Useful Native Plants in the American Southwestern Deserts[1]

In addition to yuccas, creosote bush, prickly pear cactus, agaves and the wax-producing candelilla bush, all of which have already yielded to some commercial exploitation, scores of other plants listed in this article also grow in the region and contain industrial potentialities.

A. KROCHMAL[2], S. PAUR[3] AND P. DUISBERG[4]

The Southwestern desert and semi-arid region of the United States spreads over almost a quarter million square miles, comprising much of Arizona, southern New Mexico and parts of Texas and California. Many very unusual and weird plants, with the ability to survive under the most rigorous conditions, can be found growing in this vast area. At tremendous cost man has been able to pick out promising sites in the region where he can harness water for irrigation and produce high-yielding and high moisture-consuming crops.

These irrigated areas constitute about two percent of the total land area and are responsible for much of the income derived from the region. The remaining 98% of the land is used largely for grazing to support livestock. During periods of high rainfall, overgrazing does not present too large a problem. Unfortunately, during the past ten years the average yearly rainfall has been far below normal, and many areas have been so overgrazed that much of the valuable cover of grass has been completely removed, and undesirable weeds and shrubs have begun to replace the grass.

As a result of the strong emphasis placed on irrigation farming and on livestock production, the great potential natural resources of the native desert plants have been overlooked. With the filling of irrigation dams by silt, the lowering of water tables and the possibility of range-lands becoming depleted, serious problems are presenting themselves. It would therefore seem wise to look into the vast so-called "waste-land" to determine whether some of the many plants now growing there could be either utilized in their present surroundings or removed for production under cultivation.

Although very few of these desert plants have been studied to determine their chemical constituents, the outlook for this type of research appears promising, with work along these lines being carried on at several southwestern colleges and experiment stations. This type of research is often slow to yield results, but a brief summary of some of the work that has been accomplished so far through colleges, experiment stations, federal agencies and private individuals is presented here.

[1] The material in this article, and the bibliography, have been assembled with emphasis on listing the maximum number of plants that offer possible utilization for economic purposes. The material may be considered supplementary to that previously presented in ECONOMIC BOTANY (25*a*).

[2] Science Instructor, Agricultural Institute, State University of New York, Delhi, N. Y.

[3] Formerly Assistant Agronomist, New Mexico Experiment Station.

[4] Formerly Assistant Chemist, New Mexico Experiment Station.

Yuccas

Utilization of yucca fiber has occupied a place of extreme importance, not only in the older civilizations of the ancient southwestern Basket-makers and Cliff dwellers, but also among the Indians of New Mexico and Arizona who use the fiber for making brooms, brushes, baskets, ropes, cords, belts and mats.

During the first World War, yucca fiber from New Mexico and Texas was successfully used to make 80 million pounds of bagging and burlap, but this promising development was not continued after the war. Interested German scientists, however, collected seed in this country and developed varieties suitable to their growing conditions. The fiber produced from these plantings was found to be the equal of wool in the manufacture of textiles. The project was discontinued because of the failure of the Germans to develop a cheap means of separating the fiber from the other leaf material.

A shortage of fibers during the second World War renewed interest in yucca, and a factory was built at Kingman, Arizona, to extract the fiber. This, too, proved a failure because of poor planning and lack of information.

About the same time New Mexico A and M College began a series of experiments to determine the quality of yucca fibers. It was found that the strength of the fibers varies with the species and that the two native yuccas are equal in strength to the best imported fibers. The people engaged in this problem found that there are areas in the Southwest where yucca is present in sufficient quantities to provide a commercial source of fiber.

The most important drawback to the production of yucca fiber on a large scale has been the lack of a satisfactory method for separating the fiber from the leaf residue. A machine has recently been developed that appears to do an efficient job.

A considerable amount of saponins is also obtained from the pulp after fiber removal. The residue left after the saponins are removed may have value as a livestock feed.

Creosote Bush (*Larrea divaricata* Cav.)

Of the many common shrubs that cover the southwestern region, creosote bush can be found in the greatest abundance. It has been used by the Indians for the treatment of almost as many diseases as has penicillin.

Up to 1942 the shrub was virtually unknown to the chemist. At that time scientists at the University of Minnesota successfully extracted a material known as "nordihydroguaiaretic acid", or N.D.G.A., which proved to be a remarkable antioxidant (rancidity retarder) for fats and oils. This material is now being produced commercially, and its value is reported to be about $45 a pound. Further work was started at New Mexico A and M in 1945 by one of the authors to determine the N.D.G.A. content of the creosote bushes growing in New Mexico. It was found that the leaves contain considerably more than had been supposed, but commercial yields were much lower, indicating room for improvement in the purification process. As little as .001 percent N.D.G.A. added to fats and oils will prevent rancidity many months.

Further experimentation indicates that after removal of the resinous materials, the extracted leaf contains 16% protein, or as much as alfalfa, and could be fed to livestock. Possible utilization of the wood and the presence of an essential oil are other worth-while fields for further research.

Cactus (*Opuntia* spp.)

For many years ranchers have used prickly-pears, with the spines removed, as a source of stock feed in periods of drought. Recently a Texas industrial concern has begun to evaluate the eco-

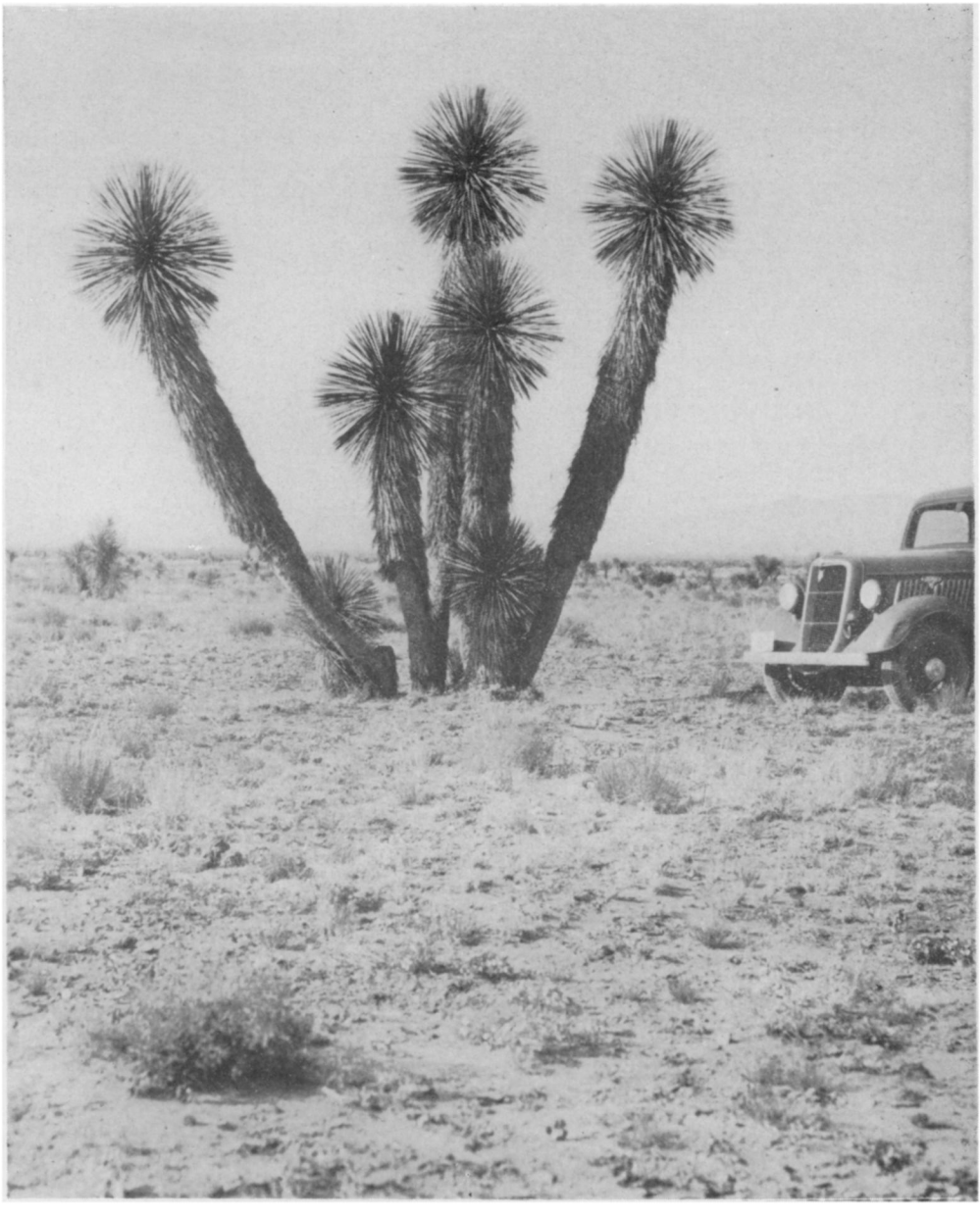

FIG. 1. *Yucca elata*. Southern Arizona, maximum growth.

nomic possibilities of processing prickly pears as a feed source.

Gums of various types have been obtained from cholla (*Opuntia fulgida* Eng.) and saguaro (*Cereus giganteus* Eng.). Some of these gums are used in Mexico as a size and cloth-stiffner in local textile mills. Mucilages with good adhesive properties have also been obtained from cactus gums. Oils have been extracted from a number of species of *Opuntia* and *Cereus*.

A high yield of almost pure cellulose has been obtained from a species of Sardinian cactus (*Opuntia ficus-indica* L.). Several alkaloids have been isolated from various cacti, 11 of them from peyote, or mescal (*Lophophora Williamsii* Lem.) alone. Various novelties are made from the dried hollow cylinder of wooden meshes of ocotillo (*Fouquieria splendens* Engelm.).

The Indians of the Southwest have long used the fruits and leaves of cacti as an important source of food, the fruits of the saguaro being utilized to make a syrup, wine and vinegar, and dried for storage. From the barrel cactus (*Echinocactus wislezenii* Eng.) both jellies and the famed cactus candy are obtained.

It should be kept in mind that cacti are valuable scenic resources, and their utilization should be regulated.

Agaves

Included among the agaves are several members commonly called "century plants", *i.e.*, mescal, maguey and lechuguilla. A drink called "pulque" is made from the fermented sap of *Agave*, while the alcoholic drink mescal, or tequilla, and industrial alcohol are made from the central stems and leaf bases. Some species are commercial sources of the fibers ixtile, sisal and henequen, from which ropes, sacking, cordage, bushes and carpets are made.

It has been suggested that agaves could be used in the manufacture of emulsions, pectins, toilet preparations, boiler compounds, vitamin C complex, glucosides and saponins, and as a precursor for cortisone.

Mesquite (*Prosopis*)

Invasion of range land by mesquite is costing ranchers millions of dollars each year. Range management experts from several experiment stations have been assigned the task of developing methods for destruction of the plant.

As an incentive for its removal, the Texas Forest Service Laboratory is attempting to develop useful products from mesquite. The plant will probably be considered as a source of charcoal, tannins, stock feed, alcohol, acids, plastics, wall-board, and sugars by wood-hydrolysis. An extender for phenol-formaldehyde plastics has been successfully made from mesquite wood flour. Trinkets and novelties can also be made from the very hard reddish wood. Mesquite gum is a source of uncommon sugars, such as L-arabinose and D-galactose, and is used to some extent in the manufacture of mucilages and gum-drops.

Candelilla (*Pedilapthus pavanis*)

The candelilla bush contains 3.5% to 5% wax, used in the manufacture of floor pastes, sealing wax, candles, phonograph records, electrical insulators, water-proof boxes and fabrics. Most of the extraction plants are in Mexico, one in Texas.

Bear Grass (*Nolena microcarpa*)

Each plant of bear-grass will yield from 30 to 75 pounds of green leaf. The Indians have long used this fiber for weaving baskets and mats. Bear grass is now being harvested in Mexico and New Mexico, and used as a substitute for broom-straw in the manufacture of brooms.

Cucurbits

At Texas A and M and New Mexico A and M colleges the seeds of three native gourds are under test to determine their

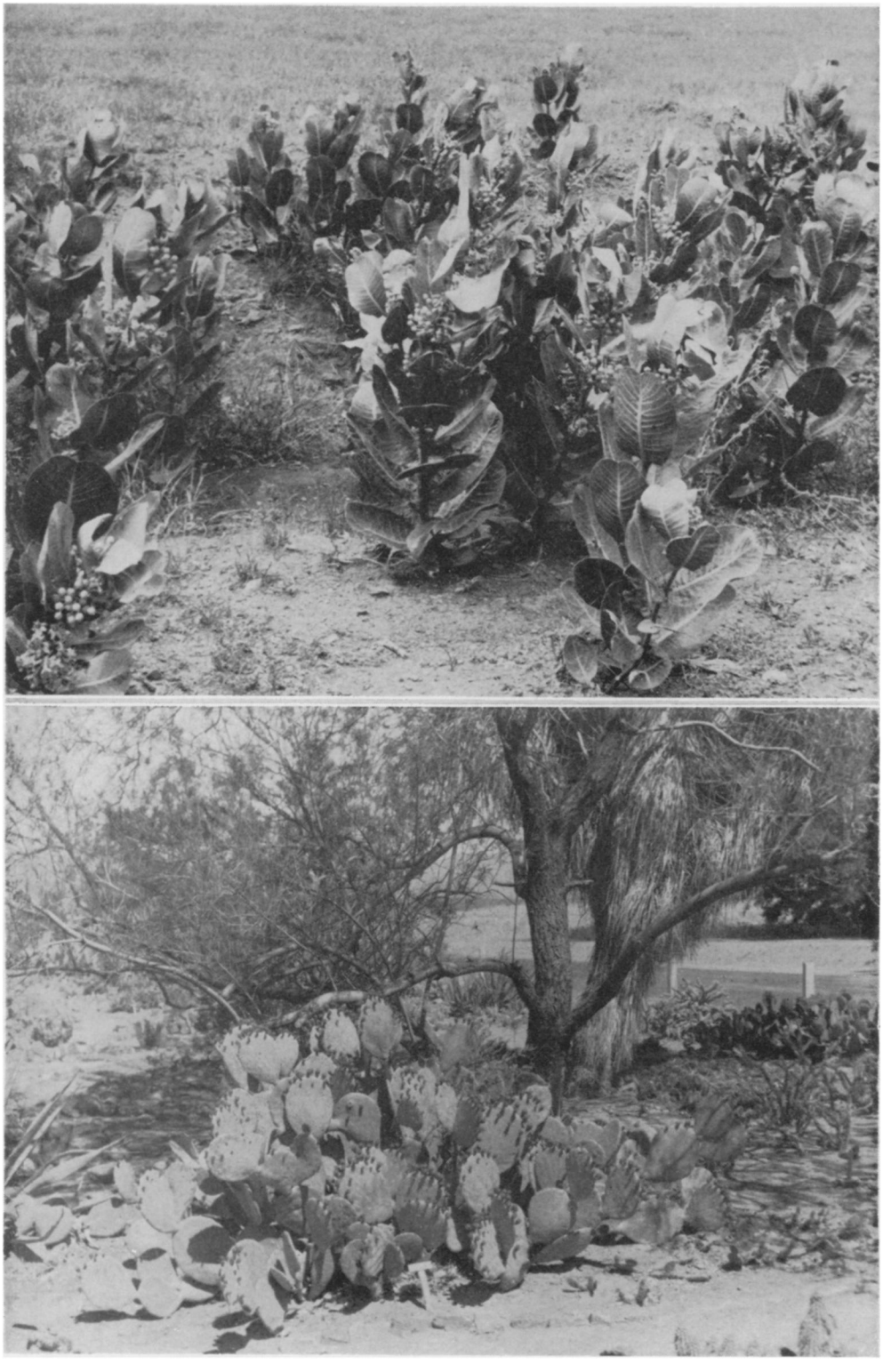

FIG. 2 (*Upper*). *Asclepias latifolia,* a potential rubber source.
FIG. 3 (*Lower*). *Opuntia* sp., the wide-spread prickly-pear.

value for high-protein concentrate feeds, and the quality and quantity of oil produced in such seeds. These plants are *Cucurbita foetidissima, C. palmata* and *C. digitata,* and their seeds contain approximately 29, 30 and 25 percent oil. The latter two are classified as drying-oils, like linseed oil, while the first has semi-drying properties like cottonseed oil.

Devil's Claw (*Martynia parviflora*)

The New Mexico A and M College has attempted to evaluate the seeds of devil's claw as an oil source, and has found them to contain about 36% oil. This semi-drying oil resembles cottonseed oil and sunflower oil, and it is believed it could be very satisfactorily substituted for cottonseed oil in the manufacture of salad oils and shortenings.

Jojoba (*Simmondsia chinensis*)

Approximately 50% of the weight of the seeds of this plant is a liquid wax, with a potential importance for the lubrication of delicate instruments, typing-ribbon inks and polishes, and may be useful in the production of cosmetics.

Canaigre (*Rumex hymenosephalus*)

The roots of this plant average 25% tannin or better, and the Indians have used them for many years as such a source. They were commercially shipped to the East and Europe in the late 1880's and the early 1900's. Research now being conducted at the Texas Experiment Station, the U.S.D.A. station at Sacaton, Arizona, and Eastern Regional Laboratories in Philadelphia indicate that this plant produces a most satisfactory tannin.

Although the outlook appears very bright for many of the foregoing plants to be utilized on a commercial scale, it must be strongly emphasized that in most cases additional research is needed to determine whether the plants can be produced economically, and to thoroughly work out production and manufacture methods. It is clear that results based on team-work of agronomists, horticulturists and chemists will not be available immediately, but will take several years of effort.

Drugs

Aplopappus nuttallii T.&G.F.N. From the roots the Hopi Indians made a tea for treating coughs (39).

Apocynum cannabinum L. Indian hemp, Dog-bane. From the roots a cardiac stimulant similar but inferior to digitalin is obtained (39).

Arctostaphylos pungens HBK. Pointleaf manganita. The leaves are used as a remedy for stomach trouble in Arizona (39).

Arctostaphylos uva-ursi Spreng. Common bearberry, Kinnikinick. Has been used for treating disorders of the urinary tract and as a substitute for tobacco (26, 39).

Berberis spp. Barberry. It is believed that many of the species contain berberine (6, 39).

Buddleja sessiliflora L. Has been used medicinally in Mexico (39).

Ceanothus integerrinos L. Deerbush. An infusion of the bark is used as a tonic (6, 39).

Cercis accidentalis L. Redbud. The astringent bark of the tree has been used as a remedy for diarrhea and dysentery (39).

Chenopodium ambrosioides L. Spanish tea, Mexican tea. A strong anti-helmintic is made from liquid distilled from the leaves and stems (39).

Cichorium intybus L. Chicory, Succory. Roots are used as an adulterant of or substitute for coffee, particularly cultivated forms (19, 20).

Clematis ligusticifolia Nutt. The Indians used this plant as a remedy for sore throats and cold, and crushed leaves were placed in the nostrils of tired horses to revive them (6, 39).

Commelina spp. Dayflower. A few species are said to be able to stop the flow of blood (39).

Cordylanthus wrightii Nutt. Clubflower. Hopi Indians used this plant to bleach their skin (39).

Croton corymbulosus Rothr. Chaparral tea, Encinilla. A domestic medicine has been made from the leaves in Texas (6, 24, 39).

Croton texensis Klotzsch. Skunkweed. Has been used by the Hopis as an eyewash and emetic, and by other Indians to relieve paralysis and as a purgative (26, 39).

Datura meteloides Dunal. All parts of this plant are narcotic; it is eaten by many Indians to induce visions (6, 26, 39).

Datura stramonium L. Jimson-weed, Thorn-apple. Same as above. Contains many alkaloids, notably atropine (daturine). All parts of the plant are poisonous (15, 16, 17, 22, 23, 26).

Ephedra torreyana Wats. Mormon tea. A decoction is used as a diuretic (6, 26).

Erigeron canadensis L. Horseweed. Used as a remedy for diarrhea and dysentery (6, 39).

Euphorbia hirta L. Spurge. Used in treating asthma and bronchitis, and is an official drug plant (39).

Eysenhardtia spp. Kidneywood. The wood of several species is fluorescent when soaked in water, and has been reported to be diuretic (39).

FIG. 4. Foreground, *Cucurbita digitata*. Note spherical fruit at right. Background, *C. palmata*.

Flourensia cernua DC. Tarbush. In northern Mexico the leaves and heads are sold in the drug markets for treating indigestion under the name "hojase" or "hojasen" (6, 39).

Fouquierra splendens Engelm. Ocotillo. To relieve tiredness and fatigue the Apache Indians bathe in a decoction of the roots, and also apply the powdered roots to painful swellings (6, 39).

Fremontodendron californicum Torr. Flannel-bush, Fremontia. An infusion

of the bark is used to relieve irritations of the throat (39).

Gaillardia pinnatifida Torr. The Hopi Indians have been reported to use this plant as a diuretic (39).

Glycyrrhiza lepidota L. Licorice. The sweet roots contain almost as much glycyrrhizin, used by druggists and confectioners, as do the imported roots of *G. glabra* L. (39).

Grindelia squarrosa Willd. Gumweed, Tarweed. This species and others of the genus are official drug plants and are administered in asthma, used as an anti-spasmodic and stomachic, and externally to relieve the irritation caused by poison ivy (39).

Heliotropium curassavicum L. Heliotrope, Turnsole. The Pima Indians applied the dried roots in powdered form to sores and wounds (39).

Heracleum lanatum Michx. Cow-parsnip. The roots have been used to control epilepsy, and appear to be somewhat stimulative and carminative (6, 39).

Heuchera spp. Alum-root. The astringent root-stocks were used by early settlers to cure diarrhea caused by drinking alkali water (6, 39).

Hymenopappus lugens Greene. The Hopis were reported to use the roots for treating toothache and as an emetic (39).

Jatropha macrorrhiza Benth. The roots are said to be strongly purgative (6, 39).

Krameria parvifolia Benth. Range ratany. An infusion of the twigs serves the Papago Indians in treating sore eyes (6, 39).

Lantana camara L. An alkaloid resembling quinine in action has been found in this plant (39).

Larrea divaricata L. Creosote bush. Contains about 9% of an anti-oxidant called nordihydroguaiaretic acid (NDGA) which is extracted from the leaves and green stems. It is used as a preservative for fats and oils.

Ligusticum porteri Koch. Lovage. The aromatic roots are used to treat coughs and colds. Called " coughroot " in the drug market (39).

Marrubium vulgare L. Horehound. Used as a confection for easing sore throats and checking coughs (39).

Monarda spp. Bee-balm. A few species have been employed in domestic medicine (39).

Nepeta cataria L. Catnip. Although this is an official drug plant, it has no therapeutic value other than being a mild aromatic. It has been used, however, as a mild stimulant, a tonic and to quiet nervous patients (39).

Nicotiana attenuata Torr. Tobacco. The dried leaves are smoked by many New Mexicans of Spanish origin (6, 26).

Nicotiana glauca Graham. Tree tobacco. The plants contain an alkaloid which has been reported more effective in killing certain species of aphids than nicotine compounds (39).

Nicotiana trigonophylla Dunal in DC. Tobacco. Smoked by Indians for ceremonial events (39).

Opuntia spp. Prickly pear, Indian fig. The heated young " leaves " have been employed to treat various types of rheumatism and other body pains; used as a poultice (6, 26). Mexicans value the green portion as a salad.

Perezia wrightii Gray and *P. nana* Gray. The roots of both these species yield pipitzahoic acid which is sometimes used as an indicator of alkalinity (39).

Plantago fastigiata Morris and *P. purshii* R. & S. Indian wheat. The seeds of these species have been used as a substitute for psyllium seed (6, 39).

Pluchea sericea Nutt. Marsh fleabane. The Pima Indians have been reported to make an infusion of the herbage to treat sore eyes (39).

Populus fremontii Wats. and *P. tremuloides* Michx. Fremont's cottonwood, Quaking aspen, Trembling aspen, Quiver-leaf. The inner bark is used

FIG. 5 (*Upper*). *Cucurbita foetidissima.*
FIG. 6 (*Lower*). *Martynia parviflora*, the Devils Claw. Note the curved fruits.

by the Indians as an anti-scorbutic (6, 39).

Prosopis odorata Torr. & Frem. Fremont screwbean. The Pima Indians use the inner bark to treat wounds (6, 39).

Ranunculus sceleratus L. Buttercup. It is said that beggars have used the acrid juice to induce sore-formation (39).

Rhus glabra L. Smooth sumac, Scarlet sumac. The fruits have astringent properties and are official in the U. S. Pharmacopoeia (6, 39).

Robinia neomexicana Gray. New Mexico locust. This plant has been reported to be used as an emetic and in treating rheumatism by the Hopis (6, 39).

Salix spp. Willow. From the bark of several species the drug salicin is obtained, which is used as a tonic and antiperiodic, and has febrifugal properties (6, 39).

Selloa glutinosa Spreng. Used in Mexico for treating diarrhea (39).

Solanum eleagnifolium Cav. Bullnettle. The Pima Indians added the crushed berries of this plant to milk in making cheese. An enzyme, similar to papain, has been obtained from the plant (26, 39).

Sonchus oleraceus L. Sow-thistle. The gum obtained from the juice is said to be strongly cathartic (39).

Sphaeralcea spp. Globe-mallow. Used by the Hopi Indians for treating disorders of the bowels (39).

Verbascum thapsus L. Mullein, Flannel-plant. The dry leaves have served as a substitute for tobacco (26).

Verbesina encelioides Cav. Crown-beard. Both the Hopis and early white settlers used this plant to treat boils and other skin diseases (39).

Wyethia scabra Hook. Mules ears. Used by the Navajos and Hopis as an emetic but considered dangerous by them (39).

Xanthium commune Britt. Cocklebur. Indians use leaves boiled in water to relieve diarrhea. A poultice made of the leaves supposedly cures rattlesnake bites (26).

Foods, Flavorings, Seasonings

Acacia greggii Gray. Catclaw acacia. From the pods of this plant Arizona Indians made a meal for use in cakes and mush (6, 10, 26, 39).

Agave spp. Century-plant. Fermentation of the fleshy leaves yields potent liquors, pulque and mescal. The fibers sisal and henequen are obtained from the plants. Navajos roasted the crowns for several days to produce a nourishing food (6, 10, 39).

Acanthochiton wrightii Torr. Eaten by Hopis as greens or dried and stored (10, 39).

Allium spp. Several species are used by the various tribes for food and seasoning (6, 10, 39).

Amaranthus spp. Pigweed. Both the young leaves and stems of several species have been used as greens, and the mature seeds for meal (6, 10, 16, 39).

Arctostaphylos pungens HBK. Pointleaf manzanita. An excellent jelly is made from the unripe fruits (6, 39).

Arundo donax L. Giant reed. Young shoots are sometimes eaten by Indians.

Asclepias galioides HBK. Milkweed. The immature pods have been eaten by the Indians, as well as the young greens (6, 10).

Astragalus ceramicus Sheld. Milk vetch. In the spring Hopi children eat the sweet roots of this species (39).

Atriplex spp. Salt-bush, Orach. The Indians made a meal from the parched seeds and used the leaves and young shoots as greens (6, 10, 39).

Atriplex canescens Pursh. Fourwing saltbrush. The Hopi Indians are reported as using the ashes of this plant as a substitute for baking powder (39).

Calochartus spp. Mariposa lily, Globe tulip, Butterfly lily. Both Hopis and

Navajos eat the large fleshy bulbs of many species (6, 10, 39).

Chenopodium spp. L. Lambs-quarter, Pigweed, Poulette, Chou grass. From the seeds of many species the Indians made mush and cakes, and ate the leaves for greens (6, 10, 26, 39).

Cichorium intybus L. Chicory. The roots, particularly of cultivated forms, are eaten under the name "witloof", while the leaves may be cooked or eaten raw (39).

Cleome spp. Beeweed, Spiderflower. Some species have been eaten by Indians as greens (6, 10, 39).

Cucurbita foetidissima HBK. Buffalo gourd, Fetid wild pumpkin. Both New Mexico and Arizona Indians make a type of mush from the seeds. The whole fruits were dried for winter use (6, 26, 39).

Cycloloma atriplicifolium Spreng. Winged pigweed. A type of mush and cakes are made from the ground seeds (39).

Cymoptenus bulbosus L. The dried leaves are used to flavor chile and beans (6, 39).

Daucus pusillus Michx. Wild carrot. The roots are eaten raw or boiled by the Navajos (10).

Descurainia spp. Tansy-mustard. A few species are used by the Indians for greens and in making pinole from the parched and ground seeds (39).

Echinocereus spp. Hedge-hog cactus. Both pulp and rind have been used by Indians in making conserves (6, 10).

Ephedra spp. Mormon tea. From the dried flowers and stems palatable tonic beverage is made. Source of ephedrine (8, 39).

Helianthus annuus L. Sunflower. The seeds of this and other species are eaten by the Indians (6, 10, 26, 39).

Heracleum lanatum Michx. Cow parsnip. Indians have been reported as eating the young stems and leaves (6, 39).

Hoffmanseggia densiflora Benth. Hog-potato. The tubers make excellent hog food and, after roasting, good human food (6, 10, 26, 39).

Humulus americanus Nutt. Hop. Used by the Apache Indians. Their name for it means "make bread with it" (6, 39).

Hydrophyllum occidentale Gray. Western squaw lettuce. Leaves are used as salad greens (39).

Iris missouriensis Nutt. Blue flag. A substitute for coffee is made from roasted and ground seeds (39).

Lomatium spp. Raf. Biscuitroot. The edible roots of several species have been eaten raw, cooked or ground into flour (39).

Lycium pallidum Miers. Rabbit thorn. The ripe fruits are either eaten raw or cooked by Indians (6, 10, 26).

Mentha spp. Peppermint. The aromatic leaves were used by the Hopis for flavoring mush and also used as a stomachic (10, 26, 39).

Monarda menthaefolia Graham. Bee-balm, Fern mint. The Hopis often cultivated this plant as a green, and dried it for winter use. The dried leaves of this species and *M. pectinata* L. are used as a seasoning for beans and stews (10, 26, 39).

Monolepis nuttalliana R. & S. Patata, Povertyweed. The Indians made pinole from the seeds, and ate the vegetative parts as greens; the roots were also eaten (10, 39).

Oenothera trichocalyx Nutt. Evening-primrose. Used as a potherb (6, 39).

Opuntia spp. Prickly-pear. After the spines are burned off, the joints may be used as cattle feed, containing about 8% protein. Young joints, stems and fruits of several species are eaten raw by Indians and Mexicans (6, 10, 26, 39).

Pectis papposa Harv. & Gray. The Indians in New Mexico use the flowers to flavor meat (10, 39).

Perideridia gairdneri L. Wild-caraway. The Indians used the tuberous roots as food, while the seeds served for seasoning (39).

Phaseolus acutifolius Gray. Tepary beans. The small white beans have been used by both Indians and the pioneers. Somewhat less palatable than *P. vulgaris*.

Phoradendron californicum Nutt. Mistletoe. The berries are dried and stored, or boiled and eaten directly by the Papagos and other Indians (10, 39).

Physalis spp. Ground-cherry. The berries have been used in making preserves, and have been eaten cooked and raw by the Indians (6, 10, 26, 39).

Phytolacca americana L. Poke-weed, Scoke, Garget, Pigeon-berry. The succulent young shoots make excellent greens but must be thoroughly cooked (39).

Pinus edulis Engelm. Pinon pine, Nut pine. The fruit are widely used by the Indians, particularly the Navajos. They are also sold throughout the United States, often under the name "Indian Nuts" (6, 10, 26, 39).

Poliomintha incana Torr. The flowers are used by the Hopis for seasoning, and the vegetative parts eaten raw or cooked (10, 26, 39).

Portulaca oleracea L. Common purslane. Used by the Indians and others as a salad green (6, 10, 26, 39).

Prosopis juliflora D. Common mesquite, Honey mesquite, Screw bean, Algaroba. From the sweet pods of this plant a type of meal is made (pinole) by the Pima Indians and others, and fashioned into cakes. An alcoholic beverage is also made from the fermented pinole. The gummy exudation secreted from the bark is used to mend pottery, make candy and furnish a black dye. A substitute for rennet, used to curdle milk, is obtained from the inner bark (6, 10, 26, 39).

Prosopis odorata Torr. & Frem. Fremont screwbean. Used by the Indians for food very much in the same way as the common mesquite (6, 10, 26, 39).

Prunus virginiana L. Common chokecherry. The fruit is eaten either raw or cooked, or made into preserves (6, 10, 26, 39).

Pteridium aquilinum L. Bracken fern, Pasture brake, Hog brake. Both roots and young fronds have been used for food (39).

Quercus spp. Oak. The acorns of most species have been used for food by many Indian tribes (6, 10, 26, 39).

Rumex crispus L. Curled dock, Curly-leaf dock. Sometimes used as a salad green (6, 26, 39).

Rumex hymenosepalus Torr. Canaigre. The leaves, petioles and roots have been eaten by Indians (10, 26, 39, 40).

Stanleya pinnata Pursh. Desertplume. This plant has been used as a potherb, and a mush has been made from its seeds by the Indians (26, 39).

Solanum jamesii Torr. and *S. fendleri* L. Wild potato. The tubers of both species have been used by Hopi and other Indians in making yeast and are cooked in saline clay. The tubers are like the cultivated potato, but smaller (6, 10, 26, 39).

Suaeda spp. Seepweed, Sea-blite. The Pima and other Indians ate the young plants as greens and made pinole from the seeds (10, 26, 39).

Tecoma stans HBK. (*Stenolobium stans* Seem.). Trumpet-bush, Yellow-bells. The roots are used in Mexico for making a type of beer, and also medicinally (39).

Thelesperma longpipes Gra. Used in New Mexico as a substitute for tea under the name "cota" (6, 39).

Tradescantia spp. Spiderwort. The Indians have used this plant for salad greens (10, 26, 39).

Tradescantia pinetorum Greene. Spiderwort. The Indians reportedly eat the tuberous roots (39).

Vitis arizonica Engelm. Canyon grape,

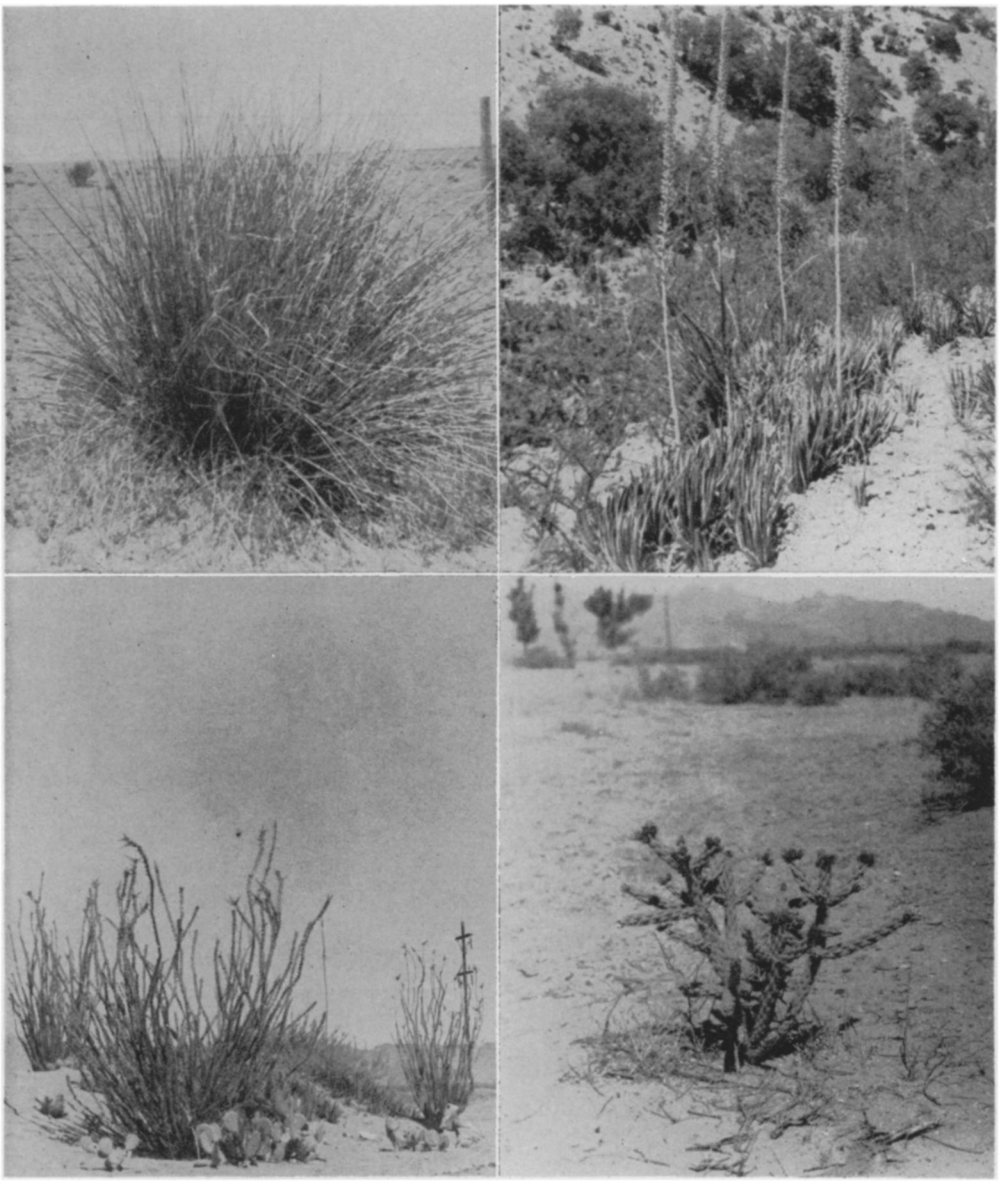

FIG. 7 (*Upper left*). *Nolina texana* in an ungrazed area eight miles east of Marfa, Texas.

FIG. 8 (*Upper right*). *Agave lechugilla,* used for a fiber source. Reputed to be poisonous to stock, causing a form of sleeping sickness.

FIG. 9 (*Lower left*). *Fouquieria splendens* Engelm., Ocotillo or Devil's walking stick, used for carving and as a fence in southwestern areas.

FIG. 10 (*Lower right*). *Opuntia fulgida* Engelm., the cholla, whose purple-red blossoms are a familiar sight to residents of desert areas.

Wild grape. The fruit is eaten fresh, or dried for raisins, by the Pueblo Indians. The ancient cliff dwellers used the fruit (10, 39).

Yucca spp. Soapweed, Beargrass, Spanish-bayonet. All parts of the flower stalks are eaten by the Indians, either raw or boiled. The large fruits of some species are ground into meal, dried and eaten raw or roasted. Soap is made from the pounded leaves. The fruits are sometimes fermented to produce an alcoholic beverage (39).

Fibers

Abutilon incanum Link. Rope is made in Mexico from the stem fiber (39).

Agave spp. American aloe. Excellent fibers are obtained from several species of this genus, particularly *A. lechugilla* which is the source of a fiber used for brushes and as a waste fiber for upholstery tow (6, 26, 39).

Apocynum spp. Indian hemp. The bark of several species has served the Indians as cordage.

Linum lewisii Pursh. Flax. The long fibers have reportedly been made into cordage by western Indians (39).

Martynia parviflora Wooten. Devils claw. Indians have used the split mature pods in weaving block designs in their baskets (6, 39).

Nolina microcarpa Wats. Beargrass. The fibers obtained from the leaves have been used by the Indians for making mats. Several small companies harvest these plants as a substitute for broom corn. The plants contain 48% fiber (6, 39).

Parryella spp. The Hopi Indians make baskets and brooms from this plant (39).

Populus fremontii Wats. Fremont cottonwood. The twigs are used by the Pima Indians for basket material (39).

Prosopis juliflora DC. Common mesquite, Honey mesquite, Screw bean, Algaroba. The Indians make a coarse fabric and baskets from the inner bark (39).

Rhus trilobata Rehd. Squawbush. The pliable stems are used in basket weaving by Indians (39).

Salix spp. Willow. The twigs furnish the Pima Indians basket material (39).

Sesbania exaltata Raf. Cory. Indians obtained excellent fibers from the stems (6, 47).

Stipa vaseyi Scribn. Porcupine grass. The fibers have been used for making brooms and brushes (26).

Yucca glauca Nutt., *Y. baccata* Torr. and *Y. elata* L. Soapweed, Spanish bayonet. The Indians make baskets, mats, sandals and rope from the excellent fibers in the leaves. Rope and paper have been made commercially from a few of these species (6, 39).

Gums and Resins

Actinea richardsoni Hook. From the bark and roots a substitute for chewing gum is made in New Mexico (39).

Apocynum cannabinum L. Dogbane, Indian hemp. From the dried milky fluid in the stems a substitute for chewing gum is made (39).

Bumelia rigida Gray. Buckthorn. Children in Texas chew the gum exuded from the bark (39).

Coursetia microphylla Gray. An orange colored lac is often found on the stems of this plant, caused by an infestation of an insect member of the genus *Tachardia*. The Papago Indians used the lac to seal jars of saguaro syrup (39).

Larrea divaricata Cav. Creosote bush. The leaves and small stems contain 15–17.5% ether-extracted resins. Varnishes can be made from this resin. Indians used the material to mend pottery and fix arrow points.

Opuntia fulgida Engelm. Cholla. The gum obtained from this plant is sold in Tucson, Arizona, and is used in Mexico as a size or stiffening. The

gum contains L-arabinose, D-galactose and glucosonic acid.

Prosopis juliflora DC. Common mesquite, etc. A gum similar to gum arabic is obtained from this plant. Contains same organic compounds as above.

Juniperus monosperma Engelm. Juniper pitch. Chewed by the Indians instead of commercial chewing gum (26, 39).

Plantago spp. Indian wheat, Plantago. When wet the seeds become mucilaginous (39).

Sphaeralcea spp. False-mallow, Globemallow. The Hopis used the mucilaginous stems as a substitute for chewing gum.

Insecticides

Anthemis cotula L. Mayweed, Stinking chamomile, Dog fennel. The dried powdered flowers have been reported to be very effective against fleas, bedbugs and flies. The leaves also have insecticidal properties (6, 39).

Artemisia spp. Wormwood. The aromatic oil obtained from several species is supposed to be insect-repellant (6).

Croton texensis Muell. & Arg. Skunkweed. Has been used as a household insecticide by Indians in New Mexico (26).

Rhinanthus rigidus L. Yellow-rattle. Has been reported to be used as an insecticide (39).

Oils

Apodanthera undulata Gray. Melonloco. The seeds contain 30% oil.

Camelina microcarpa Andrz. False-flax. An oil similar to linseed oil is extracted from the seeds (39).

Cucurbita digitata Gray. Large quantities of a drying oil have been obtained from the seeds.

Cucurbita foetidissima HBK. Buffalo gourd, Missouri gourd, Fetid wild pumpkin. The seeds contain about 27% oil with semi-drying qualities.

Cucurbita palmata Wats. Coyote melon. The seeds yield about 30% of a drying oil.

Helianthus annuus L. Sunflower. From the seeds of the cultivated varieties high quantities of a semi-drying oil are obtained, used as salad oil and for hair-dressing (6, 10, 26, 39).

Juniperus communis L. Common juniper. An aromatic oil obtained from the fruits and wood is used in flavoring gin and in various patent medicines (6, 39).

Martynia parviflora Wooten. Devils claw. The mature seeds yield 36% oil when pressed. The oil resembles both sunflower and cottonseed oil (6, 21).

Reverchonia arenaria Gray. The Indians used the seeds for oiling their grinding stones (39).

Ricinus communis L. Castor bean. The seeds yield castor oil, used medicinally and for lubricating oil, in paints and varnishes (39).

Stillingia sylvatica L. Queen's-delight, Queen's-root. The seeds have yielded up to 30% oil. A resin, an oil and a glucoside have been extracted from the roots (25).

Xanthium commune Britt. Cocklebur. The oil extractable from the burrs can be used in paints and varnishes (26).

Essential Oils

Opuntia spp. Prickly pear, Indian fig. An essential oil is extracted from the yellow and pink flowers of several species and made into perfume.

Pectis papposa Harv. and Gray. The leaves contain over 1% essential oils, on a dry weight basis.

Yucca baccata Torr. A perfume is prepared commercially from the blossoms.

Pigments

Alnus spp. Alder. A pale red dye is obtained from the bark of several species (9).

Berberis repens Lindl., *B. haemotocarpa*

Wooten. Oregon grape, Algerita. The roots of both species contain a brilliant yellow dye.

Cercocarpus spp. Mountain mahogany. The Hopis get a red-brown dye from the bark and use it to dye leather (39).

Chrysothamnus spp. Rabbitbrush. A yellow dye is obtained from the flowers of several species and a green dye from the inner bark (6, 26, 39).

Cleome serrulata L. Rocky Mountain beeplant, Stinking clover. A black dye is obtained when the entire plant is boiled in water (6, 26).

Ephedra spp. Mormon tea. The Navajos obtain a red dye from this plant.

Galium spp. Bedstraw, Cleavers. A dark red dye is obtained from the roots of several species (6).

Helianthus annuus L. Sunflower. Purple and black dyes are extracted from the seeds of this and other species by the Indians for use in baskets, textiles and painting their bodies. A yellow dye is obtained from the leaves (26, 39).

Juniperus spp. Juniper, Cedar. An olive-brown dye is extracted from the berries of several species.

Krameria parviflora Benth. Range ratany. The Papago Indians obtained a dye from the roots to color wool and other materials (39).

Lithospermum spp. Gromwell, Puccoon. The Indians obtained a purple dye from the roots (6, 39).

Pectis angustifolia Torr. The Hopi Indians extracted a dye from this plant (39).

Rhus trilobata Fern. Squawbush. The Indians used the berries as a mordant in dyeing (39).

Rivina humilis L. Rouge-plant, Pigeonberry. A red dye is obtained from the fruits (39).

Rumex hymenosepalus Torr. Canaigre. A mustard-colored dye has been obtained from the roots.

Thelesperma megapotamicum Spreng. A yellow dye is furnished by the flowers, and a brown dye from other parts of the plant, used on baskets and clothing (26, 39).

Latex

Actinea richardsoni Hook. Colorado rubber-plant. Sap contains small quantities of rubber (6, 39).

Amsonia hirtella Standl. On extraction the entire plant yields about two and one-half percent rubber (9).

Asclepias spp. Milkweed, Silkweed. Almost all milkweeds contain some rubber. *A. erosa* Torr. has produced as high as five and one-half percent rubber when grown under cultivation (9).

Chrysothamnus nauseosus Gray. Rabbitbrush. Also *C. paniculatus* Gray and *C. vescidiflorus* Hook. Sources of small amounts of latex (39).

Funastrum cynanchoides Schlecht. Gum vine. Some samples have yielded almost four percent latex (9).

Parthenium incanum HBK. Mariola. Has small amounts of latex, while *P. argentatum* Gray (guayule) has a high enough latex content to make profitable commercial production in Arizona, Texas and California (9, 39).

Solidago canadensis L. Goldenrod. This species contains about four percent latex (9).

Tecoma stans HBK. or *Stenolobium stans* Seem. Yellow-bells, Trumpet-bush. Almost four percent latex was obtained from this bush (9).

Saponins

Agave spp. American aloe. Saponins have been obtained from several species.

Cucurbita spp. Gourds. The fruits of several species contain saponins and have been used as a substitute for soap by the Indians.

Phytolacca americana L. Pokeweed, Scoke, Garget, Pigeonberry. Both roots and berries contain saponins (18, 39).

Sapindus drummondi (H.&A.). Soapberry. The fruits have been used by the Indians as a form of soap in washing clothes (39).

Saponaria officinalis L. Bouncing Bet, Soapwort. Both roots and leaves contain saponins and lather easily in water (39).

Yucca spp. Soapweed. A type of soap and a laxative are made from the saponin-rich roots (39).

Tannins

Acacia spp. Tannins can be extracted from the bark of a few species (6, 39).

Arctostaphylos uva-ursi L. Bearberry. Both leaves and bark contain tannins (6).

Erodium spp. Heronbill. It has been reported that the roots of several species contain tannins (6, 39).

Geranium spp. Cranesbill. The roots of some species contain tannins (6).

Rhus spp. Sumac. Both roots and bark of a few species contain tannins (6, 39).

Rubus spp. Brambles. Tannins are obtained from roots and bark of several species (6).

Rumex hymenosepalus Torr. The roots contain 35–42% tannins. Probably the most promising wild tannin source in the Southwest. Now being produced commercially in Arizona, and the subject of research by State and Federal agencies (6, 10, 26, 39, 40).

Salix exigua virens. Coyote willow. A solution made from bark soaked in water is used to tan hides (36).

Waxes

Fouquieria splendens Engelm. Ocotillo. An excellent belt dressing is made from the wax that coats the stems (6, 39).

Bibliography

1. Aldous, A. E., and Shantz, H. L. Types of vegetation in the semi-arid portion of the United States and their economic significance. Jour. Agr. Res. 28: 99–128. 1924.
2. Beckett, R. E., and Stitt, R. S. The desert milkweed (*Asclepias subulata*) as a possible source of rubber. U. S. Dept. Agr., Tech. Bull. 472. 1935.
3. ———. Rubber content and habits of a second desert milkweed (*Asclepias crosa*) of southern California and Arizona. U. S. Dept. Agr., Tech. Bull. 604. 1938.
4. Bell, E. H., and Castetter, E. F. The utilization of mesquite and screwbean by the aborigines of the southwest. N. M. Univ., Bull. 314. 1937.
5. Benson, L., and Darrow, R. A. A manual of southwestern desert trees and shrubs. Univ. Ariz., Biol. Soc., No. 6. 1945.
6. Bolles, L. C. Why I collect plant information. [Unpub.] 1949.
7. Botkin, C. W. Pinon nuts as a food crop. N. M. Agr. Exp. Sta., Bull. 899. 1940.
8. ——— and Shires, L. B. The composition and value of pinon nuts. N. M. Agr. Exp. Sta., Bull. 344. 1948.
9. Buehrer, T. F., and Benson, L. Rubber content of native plants of the southwestern desert. Univ. Ariz., Tech. Bull. 108. 1945.
10. Castetter, E. F. Uncultivated plants used as sources of food. N. M. Univ., Bull. 266. 1935.
11. ———. Ethnobiological studies of the American southwest. 1938.
12. ——— and Bell, W. H. Pima and Papago agriculture. 1942.
13. ——— and Underhill, R. M. The ethnobiology of the Papago Indians. N. M. Univ., Bull. 297. 1936.
14. ——— and Opler, N. E. Ethnobiology of the Chiricahua and Mescalero Apache. N. M. Univ., Bull. 297. 1936.
15. Chemical Abstracts 4: 3273[8].
16. *Ibid.* 6: 1053[1].
17. *Ibid.* 8: 399[4].
18. *Ibid.* 9: 121[8].
19. *Ibid.* 9: 940[6].
20. *Ibid.* 9: 2677[7].
21. *Ibid.* 9: 2989[2].
22. *Ibid.* 10: 353[2].
23. *Ibid.* 10: 355[2].
24. *Ibid.* 10: 497[2].
25. Chemurgic Digest 5(10): 3. 1951.

25*a*. Cruse, R. R. A chemurgic survey of the desert flora in the American Southwest. Econ. Bot. 3(2): 111–131. 1949.

26. Curtin, L. S. M. Healing herbs of the Rio Grande. Lab. Anthropol., State Museum, Santa Fe, N. M. 1947.

27. Dayton, W. A. Important western browse plants. U. S. Dept. Agr., Misc. Pub. 101. 1931.
28. Dayton, E. F., *et al.* Range Plant Handbook. U. S. Forest Service. 1937.
29. Gooding, L. N. Notes on native and exotic plants in Region Eight. U. S. Dept. Agr., Soil Cons. Bull. 1938.
30. ———. Native legumes in Region Eight. U. S. Dept. Agr., Soil Cons. Serv., Bull. 55. 1939.
31. Henkel, A. Weeds used in medicine. U. S. Dept. Agr., Farm. Bull. 188. 1904.
32. ———. American root drugs. U. S. Dept. Agr., Bur. Plant Ind., Bull. 107. 1907.
33. ———. American medicinal barks. U. S. Dept. Agr., Bur. Plant Ind., Bull. 139. 1909.
34. ———. American medicinal leaves and herbs. U. S. Dept. Agr., Bur. Plant Ind., Bull. 219. 1911.
35. ———. American medicinal flowers, fruits and seeds. U. S. Dept. Agr., Bull. 26. 1913.
36. Hershey, A. L. Wild flowers of New Mexico, Part I. N. M. Agr. Exp. Sta., Bull. 814. 1937.
37. ———. Wild flowers of New Mevico, Part II. N. M. Agr. Exp. Sta., Bull. 819. 1937.
38. Hitchcock, A. S. Manual of the grasses of the U. S. U. S. Dept. Agr., Misc. Pub. 200. 1935.
39. Kearney, T. H., and Peebles, R. H. Flowering plants and ferns of Arizona. U. S. Dept. Agr., Misc. Pub. 423. 1942.
40. Krochmal, A., and Paur, S. Canaigre, a useful desert plant. Econ. Bot. 5: 367–377. 1951.
41. Medsger, P. Edible wild plants. 1939.
42. Orr, N. Native plants of New Mexico, Part I. N. M. Agr. Exp. Sta., Press Bull. 733. 1934.
43. ———. Native plants of New Mexico, Part II. N. M. Agr. Exp. Sta., Press Bull. 734. 1934.
44. Safford, W. E. Narcotic plants and stimulants of the ancient Americans. Smithsonian Inst., Ann. Rep. 1916: 405–409. 1917.
45. Standley, P. C. Some useful plants of New Mexico. Smithsonian Inst., Ann. Rep. 1911: 447–462. 1917.
46. ———. Trees and shrubs of Mexico. Cont. U. S. Nat. Herb. 23: 1–1721. 1920–1926.
47. Sidestrom, I., and Kitrell, T. Flora of Arizona and New Mexico. 1941.
48. Whiting, A. F. Ethnobotany of the Hopi. Mus. N. Ariz. Bull. 1939.
49. Williams, E. Native shrubs of southern New Mexico. N. M. Agr. Exp. Sta., Press Bull. 830. 1937.
50. Wooten, E. O. Native rubber-plants of New Mexico. N. M. Agr. Exp. Sta., Press Bull. 125. 1907.
51. ——— and Standley, P. C. Flora of New Mexico. Cont. U. S. Nat. Herb. 19: 1–794. 1915.
52. Yanovsky, E. Food plants of the North American Indians. U. S. Dept. Agr., Misc. Pub. 237. 1936.

Utilization Abstract

Tomato. An annotated bibliography on the use of the tomato, disregarding nomenclature, origin, development, etc., indicates that our modern appreciation of this fruit came, not from Mexico to which it had spread by the time of the Conquest from its original home in northwestern South America, but by way of the Italians and French; it also suggests that the French took over the use from the Italians and that the latter may have become acquainted with it from the Turks, or at least from peoples in the Levant. Nearly 500 citations make up the bibliography, divided into various geographical groupings, not including, however, either Central or South America. Regarding this discrimination, the author states: "There seems to be adequate justification for this omission. These areas are, from all evidence, the home of the tomato both wild and cultivated; its use in these areas is quite ancient. Thus, the history of the use of the tomato in most of these areas is a very different problem from the one which necessarily would be the focus for the rest of the bibliography, namely, the history of the use of the tomato among peoples to whom it was introduced, fully developed as a food plant, in comparatively recent times. Certainly, the problem of research is very different". (G. A. McCue, *Ann. Mo. Bot. Garden 39*(*4*): *289–348. 1952*).