf. *A. retroflexus*.

*Amaranthus hybridus* L. Cf. *A. retroflexus*.

*Amaranthus palmeri* S. Wats. Cf. *A. retroflexus*; also *Chenopodium leptophyllum*.

*Amaranthus retroflexus* L. Amaranth. Pigweed, *quelite*, *alegria*. This as well as *A. blitoides* is very commonly used as food by the Navajo and the Pueblo Indians, as well as the Spanish Americans of the Rio Grande Valley. Both species are boiled and eaten much as we would eat spinach; or they are first boiled, then fried in lard, or they are sometimes boiled and canned.

The Acoma and Laguna term both of the above plants, as well as *A. hybridus*, *shiipa* or *tsetayi*. The young plants are used as greens, being boiled and eaten or dried for winter use. The Cochiti eat as greens the young plants of *A. graecizans*, red root, tumbleweed, *shiritsa*, as well as those of *A. retroflexus*, *shiipa*. The Jemez used the young plants as greens for many generations, but the species is not now in common use by them. Among the Papago the leaves and young stems of *A. palmeri*, pigweed, are eaten as greens, while the leaves of *A. torreyi* are boiled and eaten with meat by the Hopi (14).

Palmer (31) records the use of the leaves of *A. retroflexus* as greens and the parched seeds as meal among the White Mountain Apache of Arizona.

The young plants of *Chenopodium leptophyllum*, lambsquarter, as well as those of several other species, particularly *C. album*, lambsquarter, are gathered and cooked as greens by most of the Pueblo Indians of the Rio Grande Valley, as well as the Zuni, the Mescalero Apache, and the Spanish Americans. The Isleta eat the leaves of various species as greens.

The Hopi boil and eat the leaves of *C. album*, lambsquarter, with fat (14, 22, 23), and sometimes cook them with meat.

*Amaranthus torreyi* (A. Gray) Benth. Cf. *A. retroflexus*.

*Amelanchier prunifolia* Greene. Service berry. The fruits of this shrub, as well as other species of the genus, often called apples by the Indians, were formerly an important article of food at Isleta, although they are not eaten extensively today. These Indians gathered them in the Manzano mountains.

Among the Navajo the berries were eaten fresh (15). Those of *A. pallida* are eagerly sought after by the Hopi (23).

*Amelanchier pallida* Greene. Cf. *A. prunifolia*.

*Ammobroma sonorae* Torr. Cf. *Solanum fendleri*.

*Anogra albicaulis* (Pursh) Britt. Evening primrose. The Mescalero Apache eat the fruits of this plant.

*Apocynum angustifolium* Wooton. Cf. *Hymenopappus filifolius*.

*Artemisia dracunculoides* Pursh. Cf. *Cleome serrulata*.

*Artemisia wrightii* A. Gray. Cf. *Chenopodium leptophyllum*.

*Asclepias galioides* H. B. K. Milkweed. The young buds of this plant are gathered by the children at Zuni (38). In many of the Rio Grande Pueblos the roots as well as the unripe pods of various *Asclepias* species are eaten raw; this is done rather generally at Jemez. The leaves and young shoots of *A. speciosa* are boiled with meat and eaten by the Hopi (14). Also Cf. *Hymenopappus filifolius*.

*Asclepias speciosa* Torr. Cf. *A. galioides*; also *Hymenopappus filifolius*.

*Asparagus officinalis* L. Asparagus, *esparrago*, escaped from cultivation, but has more or less established itself in the wild state and is used as food by the Isleta.

*Astragalus diphysus*. A. Gray. This and a number of other species of *Astragalus* are utilized as food by most of the Pueblo Indians of New Mexico, especially the Jemez. The pods are gathered and eaten raw or cooked. The fleshy roots of certain *Astragalus* species, termed *sutyitawe*, are eaten fresh as food by the Acoma and Laguna, and in addition to this the Zuni dry the fruits for winter use, when they are boiled and salted and regarded as quite delicious (38). The roots of *A. pictus filifolius* and of *Parosela lanata* are scraped and eaten as sweets by the Hopi (14, 23).

*Astragalus pictus filifolius* A. Gray. Cf. *A. diphysus*.

*Atriplex argentea* Nutt. Cf. *A. nuttallii*.

*Atriplex bracteosa*. Cf. *A. nuttallii*; also *Opuntia arborescens*.

*Atriplex canescens* (Pursh) Nutt. Shad scale, saltbush. This valuable forage plant is used by Indians quite generally throughout the Southwest as food for cattle, goats, horses, and sheep. Other shrubby species of *Atriplex* such as *A.*

*sabulosa* are utilized in similar manner. At Hano the ashes of the former species are stirred with the corn dough in making wafer bread for the purpose of turning the natural purplish gray color of the corn meal, ground from blue grains, to a greenish blue color (33).

*Atriplex confertifolia* (Torr.) S. Wats. Saltbush. The water in which the scented leaves of this plant have been boiled is used to mix the corn meal for making a sort of pudding among the Hopi. This meal pudding is baked (14, 23).

*Atriplex cornuta* Jones. Cf. *A. nuttallii*.

*Atriplex coronata* S. Wats. Cf. *A. nuttallii*; also *Opuntia arborescens*.

*Atriplex elegans* (Moq.) D. Diets. Cf. *A. nuttallii*; also *Opuntia arborescens*.

*Atriplex lentiformis*. Cf. *Chenopodium leptophyllum*.

*Atriplex nuttallii*, saltbush, is utilized by the Pima for food and for flavoring purposes (34). The young stems and flower heads are boiled with wheat for the purpose of flavoring, the stems being cut in short lengths and sometimes used as a stuffing in cooking rabbits. Other species, especially *A. argentea* and *A. cornuta*, are used among the Pueblo Indians of the Rio Grande Valley by boiling alone or with various plant products and meats for flavoring. The young leaves of *A. argentea* are boiled and eaten as greens at Isleta. The fruits of the same species, *tweemutsi*, are eaten by the Acoma and Laguna as food as well as utilized for their salty flavor. These two Pueblos also eat the young plants of *A. philonitra*, saltbush, *shita*, as greens, as do the Cochiti among whom the plant is known as *shikui*. By the Hopi the salty leaves are boiled and eaten with fat. This is the earliest of the six typical Hopi spring food-plants (14, 22, 23). Palmer (30a) records the use of six species of *Atriplex* as food by the Indians of Utah, Arizona, and California.

The plants of *Suaeda arborescens* and of *S. suffrutescens* are added by the Pima to greens or to the fruit of vari-

ous species of cactus when being cooked for the purpose of giving flavor (34). Cf. *Opuntia arborescens*. The young plants of *Atriplex bracteosa*, *A. coronata* and *A. elegans*, saltbush, are sometimes boiled with other foods, such as the fruit of the cane cactus, *Opuntia arborescens*, for flavoring (34).

*Atriplex philonitra* A. Nels. Cf. *A. nuttallii*.

*Atriplex powellii* S. Wats. Cf. *Chenopodium leptophyllum*.

*Atriplex sabulosa* Jones. Cf. *A. canescens*.

*Berberis fendleri* A. Gray. Cf. *B. haematocarpa*.

*Berberis haematocarpa* Woot. Algerita, redberry. Some of the Pueblo Indians of the Rio Grande Valley, but more commonly the Spanish-Americans, make jelly of the bright red berries of this species which are pleasantly acid to the taste. They are also eaten fresh by the Mescalero Apache. The small red berries of *Berberis fendleri*, barberry, are gathered and eaten as food by the Jemez.

*Berlandiera lyrata* Benth. *Noshityini ayashityi*, *maskawi wawa*, buzzard medicine. The flowers are mixed with sausage by the Acoma and Laguna for the purpose of seasoning.

*Bossekia parviflora* (Nutt.) Greene. Thimbleberry. The fruits of this plant, which grows in the higher reaches of the Manzano mountains on the Isleta reservation, are considered as quite a delicacy by these people.

*Calochortus aureus*. S. Wats. Mariposa lily. The Navajo and Hopi gather the bulbs of this plant in early spring, peel and eat them raw (15). The Navajo also similarly eat those of *C. luteus* (15).

*Calochortus luteus*. Cf. *C. aureus*.

*Camassia esculenta* Lindl. Cf. *Solanum fendleri*.

*Carnegia gigantea* (Engelm.) Britt. & Rose. Giant cactus, *sahuaro*, *pitahaya*. The Papago utilize the pitahaya fruit as an important article of diet; they grind the seeds to make flour and also prepare a sort of conserve from the fruit. An oil is extracted from the seeds, and a sirup made by boiling the fruits.

According to Russell (34) the ripe fruit of this giant cactus is gathered in June by the Pima, the large harvest being of such importance as to mark the beginning of the new year in their calendar. The abundant harvest may be utilized as a source of food throughout the whole year since seeds and dried fruit may be preserved.

The ripe fruit may be eaten fresh or after being dried. When dried it is made into balls about six inches in diameter and stored for future use. Either fresh or dried fruits may be utilized to make a sirup by boiling for a number of hours. The residue is made into an oily paste by grinding on the metate, and is eaten without any further treatment (30a, b). Bartlett (3) writing in 1854 records that "The Pima and other Indians, collect the pulp of the pitahaya and roll it into balls; in which state it probably keeps the whole year, as it was offered to our party which passed through in January. They also boil the pulp in water, and evaporate it to the consistency of molasses; after which it is preserved in earthen jars."<sup>1</sup> Bancroft (1) refers to the Papago and Pima as collecting large quantities of pitahaya fruit for food, and to the latter drying it in the sun to be stored, and boiling it to make a thick sirup which was also stored for future use; also to the northern Mexicans and the Indians of Lower California as using this fruit as an important source of food. Russell (34) and Bancroft (1) refer to the Pima and the Indians of Lower California, respectively, as picking the undigested pitahaya seeds from human faeces, parching and grinding these seeds and then eating the meal with great relish.

The small seeds are eaten fresh among the Pima, or ground to make meal, which is eaten mixed with water to form a sort of gruel combined with other kinds of meal for use in bread (34).

Cremony (13) in 1868 reported the use of the pitahaya fruit as food by the Maricopa and Pima, while Bourke (6) recorded its use among the Apache of Arizona.

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1. Personal narrative 2:191.

*Carthamus tinctorius* L. Saffron. The flowers of this plant, said to have been obtained from the Mormons about sixty-five years ago, are used by the Hopi to give a yellow color to paper-bread (14).

*Ceanothus fendleri* Gray. Buckthorn. The berries of the buckthorn, *tsitsi*, are sweetened with sugar and used as food by the Acoma and Laguna.

*Celtis douglasii* Planch. Cf. *C. reticulata*.

*Celtis occidentalis* L. Cf. *C. reticulata*.

*Celtis reticulata* Torr. Hackberry, *palo duro*. The berries of this species as well as those of *C. douglasii* are eaten by many of the Pueblo Indians of the Rio Grande Valley. They are extensively used as food by the Acoma and Laguna who call the tree *shikai-shikai-ka*. The Papago also utilize the fruit of this species as food. Among the Navajo the fruits are dried, ground, boiled, and eaten (15). It is reported that the fruits of *C. occidentalis* are very rich in calcium (45).

*Cercis occidentalis* Torr. Red bud. The Navajo roast the pods of this legume in ashes and eat the seeds, although it is not native in their immediate country.

*Cereus giganteus* Englem. A synonym of *Carnegia gigantea*.

*Chamaesaracha coronopus* (Dunal) A. Gray. The seeds of this species are eaten as food by the Hopi (22, 23).

*Chenopodium album* L. Cf. *C. leptophyllum*; also *Amaranthus retroflexus*.

*Chenopodium cornutum* (Torr.) Benth. and Hook. Cf. *C. leptophyllum*.

*Chenopodium leptophyllum* (Moq.) Nutt. Narrow-leaved lambsquarter. The Zuni maintain that the seeds of this species, together with those of *Artemisia wrightii*, were among their most important food plants when they first reached this world. The seeds of both species are ground, and eaten alone or in combination with corn meal, mixed with water, seasoned with salt and the resulting batter made into pats or balls which are steamed for use (37, 38). These

people originally ate the seeds of *Amaranthus blitoides*, but when they began to grow corn they ground the seeds with black corn meal, mixed it with water and also made it into pats which were steamed and eaten (37, 38). The same situation obtains with reference to *Atriplex powellii*, with the exception that its seeds were mixed with ground corn to make a sort of mush. The small seeds of *Cycloloma atriplicifolium*, winged pigweed, are also similarly used. Before corn was introduced at Zuni the seeds of a number of species of plants were used to make meal (38).

Among the Hopi the seeds and flowers of *C. cornutum* as well as the seeds of *Amaranthus blitoides* are eaten as food. Those of the former species are ground and mixed with corn meal to make small dumplings which are wrapped in corn husks and tied with a shred of *Yucca* (14, 22, 23).

At Isleta the seeds of *Koeleria cristata*, June grass, constituted an important article of food before the introduction of wheat. Meal prepared from the seeds was made into both bread and mush. The seeds of *Nolina microcarpa*, bear-grass, are ground by these people to make meal which is prepared and eaten in a manner similar to that of the above species. The large seeds of *Cleome serrulata*, Rocky Mountain bee plant or *guaco*, were also formerly used by the Isleta to prepare meal used in baking bread. Among the Acoma and Laguna who know the plant as *waku*, the seeds are gathered in the fall, cooked well and spread out on willow sticks to dry. Before using they are cooked into mush. These two Pueblos also use, although not so extensively as formerly, the seeds of *Amaranthus blitoides*, *shiipa*, *tsetayi* as a source of food, the seeds being ground to make meal.

The Navajo parch the seeds of the hedge mustard, *Sisymbrium officinale leiocarpum*. Formerly they were placed in a basket with live coals and shaken until parched, whereupon they were ground into meal and made into soup or stew. Dodder seeds (*Cuscuta sp.*) were similarly treated by these Indians (15, 44).

The Navajo ground the seeds of an undetermined species of *Amaranthus* (probably *A. blitoides* or *A. palmeri*) and used the resulting meal as food, and also obtained sugar by chewing handfuls of meal from the parched seeds. The seeds of two other species of pigweed were also used as a source of food, the meal of one being made into a stiff porridge (15). These people also make pigweed seeds into a gruel by mixing them with goat's milk.

Among the Papago the seeds of *Amaranthus palmeri*, pigweed, are ground and eaten as food.

The heads of an unidentified species of *Atriplex* are pounded into a mortar by the Pima who screen them to remove the hulls. They are then washed, dried and ground, whereupon they are ready to be eaten as a kind of *pinole*,<sup>1</sup> or dry in which case pinches of meal are taken alternately with sips of water (34). The seeds of *Monolepis nuttalliana* are similarly boiled, dried, and ground to make a sort of pinole by the Pima (34).

The Pima also parch and then grind the seeds of *Chenopodium murale* to make meal, which may be eaten as a kind of pinole or in combination with other meal. The seeds of various species of *Chenopodium* were formerly gathered by various Pueblo Indians of the Rio Grande Valley, ground or parched and then used in making cakes or a sort of mush. The Pima also cook the seeds of *Atriplex lentiformis*, saltbush, in pits lined with *Suaeda arborescens* and the inner bark of the cottonwood (*Populus deltoides*) moistened and mixed together. The seeds are thus roasted over night, afterwards dried, parched, and stored. Before eating they are made into a thick gruel (34).

Cf. *Amaranthus retroflexus* for use of *C. leptophyllum* as greens.

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1. Strictly speaking *pinole* is a substance made by parching ripe corn, which is then ground and mixed with *panocha* (Mexican raw sugar or brown sugar). Flavoring substances are also usually added, the most common being cinnamon (*Cinnamomum zeylanicum*) and anise (*Pimpinella anisum*). Pinole is usually eaten as a dry cereal in combination with milk and cream, although it may be made into a beverage by adding water. The term pinole is, however, often loosely used to apply to other substances such as parched, ground mesquite beans (*Prosopis glandulosa*), etc.

*Chenopodium murale*. Cf. *C. leptophyllum*.

*Chrysothamnus confinis* Greene. Rabbit brush. The San Felipe, among whom the plant is known as *kuyapiapa*, salt, and eat the flower buds as food.

*Cleome serrulata* Pursh. Rocky Mountain bee plant, *guaco*, is one of the most important native plants in use by the Pueblo Indians of New Mexico, having outstanding significance as a food plant even today, although this was obviously more marked before the introduction of some of the cultivated plants. Among the Tewa of Hano and the Hopi the plant is of sufficient economic importance to be listed in songs with the three main cultivated plants, corn, pumpkins, and cotton. The plant is used in a variety of ways. It is gathered in mid-summer and boiled for a long time to counteract the alkaline taste and then eaten much as we eat spinach. Robbins and Harrington (33) report that among the Tewa the plant is boiled thoroughly in water, the fibrous parts removed, and the decoction further boiled until thick and black. It is then poured on boards where it is allowed to dry and harden into cakes. This *guaco* is used as food, the cakes when wanted for use being soaked in hot water, then fried in grease. The Hano thoroughly boil then eat the plants with corn meal porridge, salt being added to give it a better flavor (33). The Hopi boil and eat the young leaves and flowers (14); also boil the young plants with green corn (33).

The Zuni cook the young plants with corn (on or off the cob) strongly flavored with chile. They are also gathered in large quantities and hung indoors to dry for winter use (38).

The plant is used as food in several ways by the Navajo, who often make a stew of it with wild onions, wild celery (*Cymopterus glomeratus*) and a little tallow, or bits of meat. Morsels of bread are then dipped into the stew and eaten. The young plants are also boiled with the addition of a pinch of salt and eaten as greens. The remnants of these plants are sometimes allowed to dry, and then cooked in the

shape of small dumplings with meat or tallow (15). The young plants are also boiled and pressed out three different times after which they are rolled into balls and eaten; or they may be dried and stored for winter, and when the balls are to be used they are soaked, then boiled with or without mutton. The Navajo claim that guaco has on occasions saved them from starvation.

Cf. *Chenopodium leptophyllum* for the use of the seeds of this species.

The tender plants of *Polanisia trachysperma*, clammy weed, *Stanleyella wrightii*, *Sophia sophia* and *Sophia halictorum*, tansy mustard, are cooked and eaten by the Pueblo Indians of New Mexico in much the same way as is *C. serrulata*. At Acoma and Laguna no distinction is made between *C. serrulata* and *P. trachysperma*, both being called *waku* indiscriminately.

The leaves of *Stanleya albescens*, *S. pinnata* and *S. integrifolia*, are similarly boiled and eaten by the Hopi (14, 23), who also boil or roast between hot flat stones the leaves of *Sisymbrium canescens* and of the sage, *Artemisia dracunculoides*, and eat them after dipping in salt water (14, 23).

*Cuscuta curta* Engelm. and *C. umbellata* H. B. K. Cf. *Chenopodium leptophyllum*.

*Cycloloma atriplicifolium* (Spreng.) Coulter. Cf. *Chenopodium leptophyllum*.

*Cymopterus fendleri* A. Gray. Cf. *Phellopterus bulbosus*.

*Cymopterus glomeratus*. Cf. *Cleome serrulata*.

*Cymopterus montanus*. A synonym of *Phellopterus montanus*.

*Cyperus inflexus* Muhl. Sedge. *Shikarau—shikrav-ka*. The small tuberous roots on this annual plant are eaten as food by the Acoma and Laguna.

*Dalea lanata* Spreng. A synonym of *Parosela lanata*.  
*Dasyilirion wheeleri* S. Wats. Cf. *Agave parryi*.

*Daucus pusillus* Michx. Wild carrot. The roots of this species are gathered in the early spring by the Navajo who eat them fresh or dry them for winter use, when they are cooked with or without wild celery (*Phellopterus montanus*).

*Datura meteloides* DC. Thorn-apple, Indian-apple. The fruits of this species are gathered in July by the Navajo who grind them with a special kind of clay and eat them without further preparation; or they sometimes dry and store them for winter, when they soak, boil until tender, and grind them with clay before eating.

*Dicoria brandegii* A. Gray. The flowers and seeds are finely ground and eaten as food by the Hopi (22, 23).

*Echinocactus wislizeni* Engelm. Cf. *E. triglochidiatus*.

*Echinocereus coccineus* Engelm. Cf. *E. triglochidiatus*.

*Echinocereus fendleri* (Engelm.) Ruml. Hedgehog cactus. The Cochiti roast the stems of this species and of *E. gonocanthus*, *yatapa*, in a pit in the earth and then eat them as food. Also Cf. *E. triglochidiatus*.

*Echinocereus gonocanthus* Engelm. Cf. *E. fendleri*.

*Echinocereus triglochidiatus* Engelm. Among the Isleta the fruits of this fleshy, spiny hedgehog cactus as well as those of the two species named above are eaten fresh after removing the spines by burning, or are made into a conserve. The pulp is prepared in a variety of ways—it may be sliced and baked like squash or made into a sweet pickle by baking it with sugar; candy is made in a somewhat similar way. The pulp is also macerated and made into a sort of cake by cooking it with sugar. The species of *Echinocereus* have the best flavored fruits of all the cacti. The fruits or tunas of several species of *Echinocereus* known as *kohaya ushsikuna* are eaten by the Acoma and Laguna. The Navajo eat the fresh fruit of several species of this genus and speak of them as being very sweet and delicious, but scarce.

The pulpy interior of the *viznaga*, *Echinocactus wislizeni*, also known as fish-hook cactus or barrel cactus, is used by the Pima as a source of moisture when water is not

available for drinking. The top of the cactus is cut off and the juicy white pulp macerated with a club, liberating a clear liquid (34). The pulp is also cut into strips and boiled for an entire day and then eaten as food, or it may be cooked with mesquite beans (*Prosopis glandulosa*), or sometimes boiled with sugar. It is regarded as a confection by the whites who sometimes secure it from the Papago (34).

The pulp of this plant is used by Mexican candy makers, who cut it into irregular portions, and candy it by boiling in a saturated sugar solution to make what they designate *cubiertas* or *dulce de viznaga*, which is regarded as quite a delicacy (44). Standley (36) reports that the pulp is cut into strips or cubes, boiled for several hours, and afterwards cooked in a thick sirup made from crude brown native sugar or *panocha*, which is so commonly used in Mexico, and finally shaped into rough cones known as *piloncillos*. This product is made in quantity every spring by the native people and sold under the name of *dulce de viznaga*.

*Encelia farinosa* Cf. *Hymenopappus filifolius*.

*Epilobium coloratum* Muhl. This plant is used by the Hopi in making bread (23).

*Equisetum laevigatum* A. Br. Smooth scouring rush. At San Felipe, where this species is known as *aota*, the plant is dried and ground to make mush for food. Among the Hopi it is dried and ground with corn meal to make a ceremonial bread (22).

*Eriocoma cuspidata* Nutt. Indian millet, sand bunchgrass. This species is widely distributed over the western portions of North America and is rather abundant in Nevada, Arizona, and New Mexico. It has been very extensively used by the Indians in portions of this area as an important source of food, especially in earlier times. It seems to have been used chiefly by the Indians from Zuni, westward to Southern California, but we have no knowledge or record of its use by any of the Rio Grande Pueblos of New Mexico.

The small black seeds were ground by the Zuni to make flour for bread. They highly regarded the plant and especially in times of food shortage scoured the country to gather large quantities of the seed (30b). Today the ground seeds are mixed with corn meal, made into dough, and the pats steamed and eaten (38, 44).

The Hopi also used the seeds of this plant for food in ancient times (22, 23). Their name for the plant is *lehu* and one of the Hopi clans with which the flute is associated is named for the species (14, 22, 23). Mr. Volney Jones has personally confirmed the early use of this grass as food by the Hopi.

The Navajo utilized the seeds of Indian millet for food. Matthews (28) gives the Navajo name as *in-dit-lith-ee*, meaning "burnt off or burnt free." This no doubt referred to the adhering chaff which can be removed only by burning at the time the edible seeds are cleaned. The Franciscan Fathers (15) give the word *ndidlidi* (that which is scorched) for this species, so called because the seeds were collected by holding a bunch of the grass near the fire, the seeds falling to the base of a flat stone placed obliquely near by. The White Mountain Apache of Arizona formerly used the seeds as a source of food, and now cut the grass for hay (32).

According to Chamberlin (11) the Gosiute Indians of Utah and Nevada, in the vicinity of the Great Salt Lake, formerly used the seeds of this plant as a source of food, while Blankenship (5) reports the former use of the seeds as food by the Indians as far north as Montana; the Panamint or Koso of Southern California similarly use the seeds as a source of food (12, 26).

In somewhat the same connection the Navajo (15) make dumplings, rolls, and griddle-cakes from the ground seeds of *Sporobolus cryptandrus*, drop-seed grass, while among the Hopi the seeds of this species as well as of panic grass (*Panicum capillare*) are ground and mixed with corn meal for food (14, 22, 23).

Pattie (40) refers a number of times to confiscating mush which had been made from grass seeds by Indians on the Gila river (apparently Apache), but it is not certain that the grass seed was Indian millet.

*Eriogonum corymbosum* Benth. Among the Hopi the leaves are boiled, and with some of the water in which they are boiled they are rubbed on the mealing stone with corn meal, then baked into a type of bread (14). Also Cf. *Hymenopappus filifolius*.

*Euphorbia serpyllifolia* Pers. Spurge, *la golondrina*. According to Stevenson (37, 38) the roots of this plant are gathered and stored in sacks by the Zuni. Then the women make the sweetening for corn meal by placing a small piece of the root in the mouth, where it remains intermittently for two days, being removed just before beginning the process of sweetening the freshly and finely ground corn meal. The mouth is filled with corn meal, which is not chewed, but retained until completely permeated with saliva, then deposited into a bowl, this process continues until the desired quantity of sweetening has been prepared. The saliva, containing the enzyme diastase, changes the starch of the corn meal into sugar, and the spurge root is probably kept in the mouth for the purpose of stimulating secretion of this enzyme.

*Fomes* sp. Cf. *Lycoperdon* sp.

*Fragaria bracteata* Heller. Strawberry. These fruits, although small, have an excellent flavor and are considered as a delicacy by the Isleta and Cochiti as well as the Mescalero Apache, and the Navajo.

*Frasera speciosa* Dougl. Deers ears. The Mescalero Apache prepare and eat the roots of this plant as food.

*Gossypium* sp. Cotton. In earlier times cotton seeds were eaten by the Pima who pounded them in a mortar with mesquite beans (*Prosopis glandulosa*), or ate the parched seeds without grinding (34).

*Grossularia inermis* (Rydb.) Coville & Britton. A synonym of *Ribes inermis*.

*Grossularia leptantha* (A. Gray) Coville & Britton. A synonym of *Ribes leptanthum*.

*Habenaria sparsiflora* S. Wats. Bog orchid, *kapani*. Formerly in times of food shortage the San Felipe used this plant for food.

*Hedeoma nana* (Torr.) Greene. Pennyroyal. The leaves of this mint are often chewed by the Isleta for its pleasing flavor.

*Helianthus annuus* L. Sunflower, *añil*. The Pueblo Indians of the Rio Grande Valley seem to have formerly cultivated the sunflower for its edible seeds, while Cremony (13) reports the use of sunflower seeds among the Apache who ground them on a metate and made the resulting flour into cakes; and Bourke (6) refers to the Moqui, Apache, Navajo, and Pueblos, as having cultivated the sunflower, the seeds of which were mixed with corn and ground into a meal which was then made into cakes.

*Hoffmanseggia densiflora* Benth. Cf. *Solanum fendleri*.

*Hoffmanseggia falcaria* Cav. Cf. *Solanum fendleri*.

*Holodiscus dumosus* (Nutt.) Heller. Ocean spray. The small fruits of this plant are eaten as food by the Tewa (33); similarly those of *Philadelphus microphyllus*, mock orange, were formerly used by the Isleta.

*Hymenopappus filifolius* Nutt. The roots of this plant, as well as of wild lettuce (*Lactuca pulchella*) are chewed by the Zuni much as we use chewing-gum (38). The roots of the former are chewed fresh, while those of the latter species are secured from young plants and hung up to dry. When they are to be used, slits are made in the roots from which a gummy substance exudes and this is dried before chewing. Among the Indians and Spanish-Americans of the Rio Grande Valley the roots of the Colorado rubber plant or *pengue* (*Hymenoxys floribunda*) are similarly chewed. In southern Colorado attempts have been made to utilize this and other allied species as a source of commercial rubber, but these species are not sufficiently abundant to make such ventures practicable even though they do produce good rub-

ber (44). The milky latex from the stems of *Asclepias speciosa*, *haapa*, (large milkweed) is collected by the Acoma and Laguna and allowed to harden before being used as chewing-gum, and the cotton from the pistillate catkins (*tatones*) of *Populus wislizeni*, valley cottonwood, *hituai* is used in the same manner, while the Isleta chew the gummy latex from the dogbane or Indian hemp (*Apocynum angustifolium*) after first mixing it with clean clay.

The Zuni chew the roots of *Parosela lasianthera* (38) while among the Hopi the mucilaginous stems of *Sphaeralcea angustifolia*, the globe mallow, and *Eriogonum corymbosum* are chewed as chewing-gum (23). Similarly the Pima use as a sort of chewing-gum the clear exudate from the white brittlebush, *Encelia farinosa* (34). Russell also states that these people chew the gum-like substance from the stems of some of the Compositae (34).

*Hymenoxys floribunda* (A. Gray) Cockerell. Cf. *Hymenopappus filifolius*.

*Juglans major* (Torr.) Heller. Walnut, *nogal*. It was customary for the Tewa to gather walnuts (probably *J. nigra*) when they hunted buffalo in the Arkansas valley (33). The New Mexico species of *Juglans* have only medium-sized fruits which are not extensively eaten, although the Navajo gather and eat them on a fairly large scale (15).

*Juglans nigra*. Cf. *J. major*.

*Juniperus monosperma* (Engelm) Sarg. One-seeded juniper, *sabina*. Rocky mountain juniper. The Jemez eat as food the berries of this species, either fresh or cooked, as do the Cochiti who call the plant *kani* and *mushrutsi*, while among the Acoma and Laguna, who know them as *kani* and *tyiika* respectively, the fruits are mixed with chopped meat, put into a clean deer stomach and roasted. They are quite generally used in seasoning meats and also are eaten in considerable quantity in the fall of the year or when food becomes scarce. At Zuni the fruits of this one-seeded juniper were gathered and ground into meal, which was then made

into cakes (38), while among the Isleta, the San Felipe, and the Mescalero Apache, the larger berries of *J. pachyphloea*, the alligator juniper, are boiled for food.

The fruits of the one-seeded as well as the Rocky Mountain juniper (*J. scopulorum*) are eaten as food by the Tewa either fresh or heated, the heated fruits being considered more palatable than the fresh. At Hano the resinous secretion from the plant is chewed as a delicacy (33) while many of the Rio Grande Pueblo Indians as well as the Navajo similarly chew the hardened resinous secretion of *Pinus edulis*. The Navajo in times of food shortage chew the inner bark of the one-seeded juniper to obtain the juice.

Palmer (30a) records the making of flour from *J. occidentalis* (?) by the Indians of New Mexico and Arizona.

*Juniperus pachyphloea* Torr. Cf. *J. monosperma*.

*Juniperus scopulorum* Sarg. Cf. *J. monosperma*.

*Koeleria cristata* (L.) Pers. Cf. *Chenopodium leptophyllum*.

*Laciniaria punctata* (Hook.) Kuntze. A synonym of *Liatris punctata*.

*Lactuca integrata* (Greene) Godr. Prickly lettuce. The young tender plants of the prickly lettuce are eaten as greens by the Acoma and Laguna.

*Lactuca pulchella* (Pursh) DC. Cf. *Hymenopappus filifolius*.

*Lathyrus decaphyllus* Pursh. Wild pea. Among the Acoma and Laguna this plant is known as *wayushe* and *wayushikuna*, respectively, while the Cochiti use the name *biri mushru* (chipmunk grass); the whole pod being utilized for food. The black seeds of the vetch, *Vicia americana*, known to the Acoma and Laguna as *wishikana* and *kama-shika wawa* (spider medicine), are eaten; while the Cochiti use the entire pods of this species, their name for it being *wayashow shikurina* (duck peas).

*Liatris punctata* Hook. Blazing star, *alfarfon*. The roots of the blazing star were formerly eaten without prep-

aration by the Tewa (33), while at San Ildefonso the raw sweet roots of *Petalostemon oligophyllus*, prairie clover, are similarly used (33). The roots of the latter species are gathered by the Acoma, Laguna, and San Felipe (who know it as *huni*), because of the sweet taste. They are also dried and ground to make meal by these Pueblos, who also chew the sweet roots of *Sophora serecia*, *ishikawatyamo*, as a delicacy.

*Lycium fremontii* var. The red berries of this species are boiled and eaten by the Pima (34).

*Lithospermum* sp. Puccoon. Among the Pima the fresh leaves are eaten as food (34).

*Lycium pallidum* Miers. *Tomatillo*. At Acoma and Laguna the berries of this plant, which is termed *dyakuna*, are cooked and made into sirup, while the Zuni (38), the Hopi (23, 33) and the Pueblo Indians of Jemez and of the Rio Grande Valley commonly eat the ripe or cooked berries as food. If not fully ripe the stewed berries are sweetened and thus regarded as a pronounced delicacy. The Hopi also mix the berries with "potato clay" and use them with paper-bread (14).

*Lycoperdon* sp. Puffballs. These fungi are gathered in large quantities by the Zuni (38) who eat them fresh or dry them for winter use, and many of the Pueblo Indians of the Rio Grande Valley regard the bracket fungi as a delicacy; they are prepared by boiling. At Isleta the bracket fungus *Polyporus harlowii*, is gathered from cottonwood trees in the fall, baked, or boiled, or stored for winter use. The San Felipe boil a species of *Fomes*, known as *kutokani*, which grows on the valley cottonwood, *Populus wislizeni*.

*Lygodesmia grandiflora* (Nutt.) Torr. & Gray. The Hopi boil the leaves of this species with meat to make a sort of stew (14, 23).

*Mammillaria* sp. Pincushion cactus. Cf. *Opuntia arborescens*.

*Mentha canadensis* L. Mint. This is eaten as a relish by the Hopi (14, 23).

*Mentzelia albicaulis* Dougl. The Hopi parch and grind these seeds into a fine sweet meal and eat it in pinches (14, 23).

*Mimulus geyeri* Torr. Monkey-flower. The Isleta slit and eat the tender shoots of the monkey-flower as a salad.

*Monarda citriodora* A. Gray. Cf. *M. menthaefolia*.

*Monarda menthaefolia* Graham. Horsemint, *oregano*. The leaves of this species as well as of *M. pectinata*, *nowatsena*, are by the Acoma and Laguna ground and mixed with sausage for seasoning. The former species, *hakutya*, is frequently chewed by the hunters of these Pueblos during the hunt.

Among most of the Pueblo Indians of New Mexico as well as the Spanish-Americans horsemint is cooked with meats and soups as a flavoring, and is often dried and stored for winter use. At Hano, however, the plant is cooked and eaten by itself (33). The Hopi boil the plants of the horsemint, *Monarda citriodora*, with rabbit meat (14, 23), while the Acoma and Laguna similarly use for flavoring purposes the leaves of *Agastache neo-mexicana*, giant hyssop, which they call *nowatsana*.

*Monarda pectinata* Nutt. Cf. *M. menthaefolia*.

*Monolepis chenopodioides* Moq. A synonym of *M. nuttalliana*.

*Monolepis nuttalliana* (R. & S.) Englem. The roots are gathered, washed, boiled, and the water squeezed out, again cooked for a few minutes with a little fat or lard and seasoned with salt. After being thus prepared by the Pima (34) they are eaten with tortillas. They are similarly prepared by the Mexicans who seem to have learned the method of preparation from the Pima.

Cf. *Chenopodium leptophyllum* for use of the seeds of *Monolepis nuttalliana* in making pinole.

*Nolina microcarpa* S. Wats. Cf. *Chenopodium leptophyllum*.

*Olneya tesota*, Ironwood. The fruits of this tree are parched and eaten by the Pima (34), and Palmer (30a)

records their use and preparation by the Mohave and other Indians of Arizona and Sonora.

*Opuntia arborescens* Engelm. Cane cactus, candelabrum cactus, *chollas*, *velas de coyote* (coyote candles). The prickly pear cacti or flat-jointed *Opuntias*, of which about thirty species occur in New Mexico, are the most widely distributed cacti in the Southwest. The Acoma and Laguna, who call this species *hipani*, use the joints roasted. The young joints are also sometimes split lengthwise, dried and stored for winter use. The stems and fruits of *O. clavata*, *ishikana* are similarly roasted and eaten in times of food shortage, although the stem sections are almost without flavor and also contain large quantities of a mucilaginous substance which render them rather objectionable. In spring and early summer the succulent stem of a species of *Opuntia* is similarly boiled and eaten as food by the Hopi (14, 23).

The fruits of a number of species of prickly pear, known as *tunas*, as well as of other genera of cacti, are commonly eaten by many Indian groups including the Navajo (20, 30a). The fruits of the New Mexican species are in general not so large nor so palatable as those which grow in Mexico where they constitute an important article of food. Some of the species native to New Mexico, however, produce large juicy fruits of pleasant flavor, although they have an abundance of large seeds. The Pueblo Indians of New Mexico gather the fruits of various species, such as *O. arborescens*, *O. clavata*, and *O. polycantha*. The spines are removed either by rolling or burning and the fruit eaten raw or after being boiled (23).

At Acoma and Laguna the fruits and joints of *Opuntia clavata*, known as *ishikana*, are roasted in time of famine for food. The ripe *tunas* of *O. engelmanni* are, by these people as well as the San Felipe, sometimes eaten fresh. They are also gathered, split lengthwise and dried, after which they are ground, seeds and all, and the meal mixed with an equal amount of corn meal to make a sort of mush for winter consumption. The *tunas* give the mush a red color. The

San Felipe, among whom this species is known as *imacho*, grind the ripe seeds with white corn and eat the resulting meal as mush. These Pueblos singe the joints of *Opuntia polycantha*, *imatsa*, in hot coals and boil them with dried sweet corn to make a very desirable winter food. The San Felipe formerly roasted and ate the joints of this species, known to them as *yatapu*.

According to Robbins and Harrington the Tewa of New Mexico eat the fruit of *O. camanchica*, while the Tewa of Hano also eat the fruit of a species of *Opuntia* (33). It is gathered by the women with tongs made of cleft sticks and the spines rubbed off with a stone. The fruit is boiled for a time, after which it is eaten with sweetened corn meal porridge.

The Zuni likewise gather the fruit of *O. whipplei* with wooden tongs, rub off the spines and eat it raw or stewed. It may be dried for winter use, ground into meal, mixed with parched corn meal, and made into a sort of mush (38).

The Pima commonly eat the fruits of the cane cactus, *O. arborescens*, which are gathered with a sort of wooden tool resembling a large clothespin. A pit is dug and stones heated on the fire built in it in a manner similar to that used in preparing mescal (Cf. *Agave parryi*). As the fire dies down the stones are taken away and a layer of saltbush, (*Suaeda arborescens*) used to cover the embers. A layer of cactus fruits is then placed on the latter and the fruits in turn covered with a layer of hot stones. Several strata of the above are laid until the pit is filled, then comes a thick layer of the saltbush, and the whole covered with a layer of earth. The fruits are thus allowed to bake over night, and in the morning spread out to dry. When thoroughly dry they are stirred with sticks to remove the spines, and are ready for storage. Preparatory to eating the fruits are boiled alone or with various other plants, such as *Atriplex bracteosa*, *A. coronata* and *A. elegans*, saltbush, in order to counteract the acid flavor. Thus prepared they are salted and eaten with pinole (34). The fruits of the chollas,

*Opuntia versicolor*, and of *O. engelmanni* are similarly prepared or eaten raw, after rubbing off the spines and peeling (34). The Papago make a sirup from the fruit of the latter species which is said to cause fever among those not in the habit of using it. They also dry the fruit to be eaten during the winter (34).

Castañeda (10) refers to the Indians of Arizona making preserves from the tunas of species of *Opuntia*, by preserving them in a large amount of their own juice.

Several species of prickly pear, commonly designated *nopales* by the Spanish-Americans, are sometimes used as food for stock, particularly in times of food shortage, and are prepared for consumption by burning off the spines with a torch. Experiments in growing prickly pear in large amounts for stock feed have failed, largely because rabbits eat the young plants with great relish (36).

The Navajo gather the fruits of several species of *Opuntia* with a cactus picker made from a forked stick. After the spines are removed by rubbing the fruits in the sand with the foot, the tunas are slit and dried in the sun and served as we serve stewed dried fruit (15). They are sometimes stewed with dried peaches, and thus prepared are regarded as quite delicious.

The tunas of various species of *Opuntia* yield a rich red coloring matter which is sometimes used in tinting candies and pastries (36).

The spines are burned off of the whole plant of certain species of *Mammillaria*, pincushion or ball cactus, which is then eaten raw by the Tewa (33). Cf. also *Rumex berlandieri*.

*Opuntia clavata* Engelm. Cf. *O. arborescens*.

*Opuntia camanchica* Engelm. Cf. *O. arborescens*.

*Opuntia engelmanni* Salm-dyck. Cf. *O. arborescens*.

*Opuntia polycantha* Haw. Cf. *O. arborescens*.

*Opuntia versicolor* Coult. Cf. *O. arborescens*.

*Opuntia whipplei* Engelm. Cf. *O. arborescens*.

*Oryzopsis cuspidata* Benth. A synonym of *Eriocoma cuspidata*.

*Oryzopsis hymenioides* (Roem. & Schult.) Ricker. A synonym of *Eriocoma cuspidata*.

*Oryzopsis membranacea*. A synonym of *Eriocoma cuspidata*.

*Padus melanocarpa* (A. Nels) Shafer. Cf. *Prunus melanocarpa*.

*Panicum capillare* L. Cf. *Eriocoma cuspidata*.

*Panicum obtusum* H. B. K. Panic grass. The seeds of this panic grass are ground with corn and eaten as food by the Hopi (22, 23).

*Parkinsonia microphylla* Torr. *Palo verde*, little-leaf horse-bean. The "beans" of this species which grows in the foothills and of *P. torreyana*, found on the mesas, were in earlier times eaten or ground to make meal by the Pima, often being combined with mesquite (*Prosopis glandulosa*) meal (34).

*Parosela lanata* (Spreng.) Britton. Cf. *Astragalus diphysus*.

*Parosela lasianthera* (Gray) Heller. Cf. *Hymenopappus filifolius*.

*Pectis angustifolia* Torr. Cf. *Pectis papposa*.

*Pectis papposa* A. Gray and *P. angustifolia* are commonly used as seasoning by Pueblo Indians of New Mexico and the plant has a pronounced fragrance of lemons. The Acoma and Laguna use the latter species, known to them as *hapu*, *tsityishityi wawa*, as a seasoning to counteract the taste of tainted meat.

The latter species is much sought after by the Hopi, who boil it with green corn for the purpose of flavoring (22, 23), while the Zuni crush the fresh flowers of the former species and sprinkle them into meat stew after the latter has finished cooking. The plants are also gathered and hung up in the house to dry for winter use (23, 38).

*Petalostemon oligophyllus* (Torr.) Rydb. Cf. *Liatris punctata*.

*Phellopterus bulbosus* (A. Nels.) C. & R. Wild celery, *chimaja*. The Cochiti, who know this wild celery as *chamu*, eat it for food as we do celery, while the Acoma and Laguna similarly eat the wild celery, *ukayawi* (*Cymopterus fendleri*).

*Phellopterus montanus* Nutt. Wild celery. The tuberous roots of this species are peeled, baked, and ground by the Navajo, who use it as an occasional substitute for corn meal (15), while the Acoma and Laguna similarly grind the roots of the sand verbena (*Abronia fragrans*) which they term *germate* and *shruwi wawa*, and mix it with corn meal to be used as food. (Cf. *Allium recurvatum*). Both Palmer (30a) and Havard (20) report the use of *Phellopterus* and *Cymopterus* species as food by the Indians of the Southwest.

*Philadelphus microphyllus* A. Gray. Cf. *Holodiscus dumosus*.

*Phoradendron californicum*. Cf. *Phoradendron juniperinum*.

*Phoradendron juniperinum* Engelm. Juniper mistletoe. The berries are eaten by the Acoma and Laguna, who know the plant as *shikatratra*, when other food becomes scarce; also by the Navajo who say that the berries are not very palatable, although the Hopi use them as a substitute for coffee (22, 23).

The berries of the mistletoe *Phoradendron californicum*, which grows on mesquite, *Prosopis glandulosa*, are boiled without removing from the stem. They are eaten by the Pima by drawing the stems between the teeth to remove the berries. Although a number of species of mistletoe grow on the trees along the Gila, this is the only one used as food (34).

*Physalis fendleri* A. Gray. Ground-cherry. The Zuni boil then crush small quantities of the fruit for use as a condiment (38).

*Physalis longifolia* Nutt. Cf. *P. neo-mexicana*.

*Physalis neo-mexicana* Rydb. Ground-cherry, ground-tomato, *tomate*, *tomate del campo*. The berries of this as

well as of *P. longifolia*, are in common use as food by the Rio Grande Pueblos, usually being boiled but sometimes eaten fresh. At Acoma and Laguna they go under the names *charoka* and *shuma charoka*; the San Felipe use this species in a similar manner and know it as *sharaoka*. The widely distributed native *P. longifolia* is cultivated by Zuni women, the ripe red berries being boiled, ground with raw onions, chile, and coriander seeds in a mortar. The dish is regarded as a great delicacy (23, 38).

The Hopi formerly ate these berries (23); the Zuni dry and grind them and the meal is made into bread (23).

*Pimpinella anisum*. Cf. *Chenopodium leptophyllum*.

*Pinus brachyptera* Engelm. This is a synonym of *P. scopulorum*.

*Pinus edulis* Engelm. Piñon, nut pine. This rather small, two-needled pine is very widely distributed in south-western United States, northern Mexico, western Texas, Colorado, and Utah, and is a very important source of food, especially in New Mexico (20, 30a). The seeds are not only eaten locally but are also gathered in large quantities by the Navajo (the best and most extensive piñon pickers), Pueblo Indians, and Spanish-Americans, who sell or trade them. Among the Indian peoples it is customary for the entire family to go to the hills and spend a number of days during the piñon season gathering the nuts. It will be remembered locally that during the winter of 1933 a considerable number of Navajo Indians were snowbound while gathering piñons on the Zuni reservation and were rescued with considerable difficulty after they had endured much hardship. The Navajo is especially proficient in picking the nuts from the ground by hand. Another method of gathering the seeds is to spread sheets or pieces of canvas under the trees, then beat the trees with sticks; or they are sometimes swept into piles on the ground with a whisk broom. After either of these processes the nuts must be threshed to remove the accumulated debris.

The most fruitful method of gathering piñons is by robbing the nests of rats who usually store from ten to thirty pounds of the seeds in a nest. The natives contend that a good crop of piñons is produced only every seven years, and that it is accompanied by an epidemic of smallpox (8).

The seeds are sold locally in small quantities by those who gather them, but are more commonly traded at stores where they are later purchased in large quantities by piñon traders. In 1915 a total of 5,000,000 pounds of piñons were exported from New Mexico and Arizona, and in 1929 New Mexico alone shipped 2,143,000 pounds of the nuts. An average of more than 2,500,000 pounds are annually exported from the two states. Almost all of these piñons go to New York City and Boston, where, after being roasted they are sold chiefly by cart venders or in penny slot machines under the name of Indian nuts (8).

Recently shelled piñons have been used in confections and pastries, the trade name *pignolia* being used for the nuts when sold for confectionary purposes. The natives prepare a dish much like toasted bread pudding, termed in Spanish, *sopa de piñon*. It is made with toasted bread, cheese, piñons, raisins and sometimes milk; the mixture is sweetened with caramel sugar and baked in the oven (8).

Among the Tewa the seeds, either fresh or roasted, formerly constituted an important article of food. About October 15, after their corn harvest, the Santa Clara go to the mountains for several days to gather piñons. At Santa Clara the piñon is said to be the oldest tree, and its seeds the oldest article of food (33) while among the Isleta and other Rio Grande Pueblos it formerly constituted an important article of food. These "nuts" are also bought from New Mexican Spanish peddlers and eaten raw on festival days (23). According to Benavides (4) piñon nuts from New Mexico were in earlier times traded to Mexico, while he, and Bancroft (1) and Bartlett (3) refer to the early extensive use of piñons as food by the Indians of New Mexico.

The Zuni themselves gather quantities and store for winter use large amounts of the nuts, in addition to quantities secured from the Navajo (38). They are usually roasted before storing as this improves the flavor.

The Navajo roast the piñon nuts in skilletts or pots, or sometimes mash them to make a kind of butter (15). They bring piñon seeds to Hano, Jemez, and the Keresan Pueblos for sale or trade, and Indian storekeepers always have them for sale. The Navajo also hull them between two stones while still hot after roasting and eat them without further preparation. At times corn is parched and eaten with the nuts. They are used in still another way by the Navajo: they first parch and grind some corn, then the hulled piñon nuts are parched, a few being allowed to go unshelled. The corn meal and parched nuts are ground together and the resulting meal is used as a form of flour. Since the introduction of coffee some tribes mix a little of the flour into their coffee. Also Cf. *Juniperus scopulorum*.

*Pinus flexilis* James. Cf. *P. scopulorum*.

*Pinus scopulorum* (Engelm.) Lemmon. Rock pine, Western yellow pine. This is the most common tree of New Mexico and Arizona, constituting about two-thirds of the timber of the former state. It is unquestionably the most important timber tree in New Mexico from the standpoint of quantity and quality of lumber.

The inner bark of this and other conifers was chewed or eaten by many groups of Indians in New Mexico and Arizona, particularly the Zuni (36), when other food was scarce (44). The seeds of *P. flexilis*, western white pine or limber pine, although having fairly thick and hard shells, are sometimes eaten by Indian peoples as food.

*Plantago major* L. Common plantain. The young leaves are used as food by the Acoma and Laguna.

*Polanisia trachysperma* Torr. & Gray. Cf. *Cleome serpulata*.

*Poliomintha incana* (Torr.) A. Gray. This plant is dipped in salt water and eaten as food by the Hopi (14).

The leaves are boiled and eaten; the flowers are rubbed, then used as a flavoring substance, which the Hopi say tastes like brown sugar (22, 23).

*Polyporus harlowii*. Cf. *Lycoperdon* sp.

*Populus deltoides* Marsh. Cf. *Populus wislizeni*; also *Chenopodium leptophyllum*.

*Populus wislizeni* (S. Wats.) Sarg. Valley cottonwood. The catkins of this species are eaten raw by some of the Pueblo Indians of New Mexico, especially the Jemez and the Isleta (Cf. *Hymenopappus filifolius*).

The Pima women during the months of February and March gather and eat the raw catkins (*tatones*) of *P. deltoides*, the flowers being stripped off by drawing the catkins between the teeth (34).

*Portulaca oleracea* L. Common purslane, verdolaga. This very important native plant is extensively used as a source of food in New Mexico. At Isleta it is gathered in large quantities and slowly dried in an oven, then stored and used as greens during the winter; while among the Acoma and Laguna, who cook this plant with meat, it is known as *shitaya* and *kayashi* respectively and eaten much as we eat spinach. The fleshy leaves and stems are boiled and eaten by most of the New Mexico Pueblo Indians, including the Tewa (33), as well as the Spanish-Americans. Cremony (13) writing in 1868 refers to his party as having lived upon purslane and water for several successive days.

Plants of *P. retusa* are boiled with meats by the Hopi (14, 23), who also formerly used them cut fine and mixed with gravy (33). The seeds of both species were at one time eaten as food by the Zuni and Navajo (36). The San Felipe, who know the plant as *shüpa*, use it when young as greens, and also fry or boil it and then mix it with young peas.

*Portulaca retusa* Engelm. Cf. *P. oleracea*; also *Chenopodium leptophyllum*.

*Prosopis glandulosa* Torr. Mesquite. This is one of the best known plants of the arid Southwest, and in southern

New Mexico and parts of Arizona is of great economic importance, having been recognized as a food of the American aborigines ever since the Spaniard Alarcon ascended the Rio Colorado in 1541. The flowers furnish excellent nectar for honey making, while the leaves and pods are extensively eaten by browsing animals of all kinds. The ripe pods, on account of their sugar content, are frequently eaten by the New Mexican Spaniards. The seeds are gathered by some of the Indian peoples, although not so extensively as in former times, who grind them and make the meal into a kind of bread (20, 30a). At Isleta the beans are toasted and eaten as a confection by sucking out the juice. The Acoma and Laguna, who term the plant *yeto*, eat the beans raw because of their sweet flavor, or they sometimes cook them as string beans. Formerly these people ground the beans to make flour which was then prepared as a sort of mush for food.

The beans of *P. velutina* are eaten by the Pima, the Maricopa, and some of the Indians of southern California, among whom it formerly constituted one of the most important sources of food, the harvest occurring somewhat later than that of the sahuaro. Among the former group the pods are gathered and stored in cylindrical bins on the tops of houses, wigwams, or sheds, preparatory to being ground into flour (3, 34). In preparing mesquite for consumption the seeds alone or with the pods are ground in a mortar, or the seeds are sometimes parched and afterwards ground into a meal which is very nourishing. This sweet flour is eaten as a pinole, used to sweeten pinole or made into bread. In 1871 Grossman (18) wrote of the extensive use of mesquite by the Pima and how they dried and ground the nearly ripe beans in a wooden mortar, then pressed the meal free of excess water, molded it into loaves which were baked in hot ashes. This sweet, heavy, nourishing bread he found to be rather indigestible. In this same connection Cabesa de Vaca (7) referred in 1535 to securing a quantity of mesquite flour from Indians in the Southwest, while Benavides (4) reported the extensive use of the beans among the Indians

of New Mexico. Pattie (40) similarly recorded that among the Indians on the Gila river in Arizona (probably the Pima) the fruit constituted one of the chief articles of subsistence, being made into a very palatable kind of bread; while Casteñada (10) referred to the making of a mesquite bread by the Indians of Arizona, which kept for a whole year, and Fernando Alarcon, who went up the Colorado river in 1541, records that the Indians brought him loaves of mesquite (3).

The Mescalero Apache also grind the seeds of *P. prosopis* into flour which is then used in a sort of pancake. The beans are often boiled, then pounded on a hide or ground on a metate, after which they are kneaded with the hands until a thick jam-like substance is formed. They are also cooked with meat by the Apache who discard the beans when the stew is eaten. Gregg (17) similarly refers to the Apache and other Indian tribes of New Mexico as grinding the mesquite pod to make flour and this flour used in making their favorite pinole; while Kendall (24) refers to the Comanche as making very palatable and nutritious meal from the seeds of this species; also to the Mexicans as using them as a source of sugar.

The Pima eat the fresh catkins of the plant, stripping them by drawing the catkins between the teeth (34). The white resinous secretion is also used by them in making candy, while the white inner bark is used as a substitute for rennet in curdling milk (34).

Cf. *Gossypium* sp; also *Parkinsonia microphylla*; also *Echinocereus triglochidiatus*; also *Solanum fendleri*.

The pods from the large shrubs of *Strombocarpa pubescens*, screw bean or *tornillo*, also contain an abundance of sugar. Some of the Indians of the Rio Grande Valley, particularly the children, chew these sweet pods as a delicacy.

The Pima roast and grind the beans to make flour, first roasting them in pits lined with arrow bushes. They are placed in alternate strata with cockleburr leaves, *Xanthium commune*, and the whole covered with earth. After baking

for several days they are removed, spread out to dry, then stored. Meal is prepared by grinding the beans in a mortar, and the resulting fine flour eaten as a kind of pinole, while the coarser material mixed with water is brought to the mouth with the hands, the juice sucked through the fingers and the residue discarded. The Pima and Yuma in ancient times also used the seeds of the cat-claw, *Acacia greggi*, for food (34).

The sweet pods and seeds of screw bean as well as of mesquite were ground into meal by the Apache who made a sort of bread from the product (6, 36).

*Prosopis pubescens* Benth. A synonym of *Strombocarpa pubescens*.

*Prosopis velutina* Woot. Cf. *P. glandulosa*.

*Prunus americana* Marsh. Wild plum. The Isleta say that this plant grew near the pueblo and the fruits were eaten as food, although it has been largely replaced by cultivation. The plant grows rather abundantly near the Taos Pueblo and these Indians utilize it rather extensively. Among the Navajo the plums are eaten fresh.

*Prunus melanocarpa* Rybd. Chokecherry, *capulin*. The fruit, although rather astringent, is eaten either fresh or cooked by many of the Rio Grande Pueblos. At Acoma and Laguna, as well as Cochiti and San Felipe, this fruit, which is known as *apu*, is either eaten fresh or dried for winter use. The dried product is soaked in water before being used. Among the Spanish-Americans the plant is known as *capulin* and the cherries are made into jelly and jam. The Jicarilla Apache make sweet, rather black cakes from the meal of the ground berries of this species, about six inches wide and one inch thick, and these are to some extent an article of trade, sometimes being brought by the Apache to San Ildefonso at Christmas time (33).

The Navajo use as food the fresh chokecherry fruit (15); also cook them into a gruel with corn meal, but the plant is not commonly found on the Navajo reservation.

*Pseudocymopterus aletifolius* Rydb. The leaves are eaten fresh as a relish, or after being cooked used for greens by the Isleta.

*Ptelea tomentosa* Raf. Wafer ash. The young fruits of this species are known at San Felipe as *chibanini* and commonly eaten by the children.

*Quamasia quamash*. A synonym of *Comassia esculenta*.

*Quercus agrifolia* Nee. Cf. *Q. utahensis*.

*Quercus dumosa* Nutt. Cf. *Q. utahensis*.

*Quercus engelmannii* Greene. Cf. *Q. utahensis*.

*Quercus gambelii* Nutt. Cf. *Q. utahensis*.

*Quercus lobata* Nee. Cf. *Q. utahensis*.

*Quercus oblongifolia* Farr. Cf. *Q. utahensis*.

*Quercus undulata* Rydb. Cf. *Q. utahensis*.

*Quercus utahensis* (DC.) Rydb. Oak. There are in the United States more than fifty species of oak, of which thirty occur in eastern United States and about fifteen in the State of California alone. The acorns of *Q. utahensis*, as well as of the Gambel oak, *Q. gambelii*, were formerly used quite extensively for food by the Pueblo Indians of New Mexico. Benavides (4), Havard (20), and Palmer (30a, b) list acorns as among the food products of the Santa Fe region, undoubtedly having reference to these same species. These acorns are even today boiled and eaten or ground to make meal by the San Felipe and the Acoma and Laguna, who know the species as *hapani*, as is also the case among the Cochiti, who call the plant *hiaskridani*. The eating of acorns is today thought by the Isleta to give greater sexual potency.

Pattie (40) refers to Indians on the Gila river (it is not certain whether they were Yuma or Apache) as using acorn mush, and Castañeda (10) refers to the Indians of the Southwest as making cakes "like sugar plums with dried coriander seeds" (*Coriandrum sativum*) out of acorns.

Acorns were boiled like beans or roasted on coals by the Navajo (15). Among the Pima the acorns of *Quercus oblongifolia* are obtained from the Papago by barter, parched and ground to make meal (34).

One is here reminded of the very extensive use of acorns as food by the Indians of the Pacific Coast, for they were quite universally eaten as an important article of diet from the Oregon boundary to the Mexican desert areas, where oaks do not grow (6, 29). Certain parts of the coast, the Upper San Joaquin Valley, and the mountains of the Coast Range are thickly covered with oak forests. The largest and most palatable acorn is that of the white oak or Mexican "roble"—*Q. lobata*, which is rather common throughout the state. It is the fruit of this species which, to a large extent, made the early Indian coast culture possible; however, all the "live" or evergreen oaks of the coast, particularly *Q. englemannii*, also yield edible acorns. Several desert species of evergreen oak, *Q. undulata*, *Q. oblongifolia*, and *Q. wislizeni*, var. *frutescens*, are of this sort. *Q. agrifolia*, the coast-line oak of California or the *encino* of the Mexicans, is the only species of black oak which furnishes food for the Indians (2). To the native Indians of California the acorn is and always has been the staff of life, being used primarily to make their daily mush and bread. The significance of this fact is realized when it is recalled that the Indian population of the state at the time of its discovery was about 300,000. *Q. dumosa* has a thick, large fruit which is today in common use as food by the Coahuilla Indians of California. The acorns are ground in the mortar and leached in the sand basket (2, 20).

*Quercus wislizeni*. Cf. *Q. utahensis*.

*Ranunculus eremogenes*. Greene. Buttercup, *gakiyatyi*. The roots of this plant, said to be poisonous, are sometimes mistakenly eaten by the Acoma and Laguna for those of *R. inamoenus*, *okiya*, which are quite edible.

*Ranunculus inamoenus* Greene. Cf. *R. eremogenes*.

*Reverchonia arenaria* Gray. The sweet berries of this plant are eaten by the Hopi (22, 23).

*Rhus microphylla* Engelm. Cf. *R. trilobata*.

*Rhus trilobata* Nutt. Skunk-bush, three-leaved sumac, *lemita*. The fruit is eaten fresh or after being ground to

form meal by the Navajo (15), the Pueblo Indians of the Rio Grande Valley, the Hopi (14, 22), and the Mescalero Apache. At Acoma and Laguna the fruits of this plant, known as *yaa*, *yaana* (the berries), which have this distinct lemon flavor, are mixed with various foods for seasoning; they are also eaten raw as an appetizer.

The Navajo eat the berries fresh or after being cooked with corn meal to form a gruel, while the Mescalero Apache use as food the sweet orange-scarlet fruits of the small-leaved sumac, *R. microphylla*.

*Ribes cereum* Dougl. A synonym of *R. inebrians*.

*Ribes inebrians* Lindl. Currant, *manzanita*. The fruit is commonly eaten, usually fresh although sometimes after being preserved, by the Indians of the Rio Grande Valley, as well as the Acoma and Laguna, who term this species *ishi*. They are also eaten at Hopi (14, 23). Among the Zuni the fresh leaves, which come early in the spring, are eaten with uncooked mutton fat, or with deer fat when available. The berries are also frequently eaten (38). The Navajo similarly eat the fresh fruit of this plant (15).

*Ribes inerme* Rydb. Gooseberry. These wine-colored berries are used as food by the Mescalero Apache, as well as many of the Pueblo Indians of the Rio Grande Valley; the Jemez and Isleta commonly eat the fresh berries of *R. leptanthum*, while the Spanish-Americans term the fruits *macita* and use them to make jelly as well as wine. Palmer (30a) reports the use of *Ribes* species among the Indians of the Southwest.

*Ribes leptanthum* A. Gray. Cf. *R. inerme*.

*Robinia neo-mexicana* A. Gray. New Mexico Locust. The large clusters of pink flowers are eaten without preparation by the Jemez.

*Rosa fendleri* Crep. Rose. The Mescalero Apache and the Navajo (15) eat the fruits or hips of this rose.

*Rubus arizonicus* (Greene) Rydb. Red raspberry. The fruit of this plant is eaten as food by the Navajo (15).

*Rudbeckia laciniata* L. Cone flower, *baishikani*. The young stems of the cone flower are used by the San Felipe much as we eat celery and are regarded as very delicious.

*Rumex crispus* L. Cf. *R. hymenosepalus*.

*Rumex berlandieri*. Cf. *R. hymenosepalus*, also *Opuntia arborescens*.

*Rumex hymenosepalus* Torr. Dock, *canaigre*. Russell reports that the stems and roots are eaten by the Pima (34). This seems strange, since the roots particularly are rich in tannin, giving them a very bitter taste; however, he reports that the stem is roasted in ashes or, more recently, cooked with sugar, and that he has "seen the children greedily devouring the raw roots in March" (34). Palmer (30b) records the use of the leafy stems as a substitute for rhubarb in making pies in Utah. The young stems of *R. venosus*, known as *shotomi*, are prepared and eaten by the San Felipe much as we eat rhubarb, while the leaves of the yellow or curled dock, *R. crispus*, are similarly used by various Indian groups of New Mexico, and the Cochiti use as greens the leaves of the Mexican dock, *R. mexicanus*, which they call *kasha wawa*. In this same connection the Pima cook the leaves of *R. berlandieri* with the fruits of various species of prickly pear cactus for the purpose of giving flavor to the latter (34). Cf. *Opuntia arborescens*.

*Rumex mexicanus* Meisn. Cf. *R. hymenosepalus*.

*Rumex venosus* Pursh. Cf. *R. hymenosepalus*.

*Sambucus microbotrys* Rydb. Elderberry. The Mes-calero Apache eat the berries of this species either fresh or after having been cooked.

*Sericotheca dumosus* (Nutt.) Rydb. A synonym of *Holodiscus dumosus*.

*Simmondsia californica* Nutt. Quinine plant, coffee berry. The nuts are, according to Palmer (30b), eaten either raw or parched by the Pima.

*Sisymbrium officinale leiocarpum* DC. Cf. *Chenopodium leptophyllum*.

*Smilacina amplexicaulis* Nutt. Solomon's seal. The ripe berries were eaten by the Tewa (33).

*Solanum elaeagnifolium* Cav. Bull nettle, silver prickly nightshade, *trompillo*. The fruits of this common and troublesome deep-rooted plant are commonly used by the Indians and Spanish-Americans of New Mexico as a substitute for rennet in curdling milk. The Cochiti, who use the plant in a similar manner, know it is *ashika*.

The berries are used by the Pima and Zuni to curdle milk, and are regarded as a delicacy. (34, 38).

*Solanum fendleri* A. Gray. Wild potato. The small tubers, closely resembling potatoes, are eaten by the Pueblo Indians of the Rio Grande Valley, although not so extensively as in earlier times. At Acoma and Laguna the plant is known as *napamu matsiana*. The Zuni eat the tubers of this species raw, counteracting the unpleasant astringent effect produced on the tissues of the mouth by taking a bite of white clay after each mouthful (38).

The tubers of *Solanum jamesii* are eaten by the Hopi, who boil and then eat them with a talc of greasy taste, known as potato clay (14, 23). Robbins and Harrington also refer to the Tewa as eating the tubers of this plant (33). Havard (20) and Palmer (30b) report the use of both of the above species as food by the Indians of the Southwest.

In somewhat the same connection the Papago and other Indians of the Southwest have used from time immemorial the sand-root (*Ammobroma sonora*), as a source of food. This plant, which is parasitic upon the roots of the small desert shrubs *Coldenia plicata* (Torr.) Cov. and *C. palmeri* Torr., as well as on *Eriogonum deserticum* S. Wats., grows in parts of the Southwest, Lower California and Mexico, where the average rainfall is between only two and five inches. It is very eagerly sought by the Papago and the Cocopa, who consider it as a most excellent food, which they eat either raw or roasted (16, 26, 39, 42). Palmer (30a, b) records that the Papago also dry and grind the stems with

mesquite beans (*Prosopis glandulosa*) to make a pinole, and discusses its general use and preparation among these people, while Havard (20) records its use by the Cocopa, Papago, and Yuma.

The tuberous, rather sweet but tough Indian potato, or *camote de raton* (*Hoffmanseggia densiflora*), was commonly roasted and eaten by various Pueblos of the Rio Grande Valley of New Mexico, as well as by the Mescalero Apache; the plant is not extensively used today. Similarly the Indian potato, *H. falcaria*, was collected among the Pima in 1885 by Palmer (30b) who reported that it tastes, when roasted, much like the Irish potato, while Cremony (13) records its use (probably this species) by the Apache.

One is here reminded of the extensive use of the roasted camas or quamash bulb (*Camassia esculenta* or *Quamasia quamash*) by the Papago and the Indians of the Northwest from Wyoming west to California (35, 41, 43).

*Solanum jamesii* Torr. Cf. *S. fendleri*.

*Solanum triflorum* Nutt. These berries are, in times of food shortage, eaten by the Acoma and Laguna, among whom the plant is known as *ityikumi* and *ostsiyi* respectively, while at Zuni the ripe fruit is boiled, ground in a mortar with chile and salt, then eaten as a condiment with mush or bread (38).

*Solidago missouriensis* Nutt. Goldenrod. The Hopi eat the young leaves with salt (22, 23).

*Sophia halictorum* Cockerell. Cf. *Cleome serrulata*.

*Sophia pinnata* (Walt.) Britton. Tansy mustard. The seeds are parched and afterward ground to make meal, whereupon it is mixed with water by the Pima to form a pinole (34).

*Sophia sophia* L. Cf. *Cleome serrulata*.

*Sophora serecia* Nutt. Cf. *Liatris punctata*.

*Sphaeralcea angustifolia* Spach. Cf. *Hymenopappus filifolius*.

*Spiesia lambertii* (Pursh) Kuntze. The Hano eat these roots as food (23).

*Sporobolus cryptandrus strictus* Scribn. Cf. *Eriocoma cuspidata*.

*Stanleya albescens*. Cf. *Cleome serrulata*.

*Stanleya pinnata*. Cf. *Cleome serrulata*.

*Stanleya integrifolia*. Cf. *Cleome serrulata*.

*Stanleyella wrightii* (A. Gray) Rydb. Cf. *Cleome serrulata*.

*Strombocarpa pubescens* (Benth.) A. Gray. Cf. *Prosopis glandulosa*.

*Suaeda arborescens*. Cf. *Atriplex nuttallii*; also *Opuntia arborescens*; also *Chenopodium leptophyllum*.

*Suaeda suffrutescens* S. Wats. Cf. *Atriplex nuttallii*.

*Taraxacum officinale* Web. Dandelion, *consuelda*. Young dandelion plants are eaten as greens by the Tewa (33).

*Tradescantia occidentalis* Britt. Spiderwort. The tender shoots of this species are eaten as food without preparation by the Acoma and Laguna, who term it *bashu*. The Hopi cook the young plants of *T. virginiana* as greens (23).

*Typha latifolia* L. Cat-tail. Among the Acoma and Laguna the roots and tender shoots of this species, which is known as *achuwa* and *ishitowa*, are salted and eaten as food, while the roots constitute an article in the diet of the Mescalero Apache. Also the San Felipe grind the shoots and mix the meal with corn meal and this is used as food, particularly in times of shortage. The seeds are used as food by the Paiute.

*Vagnera amplexicaulis* (Nutt.) Greene. Cf. *Smilacina amplexicaulis*.

*Vicia americana* Muhl. Cf. *Lathyrus decaphyllus* Pursh.

*Vitis arizonica* Engelm. Wild grape, *uva*. The fruit of this species is not very palatable but has often been used as food by the Indians of the Southwest (30b). It is still an article of the diet at Isleta, Jemez, Acoma, and Laguna and is also eaten by the Navajo (15). The domestic grape is now cultivated by the Pueblo Indians but has been intro-

duced. Palmer reports that the Pueblo Indians formerly cultivated the wild grape (30a).

*Xanthium commune* Britton. Cocklebur. At Zuni the seeds of this plant are ground, mixed with corn meal and made into pats, which are then steamed. This, according to Stevenson, was commonly eaten by the poorer Zuni in 1879 (38). Cf. *Strombocarpa pubescens*.

*Yucca bacchata* Torr. Soapweed, datil. The San Felipe, whose name for this species is *hatyani*, cook the partly matured fruits to form a thick, semi-liquid substance, which is dried and stored for winter use. They also eat the ripe fruits without preparation.

Among the Zuni, the fruit of datil is considered a great luxury and is either pared and eaten raw, or first boiled and then skinned. A conserve is also made from the pared fruit; the fleshy portion, which is bitten away from the core containing the seeds, is cooked well, made into pats about three inches in diameter, and dried in the sun. This dried substance is eaten as conserve, or pieces of it may be mixed with water forming a sort of sirup; in earlier times this sirup was used in place of sugar (38). The Cochiti prepare both conserve and sirup from this species in much the same manner as do the Zuni (33).

The Pima use *Yucca bacchata* as a source of food by boiling, drying, and grinding the fruit, and boiling the resulting meal with wheat flour (34).

The Navajo more extensively use the datil fruit than do any other people, probably because of its great abundance in their country. In late fall regular expeditions of ten to fourteen days' duration are made by the Navajo to gather the fruit in large quantity. It is eaten raw or cooked, but is more commonly dried and stored for winter use. The ripe fruits are prepared by being baked on hot coals or stones, but when they are ripe enough for the seeds to fall out they are dried on flat stones by the fireside, after which they are ground and kneaded into small cakes and slightly roasted on the stones. Small pieces are then broken off and allowed

to dry thoroughly in the sun. After drying they are sprinkled with water and shaped into cakes, then perforated with a stick for the purpose of making an opening to prevent souring; they are then stored for winter use. In preparing the dried material the cakes are broken into small bits and mixed with water, making a thick syrup, which is eaten with bread, meat and other dishes (15). Sometimes the broken pieces of the prepared substance are boiled as one would boil dried fruit, cornmeal added and the whole cooked for a time to make gruel. On other occasions the ripe fruits are cut in two, baked and dried. The cakes thus prepared are stored until needed when they are broken into pieces, mixed with water and eaten with bread, meat, or other foods (36).

The fruits of this species are somewhat similarly used by the Mescalero Apache, and Bourke (6), Palmer (30a), and Havard (20) report the extensive use of the datil fruit as food by the Apache and other Indians of the Southwest.

According to Bartlett (3) the Apache boiled and ate the flowers of certain species of *Yucca*.

At Acoma and Laguna the fruit of the datil, which is known as *hatyani* or *hatami mushi*, is usually cooked, dried, and stored for winter use. It is baked until the skin and the fiber can be removed after which it is alternately boiled and stirred thoroughly. After being allowed to dry by spreading into large sheets about an inch thick, it is rolled into loaves and stored. (At other Pueblos it is cut into squares.) In the spring it is eaten as a paste or made into a decoction by dissolving in water. This mixture was either drunk as such or *tortillas* and *guayabes* were dipped into the sirup-like liquid.

The fruit of *Yucca bacchata* is more fleshy and more palatable than that of other species, and the ripe, yellow, somewhat banana-shaped fruits are of excellent quality. The fruits of *Y. glauca*, soapweed, amole, are, however, sometimes eaten. Among the Zuni the fruits of *Y. glauca*, which are rather dry, hard, only slightly sweet and of unpleasant

taste (at least before being cooked) are boiled, especially when young, and the whole pod eaten (38). The Pima boil, dry, and grind the fruits which are then eaten with flour (34).

Among the Pueblo Indians of the Rio Grande Valley, as well as Acoma and Laguna, we have found that the fruits of both species are eaten raw or after being boiled or baked. They are also at times dried in the sun and stored for winter use. The fruit of datil is regarded as the more delicious and is also sliced when ripe, dried in the sun, and stored for winter use. At Acoma and Laguna the tender crowns of this species known as *haasha* are roasted and eaten, particularly in times of food shortage. The Hopi also eat the datil fruit (14, 23).

The Navajo bake amole fruit in ashes after which it is ready to eat. They do not regard it as so palatable as the datil fruit.

The flowers of *Y. glauca* are eaten as food by the Mes-calero Apache. Those of *Y. bacchata* are also eaten if they can be obtained at the proper time. These people also cook the young leaves of this species in soups or with meat.

Bartlett (3) reports the use of the large sweet palatable fruits of certain species of *Yucca* as food in Mexico.

*Yucca glauca* Nutt. Cf. *Y. bacchata*.

*Zizyphus lycioides* A. Gray. Lote bush. The thorny bushes are beaten to detach the black berries which are eaten without any preparation by the Pima (34).

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LIST OF COMMON ENGLISH AND SPANISH NAMES  
OF PLANTS TO WHICH REFERENCE  
HAS BEEN MADE

- |                                  |                                        |
|----------------------------------|----------------------------------------|
| Alegria, 15                      | Dandelion, 53                          |
| Alfarfon, 32                     | Datil, 14, 54, 55, 56                  |
| Algerita, 19                     | Deers ears, 29                         |
| Aloe, 12                         | Dock, 50                               |
| Amaranth, 15                     | Dock, curled, 50                       |
| Amole, 14, 55                    | Dock, Mexican, 50                      |
| Añil, 30                         | Dock, yellow, 50                       |
| Asparagus, 17                    | Dodder, 22                             |
| Barberry, 19                     | Dogbane, 31                            |
| Beargrass, 22                    | Elderberry, 50                         |
| Blazing star, 32                 | Encino, 48                             |
| Bog orchid, 30                   | Evening primrose, 17                   |
| Brittlebush, white, 31           | Fungi, 33                              |
| Buckthorn, 21                    | Giant hyssop, 34                       |
| Bull nettle, 51                  | Goldenrod, 52                          |
| Buttercup, 48                    | Gooseberry, 49                         |
| Cactus, ball, 37                 | Grape, wild, 53                        |
| Cactus, barrel, 26               | Grass, drop-seed, 28                   |
| Cactus, candelabrum, 35          | Grass, panic, 28, 38                   |
| Cactus, cane, 19, 35, 36         | Ground-cherry, 39                      |
| Cactus, fish-hook, 26            | Ground-tomato, 39                      |
| Cactus, giant, 19, 20            | Guaco, 22, 24                          |
| Cactus, hedgehog, 26, 27         | Hackberry, 21                          |
| Cactus, pincushion, 37           | Hedge mustard, 22                      |
| Cactus, prickly pear, 35, 36, 37 | Horsebean, little-leaf, 38             |
| Camas, 52                        | Horsemint, 34                          |
| Camote de raton, 52              | Indian apple, 26                       |
| Cañaigre, 50                     | Indian hemp, 31                        |
| Carrot, wild, 26                 | Indian millet, 27, 28                  |
| Capulin, 46                      | Indian potato, 51                      |
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| Cat-tail, 53                     | June grass, 22                         |
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| Century plant, 10                | Juniper, one-seeded, 31, 32            |
| Chimaja, 39                      | Juniper, Rocky Mountain, 32            |
| Chokecherry, 46                  | La golondrina, 29                      |
| Chollas, 35, 36                  | Lambsquarter, 16                       |
| Clammy weed, 25                  | Lambsquarter, narrow-leaved, 21,<br>22 |
| Cocklebur, 45, 54                | Lemita, 48                             |
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| Colorado rubber plant, 30        | Lettuce, wild, 30                      |
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| Consuelda, 53                    | Lote bush, 56                          |
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