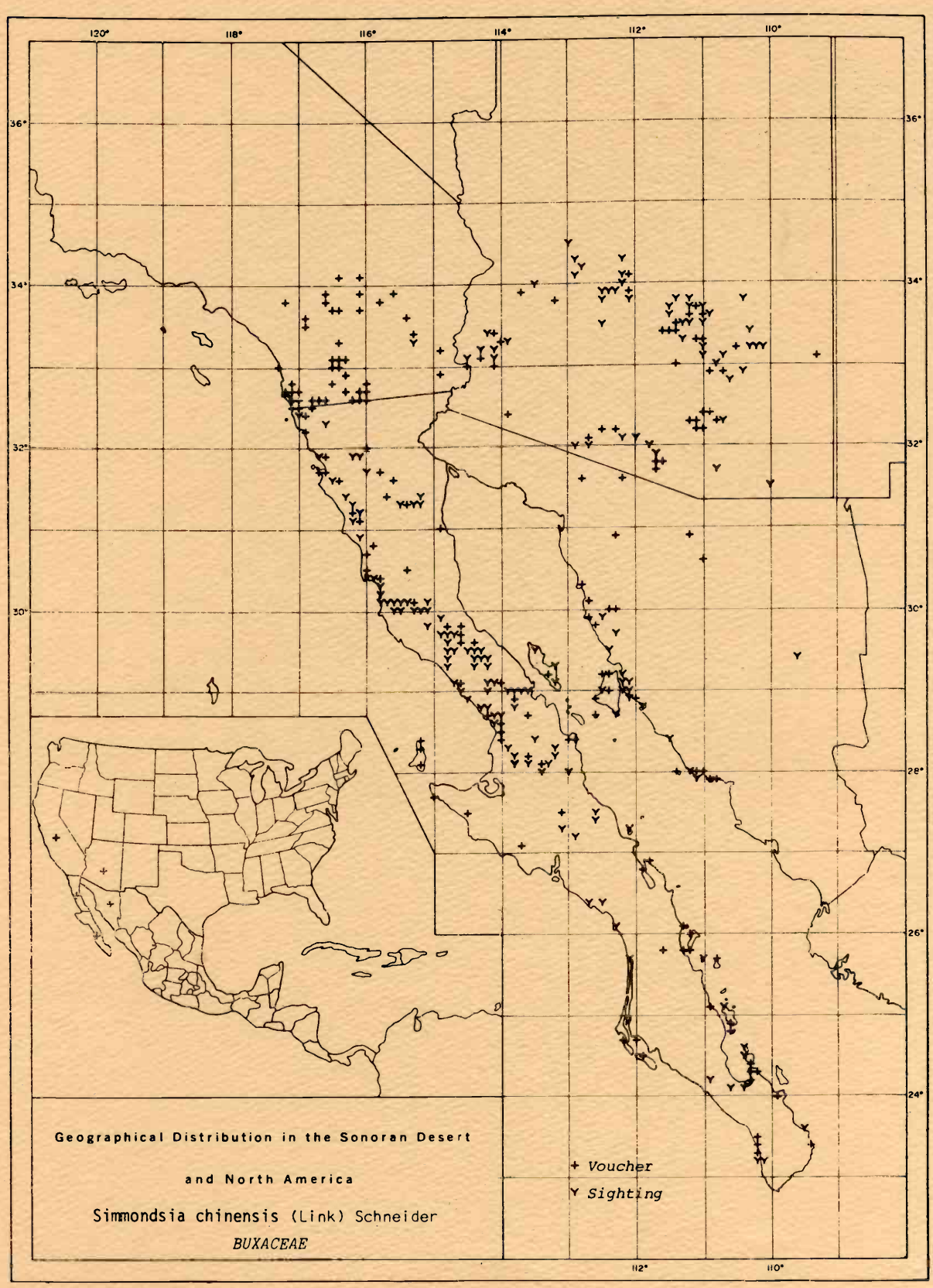
Arid Lands Resource Information Paper No. 5

JOJOBA:
A WAX-PRODUCING SHRUB OF THE SONORAN DESERT

University of Arizona
OFFICE OF ARID LANDS STUDIES
Tucson, Arizona 85719

1974



Frontispiece. Distribution of jojoba. Reproduced with permission from Hastings, Turner, and Warren (1972).

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JOJOBA:

A WAX-PRODUCING SHRUB

OF THE SONORAN DESERT

Literature Review and Annotated Bibliography

by

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and

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During the process of locating documents on jojoba, we required and received considerable assistance from the librarians of the University of Arizona Library System, particularly reference librarians at the Science Division and staff in the Interlibrary Loan Section. In addition, we were aided by personnel at the Arizona State Museum Library and at the Herbarium Library of the University of Arizona. Numerous references on jojoba were provided by the Boyce Thompson Southwestern Arboretum of the University of Arizona.

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Mr. John Nichols translated several papers from German. Systems Analyst Lynn Lybeck was responsible for making the computer program fulfill our needs. Mrs. Julie V. Garrettson was in charge of the keypunch operation, and Mrs. Jean Mills typed the manuscript.

ABSTRACT

This document reviews the literature and includes an annotated bibliography (256 references) on the desert shrub jojoba, Simmondsia chinensis (Link) Schneider, of the southwestern U.S. and northwestern Mexico. The first section, biology and natural history, treats the following topics: plant morphology and embryology, reproduction, habitat and physiological ecology, genetic variation, phytogeography, systematics, evolution, ethnobotany, use by wildlife and domestic animals, and as an ornamental. The second section, utilization of wax, covers information on the chemistry and economic utilization of the liquid wax obtained from jojoba seed. Topics include whale oil substitute, sulfurization, sulfation, hydrogenation, polymerization, epoxidation, acids, alcohols, esters, modern medicinal uses, patents, extraction, and jojoba meal. The third section reviews the literature on the production of jojoba seed, native populations, cultivated plantations, and plantation management. Current research activities of the Jojoba Indian Project, sponsored by the Office of Native American Programs at the United States Department of Health, Education and Welfare, and other research and development activities on jojoba are noted. A major portion of the paper consists of the abstracted bibliography, which appears as a computer print-out with complete citations and key words. Author and key word indices are included.

PREFACE

Jojoba (pronounced hōhōba) Simmondsia chinensis (Link) Schneider has recently received widespread attention because the seed oil (liquid wax) content of approximately 50% is a possible substitute for sperm whale oil, a product derived from an endangered species. An important industry based on utilization of the desert shrub jojoba appears to be on the horizon in the southwestern United States, Mexico, and other arid lands of the world. The following factors point optimistically toward a successful jojoba industry and economic self-development for Indians in the southwestern United States:

1) Extensive stands of native jojoba occur on the San Carlos Apache and Papago Indian Reservations in southern Arizona and it might be successfully cultivated on many Indian or private lands in Arizona and California.

2) Indians in the southwestern United States have a great need for viable and stable additions to their reservation economies.

3) A wealth of technical scientific literature indicates a considerable potential for a wide variety of useful jojoba products, such as lubricants, cosmetics, pharmaceutical preparations, polishes, candles, and a host of others.

Development of an Indian jojoba industry in the United States was given financial support by the Indian Division of the Office of Economic Opportunity in 1972-73 through the Office of Arid Lands Studies at the University of Arizona at Tucson and the Department of Plant Sciences at the University of California at Riverside. The program continues to be supported through the Office of Native American Programs in the Department of Health, Education and Welfare.

The first International Conference on Jojoba and Its Uses was held at the University of Arizona, Tucson, in June 1972, to document the state of knowledge of jojoba and appraise its future potential for utilization. The Office of Arid Lands Studies prepared a bibliography of jojoba for distribution at the conference. The conference and the subsequent publication of the proceedings signaled a renewal of interest in the economic development of jojoba around the world, and a commitment by the Federal government to foster the development of a jojoba industry on Indian reservations in the southwestern United States.

With support from the Office of Native American Programs, we have continued to identify literature on jojoba and develop a library of scientific information in the field. Our efforts have been greatly enhanced by the use of the Arid Lands Information System and Thesaurus of Arid Lands Terminology developed by Patricia Paylore at the Office of Arid Lands Studies.

Use of this computerized information retrieval system has allowed us to classify and retrieve abstracts, based on key words, of all the pertinent jojoba literature that we have located. We plan to continue our efforts, expanding the data base of our tapes as new publications become available. With that thought in mind, we would appreciate information from our readers on any jojoba literature which we may have missed, or which may be published in the future.

The capacities of our information retrieval system lend themselves well to our role as a clearinghouse for information on jojoba and its development. We are able to provide retrievals of abstracts of stored documents from key word inquiries. We also maintain a limited supply of Xeroxed copies of many of the published references cited in our bibliography for distribution to scientists and other appropriate individuals interested in jojoba research. Since July 1972, in cooperation with the International Committee on Jojoba Research and Development, a quarterly newsletter, Jojoba Happenings, has been published by the Office of Arid Lands Studies to communicate current jojoba developments to Indians, scientists, and other interested parties. Anyone interested in jojoba activities can receive this publication on a continuing basis by requesting it from the Office of Arid Lands Studies, University of Arizona, Tucson.

We hope that our bibliographic efforts will provide a helpful background of knowledge to stimulate further interest and investigation of jojoba and its economic utilization. It is our sincere desire that these efforts will eventually lead to a substantial improvement in the economic welfare of Indians in the Southwest through the development of reservation-centered jojoba industries that are integrated into the social fabric and life style of the people.

W.C.S. and E.F.H.

April 1, 1974
Tucson, Arizona

LITERATURE REVIEW

INTRODUCTION

Today's desert travelers, as they cross the southwestern United States or northwestern Mexico, probably take little note of the evergreen shrub known as jojoba, Simmondsia chinensis. A shrub of gray-green color, and common life-form, it frequently is an important, if not the most important plant species in rocky foothill plant communities. In spite of its unimpressive stature at first glance, it is truly one of the most unusual and unique plants of the North American deserts.

Unlike many of the microphyllous desert plants growing with it, jojoba has larger and broader leaves, which it usually retains year round, even after many desert perennials drop their leaves and become dormant. Jojoba is dioecious, i.e. with male and female flowers produced on separate plants, and pollination is probably effected by the wind, rather than insects. Jojoba seeds are large and covered by a thin seed coat, unlike some desert plant seeds which have hard thick seed coats which can prevent germination indefinitely. Approximately 50% of the jojoba seed is lipid, not a fat, but a liquid wax. Fats differ from waxes in being composed of a molecule of glycerine to which three molecules of fatty acids are attached, while waxes are composed of one molecule of a long-chain alcohol to which one molecule of a fatty acid is attached (Mirov, 1952). Jojoba is the only known plant in the world to produce such a substance.

Botanists have formalized recognition of jojoba's unique character by placing it in the monotypic genus Simmondsia, and some even consider that it is the only member of a unique monotypic family, Simmondsiaceae. Others consider it to be the only North American species in the Buxaceae, except for Pachysandra in the East, and the only arid adapted species in the Buxaceae, a family of worldwide distribution. Jojoba's origin remains obscured in the past, a relict (Stebbins and Major, 1965), still maintaining or perhaps expanding a wide distribution in the desert regions of Arizona, California, Sonora, and Baja California (Frontispiece). Its present day distribution may reflect the browsing pressures of herbivorous Pleistocene mammals (Gentry, 1973) that today are only known to us from the bones they left locked in rock for thousands of years. Jojoba remains today, long after former prehistoric ecosystems have changed and many species have become extinct.

Clavijero (1789), in his Storia della California, was the first to publish on the utilization of jojoba. The inhabitants of Baja California used jojoba seeds for various medicinal purposes, and employed the oil (liquid wax) in cooking. Jojoba seeds were widely utilized by American Indians throughout

the range of the plant. This utilization by native peoples stimulated interest in the jojoba plant at the Boyce Thompson Southwestern Arboretum in Superior, Arizona, where the plant is an abundant native species. Seeds and oil were sent by the Arboretum to the University of Arizona for analysis of chemical composition, and in 1933, Greene and Foster announced the startling discovery that jojoba seed oil differs radically from all other known seed oils, being a liquid wax. Its characteristics are similar to those of sperm whale oil, which occupies an equally peculiar place among animal fats and oils. These findings stimulated interest in verification of jojoba oil's unique properties. Tests were carried out independently in England (Green, Hilditch, and Stainsby, 1936) and the United States (McKinney and Jamieson, 1936). From these findings it became clear that jojoba seed oil (liquid wax) could provide an entirely new raw material possessing qualities not to be found in any other vegetable oil.

Interest in chemical manipulation of jojoba oil and in cultivation of the plant developed simultaneously. Soon chemists found that the oil could be sulfurized, hydrogenated and broken down into unusual alcohols, all providing additional possible uses for this strange liquid wax. Cultivation experiments began in Arizona and California with the idea of establishing large plantations, the selection of superior varieties, and the domestication of a new species of plant for human welfare.

BIOLOGY AND NATURAL HISTORY

The successful culture and utilization of jojoba will depend in large part on a thorough knowledge of its responses to various ecological parameters (both physical and biological), its genetic variability and evolutionary history, and its role in the desert ecosystem. Only with sufficient information on the natural history of the plant growing in native stands can realistic predictions be made on factors that might be important considerations in the development of a successful program of cultivation and/or harvest of seeds from wild populations. Many investigators have delved into various aspects of jojoba's ecology, but the individual who has contributed more than any other to our understanding of the natural history of jojoba is H.S. Gentry (1958, 1973). In these and other publications (1949, 1955, 1965, 1972), he has provided insights into how native jojoba has and is adapting to numerous environmental challanges.

Long before Clavijero (1789) first reported on the uses of jojoba nuts by the Indians of Baja California, it was a familiar plant to the inhabitants of the Sonoran Desert. Early Spanish settlers, and later, immigrants into the southwestern United States learned of the plant, its oily nuts, and its numerous uses from the native peoples. As a result of interest in the plant, its wide distribution, and the varied cultures with which it had contact, a large number of common names developed, including: bucknut, bushnut, coffee berry, coffee bush, goat-berry, goat-nut, hohowi (the original Indian name), jojoba, jojobe, jojove, nutbush, pignut, quinine nut, sheepnut, wild hazelnut, deernut, and lemonleaf (McMinn, 1951; Daugherty, Sineath, and Wastler, 1953). The common name now most frequently used, jojoba (pronounced hōhōba), is that used by colonial Spaniards, who took it from the Papago Indian name, "jojowi" (Gentry, 1965). Many of these names reflect knowledge of the uses of the seeds by wildlife, domestic animals and man.

Plant Morphology and Embryology

Jojoba is a woody shrub, often multi-stemmed, which commonly grows to between two and seven feet in height, although plants over ten feet can be found. The leaves are thick, leathery, bluish-green, oblong, opposite, and evergreen. The seeds are large, about three-quarters of an inch long, and most commonly occur singly in each fruit. The literature contains numerous botanical descriptions of jojoba (Link, 1821-22; Nuttall, 1844; Mauri, 1845; Kellogg, 1859; Baillon, 1880; Standley, 1920-26; Munz, 1935; Abrams, 1951; Daugherty et al., 1953; Shreve and Wiggins, 1964). In addition to numerous

general descriptions of jojoba, several studies have detailed the description of anatomical structures.

Van Tieghen (1897, 1898) described the characteristics of the roots, flowers, stems, and fruit in his analysis of the familial relationships of the genus Simmondsia. Several other authors have histologically examined the anatomical characteristics of the family Buxaceae, described the leaf, stem, wood and root structure, and attempted to utilize these data to determine the evolutionary relationships of Simmondsia (Pax, 1896; Solereder, 1908; Metcalfe and Chalk, 1950; Melikyan, 1968).

The epidermis of the leaves is covered with hairs, stomata are equally numerous on both leaf surfaces, the mesophyll consists wholly of palisade cells, and oxalate of lime crystals occur abundantly in the peripheral portions of the leaf. An anomalous growth of successive rings of xylem and phloem has been noted in the stems and roots (Solereder, 1908; Record and Hess, 1943; Metcalfe and Chalk, 1950). These growth rings have been utilized by Gentry (1958) in estimating an age of 100 through 200 years for jojoba plants. The wood is lemon-yellow throughout, without distinctive odor or taste, hard and heavy, and not resistant to decay (Record and Hess, 1943).

Gentry (1958) has noted considerable variation in size, shape, color, thickness, and amount of pubescence of leaves. Some of these leaf forms correlate with other characteristics, such as the small leaf and small-seeded capsule combination which characterizes a recurrent form. Leaves apparently live through two or three seasons, depending on humidity factors. Jojoba may develop several tap roots which may penetrate to a depth of 10 m. No shallow or subsurface feeder roots or true rhizomes develop (Gentry, 1958).

Female flowers are usually single, inconspicuous, and pale green in color, while male flowers are small, yellow, and occur in clusters. Both types are apetalous and borne in the leaf axils. Normally, only one of the two leaf axils at the node flowers, the opposite bud remaining dormant. But drought conditions can inhibit flowering, and with the return of favorable conditions there is a burst of flowering encompassing all the buds on a branch (Gentry, 1958). Detailed structural descriptions of both male and female flowers, organography, vascular anatomy and floral histology have been provided by Gail (1964). Pollen structure has been described and interpreted in terms of pollination mechanisms and systematic relationships (Wiger, 1935; Erdtman, 1952; Gail, 1964; Solomon et al., 1973).

The seed structure, like so many Simmondsia characteristics, is exceptional. Jojoba seeds, which develop in a capsule, contain little or no

endosperm, consisting of embryo and cotyledons enclosed in a thin, hard testa (Green et al., 1936; Gentry, 1958). The cotyledons consist of parenchyma cells with oil drops and small aleurone grains. The testa consists of various layers of parenchyma cells with brown pigmentation (Vaughn, 1970). Simmondsia differs from other genera in the Buxaceae in the structure of the integuments (an extraordinarily multi-layered outer integument with vascular bundles, and an inner integument of about five layers) and in the occurrence of nuclear endosperm (Wunderlich, 1967).

The histological and morphological details of seed and pollen development for the family Buxaceae, including Simmondsia, were studied by Wiger (1935). He notes that Simmondsia differs in several respects from other members of the family. Mauritzon (1935) has questioned Wiger's assertion that, "The endosperm in Simmondsia contains no reserve nutriment, wherefore this is lacking in the seeds (Pax, 1896)". In a paper which replies to several criticisms of his original work by Mauritzon, Wiger (1936) maintains his position on the matter. In reference to the seed coat, the micropyle is formed at later stages of seed development by the inner integument alone (Wunderlich, 1967). During seed maturation there is a clear increase in the oil content per seed, but the qualitative composition of the oil, as well as the the quantitative composition of fatty acids, alcohols, and wax esters, does not change significantly (Mirov, 1955; Wells and Tomoff, 1973).

The biosynthesis of jojoba seed wax has been studied by Matsuda (1962). Miwa (1971) found nonrandom wax ester formation and implied that at a certain stage of seed oil development, docosenyl eicosenate is biosynthesized almost exclusively. The relationship between growth of the capsule and the contained ovule is noted by Gentry (1958).

Reproduction

Link (1821-22) in his original description of jojoba as Buxus chinensis failed to note that the staminate and pistillate inflorescences occur on separate plants, i.e. that the species is dioecious. Recognition of this fact missed note by subsequent authors (except Pax, 1896), possibly as a result of the frequent occurrence of two or more multi-stemmed plants of different sexes growing together as one shrub. Gibson (1938) clearly established the dioecious nature of the jojoba plant and noted that this aspect of the plant's biology would be of considerable importance in any attempts at cultivation.

The ratio of male plants to female plants is very unequal in Arizona, where males may outnumber females by more than four to one, while in California the sex ratio is nearly equal. Gentry (1958) has attributed this

disparity in the sexual ratio in Arizona to environmental rather than genetic factors. Apparently a greater proportion of the males survive the stresses of seedling establishment.

The fruiting of isolated pistillate plants and the lack of knowledge of biological pollinating agents, such as insects or birds, led Gentry (1955) to hypothesize that jojoba was apomictic. Later experimentation led him (1965) to reverse that idea and note that the pollen is easily borne by the wind. The female flowers are pale green in color much like new leaves. They lack nectaries, are without scent glands, and have not been observed to be visited by insects (Gentry, 1958; Gail, 1964). The male flowers are frequently visited during pollen shedding by bees, which could accidentally effect pollination as reported by Gail (1964), who suggests that wind pollination is a secondarily acquired trait of recent origin since Simmondsia presently seems to be bridging between insect and wind pollination. Wind pollination has resulted in several modifications which set Simmondsia apart from other members of Buxaceae: a dioecious habit, long exerted fully-stigmatic styles, elaboration of stamen number, and a possible increase in number of male flowers per inflorescence. But the medium-sized tricolpate pollen grains and the retention of relatively short stamens are adaptations for insect dispersal, indicating jojoba is still in a relatively early stage in development of the wind pollinated habit (Gail, 1964). Scanning electron photomicrographs of the pollen grains are available (Solomon et al., 1973).

Clavijero (1789) noted that flowering and the setting of seed does not occur in Baja California during years of drought. The importance of drought on the inhibition of flower bud development and vegetative growth has been noted throughout the range of jojoba. Gentry (1958) discusses the phenological aspects of jojoba in Arizona and California where, because low winter temperatures also inhibit growth of flowers, the drought of summer and the cold of winter tend to concentrate flowering in the spring. The seasonal growth and flowering period of jojoba is in general directly responsive to the winter-spring rains, varying with their date of onset, magnitude, and duration. While summer rains, which occur generally in Arizona but not in California, appear to have little influence on the annual growth and reproductive cycle. They may play a role in prolonging the ripening of maturing seeds. The development of the capsule takes about three months, and the seeds may be aborted if environmental conditions are unfavorable. Complete maturation, from fertilization to mature seed, requires a period of about six to seven months. Because jojoba is found in areas of considerable geographic, topographic, climatic, and other environmental variation and because it exhibits significant morphological and physiological variation, further studies on the phenological aspects of jojoba are basic to our understanding of the plant (Haase, 1973).

Germination in Simmondsia is hypogeous (U.S. Forest Service, 1948; Gentry, 1958). Development of the radicle into a deep tap root occurs rapidly, and is well underway by the time leaves first appear above ground (Van Tieghem, 1897; U.S. Forest Service, 1948; Martinez, 1959b). Burden's (1970) study of factors affecting Simmondsia germination showed the optimal conditions for germination to be darkness, constant moisture, and temperatures of 26° to 30°C.

Habitat and Physiological Ecology

Several authors have briefly commented on the ecology of jojoba in Mexico (Kellogg,1859; Zacatecas, 1943; Sanchez, 1944; Benavides, 1950; Martinez, 1959b). But, the most extensive studies on Simmondsia habitat requirements are the natural history study of Gentry (1958) and Burden's (1970) study of jojoba ecology at its lower elevational limits in Arizona. Gentry describes associated plants in the Arizona uplands of the Sonoran Desert, coastal southern California, and Baja California. Burden presents data on phytosociological relationships, microclimatic requirements, topography and soils. Density of S. chinensis is positively correlated with densities of Cercidium microphyllum, Eriogonum fasciculatum, and with aspect and slope angle. Forty-five percent of the density variability of S. chinensis was accounted for by topographic and edaphic factors. Whittaker and Neiring (1964) include jojoba in their analysis of the ecological classification and distribution of plant species in the vegetation of the Santa Catalina Mountains, Arizona.

Jojoba is usually restricted to coarse and well-drained desert soils, such as the sandy alluviums and coarse atrital mixtures of gravels and clays (Gentry, 1958). It is sometimes found on soils of loamy texture (Natural Vegetation Committee, 1973). Gentry (1958) notes that it is generally absent from the bottomland soils of clay and silt throughout its range. Such sites may often be colder at night than the adjacent slope lands. Jojoba is usually found on dry slopes and along washes at elevations of 1,000 to 5,000 feet (Natural Vegetation Committee, 1973), but in Mexico and California it occurs down to sea level (Gentry, 1958). Optimum annual precipitation appears to be between 12 and 18 inches (Gentry, 1958).

Because of its drought-resistant character, jojoba occurs in arid regions, but within these areas it must find sufficient moisture to maintain a delicate balance of survival (Gentry, 1958, 1973; Burden, 1970). During severe drought, the leaves of this normally evergreen shrub may be shed (Clavijero, 1789; Felger, 1966). Successful production of seeds requires a minimum of precipitation (Clavijero, 1789; Gentry, 1958). In his study of

the ecological factors influencing jojoba density and distribution at its lower elevational limits, Burden (1970) studied the influence of temperature and soil moisture conditions, concluding that available soil moisture during germination and establishment is critical for the distribution of jojoba at lower elevations in Arizona. McGinnies and Arnold (1939) studied the water requirements of Arizona range plants and concluded that jojoba had a medium water requirement in comparison with the other arborescent species studied. It utilized soil moisture during most of the year, and in some respects functioned as a chaparral species. Osmotic concentrations of the sap were studied by Harris and Lawrence (1916) and the seasonal water content of the leaves was investigated by Elder (1953). Seasonal variations in xylem tension in relation to topography and diurnal response have been studied in Arizona (Halvorson and Patten, 1974).

Ani et al. (1972) studied the physiological ecology of drought resistance for Simmondsia chinensis from varied habitats. Seasonal physiological measurements included leaf water potential, net photosynthesis, dark respiration, and carbohydrate content. In all habitats, including coastal and severe desert, the plants of four populations were physiologically active during the entire year, indicating that these plants are true drought endurers and have the capacity to maintain a positive carbon balance even under conditions of severe desert drought. A comparative laboratory study of the physiological ecology of jojoba plants from different populations showed that all possessed a high degree of physiological tolerance to drought and high temperature, but with distinct differences between the coastal and desert populations corresponding to decreasing available soil moisture in their natural environments.

Genetic Variation

Stebbins and Major (1965) reported the chromosome number of Simmondsia chinensis to be n=ca. 100. Raven, Kyhos, and Hill (1965) reported 2n=26 (erroneously cited as n=26 by Gentry, 1973) and have suggested that plants or populations with n=52 should be sought in the field. The presence of polyploidy could provide a large potential for breeding varieties for agricultural use (Gentry, 1973).

Gentry (1958, 1965) has devoted considerable study to the variability of morphological characters in jojoba. Variations in habit, foliage, flowers, and fruits occur at random throughout the various populations in such a way that no distinct subspecies are recognizable. This variation reflects the diversity of habitats in which jojoba grows and its extensive geographical distribution in the Sonoran Desert. Several aspects of this genetic variability are of interest in the selection of strains of jojoba for cultivation.

Gentry (1958, 1965) describes the habit, leaf, flower, and capsule characteristics of several populations from Arizona, California, and Baja California. Coastal forms differ significantly from desert forms in habit, with coastal plants growing closer to the ground. Leaves vary on different plants, in size, shape, color, thickness, and amount of pubescence. Also, some shrubs appear to defoliate more readily than others. In Arizona populations, female flower buds remain dormant at every other node, while in California plants, flowering commonly occurs at every node. This could conceivably reduce the yield potential of Arizona stock.

Capsules may contain between one and three seeds although one-seeded capsules are by far the most common. Gentry (1958) notes that some individual shrubs tend to have a high percentage of one or the other and suggests primary genetic control modified by environmental conditions. Gail (1964) has suggested that seed number variability per capsule could result from differential success in pollination. Capsules vary in size, shape, and color. Although not common, clustered or fascicled and racemose inflorescences occur in nature. Seeds vary in color, size, shape, lumpiness, and oil content, as well as in the amount of pubescence and its distribution. Gentry (1958) states that the season of seed fall is predetermined by both environmental and genetic factors involved in seed maturation.

Miwa (1971) investigated the chemical composition of the jojoba seed oil in various populations. Two adjacent Arizona populations were essentially identical in oil composition. Shrubs of similar phenotypes that are adapted to the hot and dry environment of the California desert have increased markedly in seed size over the Arizona populations, but have changed only slightly in chemical composition of the oil. Conversely, a prostrate phenotype growing near San Diego with seed similar in size to the Arizona type had a distinct shift in oil composition toward larger molecular size. Another sample of unknown origin showed a shift toward shorter chain lengths.

Phytogeography

Maps of the recent distribution of S. chinensis show that jojoba's range includes most major areas of the Sonoran desert (Gentry, 1958; Shreve and Wiggins, 1964; Ani et al., 1972; Hastings, Turner, and Warren, 1972) (see Frontispiece and Fig. 1). Jojoba's occurrence on the islands of the Gulf of California and coastal Sonora has been recorded by numerous authors (Kellogg, 1859; Watson, 1889; Rose, 1892; Gentry, 1949; Felger, 1966). Daugherty et al. (1953) note that in Arizona, jojoba is localized in the mountains around Tucson, south and east of Phoenix (the Superstition, Graham,

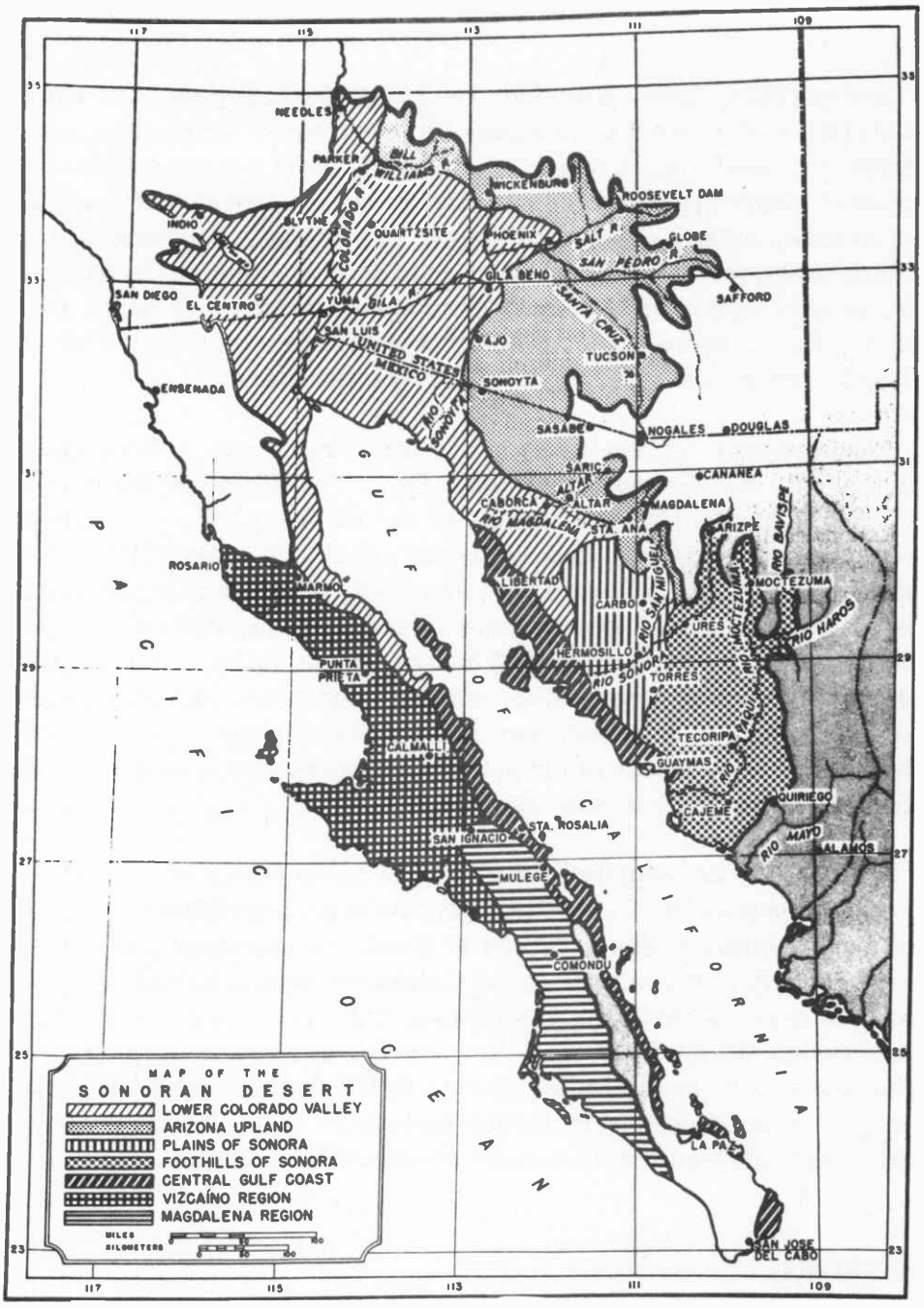

Fig. 1. The Sonoran Desert and its vegetational subdivisions. Reproduced from Shreve and Wiggins (1964) with permission of the Stanford University Press.

Catalina, Rincon, Santa Rita, Cerro Colorado, Baboquivari, and Ajo ranges), and a small population north of Yuma. In California it inhabits the mountains around the Salton Sea basin of the Colorado Desert and the southern portion of San Diego County. Localities in San Diego County are noted by Higgins (1949). Daugherty et al. (1953) also state that it has been growing in New Mexico, but to our knowledge records of naturally occuring populations in that state are still lacking.

Croizat (1952) has interpreted the phytogeography of Simmondsia in the context of worldwide dispersal of the family Buxaceae. Gentry (1973) notes that jojoba's habit of growing and flowering in response to the winter-spring rains, and the maturation of seed in the dry summer, indicate that S. chinensis had its origins along or near the Pacific Coast, in Mediterranean-type climate. Cold temperatures along the continental divide apparently have been a barrier to migration eastward, while the closed climatic communities of chaparral to the northwest and thorn forest to the south have limited further dispersal in those regions (Gentry, 1973). Jojoba grows best in the open spaces, milder climate, and moister margins around the Sonoran Desert. McGinnies and Arnold (1939) have also noted that jojoba avoids areas of frost. Climatic factors influencing the distribution of S. chinensis in Arizona at its lower elevational limits have been studied in detail by Burden (1970). Both he and Gentry (1973) note that jojoba avoids the driest sites in the low desert. Gentry (1973) has offered the idea that the present day distributions of jojoba, a nutritious browse plant, could have resulted from the grazing pressures of the Pleistocene ruminant fauna of the Southwest. This would explain the general absence of jojoba from the mesquite grasslands, which appear in general respects to be appropriate habitat (Gentry, 1973). Felger (1966) has noted the effect of cattle on limiting jojoba distribution to the protected areas of spiny desert shrubs in Sonora. Stebbins and Major (1965) have classified S. chinensis as a paleoendemic. Gentry (1973) notes that if it were a paleo-endemic, one would expect it to occur in the Coahuilan as well as the Sonoran Desert, as do the two paleoendemics Koeberlinia and Holocantha.

Systematics

The taxonomic and systematic status of jojoba, properly known as Simmondsia chinensis (Link) Schneider, has been the subject of much confusion and debate (McMinn, 1951; Mirov, 1952; Gentry, 1965). Originally described as Buxus chinensis (Link 1821-22), it was mistakenly thought to be from China. Twenty-two years later Nuttall (1844) named specimens from San Diego, California, Simmondsia californica, designating a monotypic genus Simmondsia in honor of the naturalist F.W. Simmonds. Mueller (1869)

recognized that S. californica and Buxus chinensis were the same species, but chose to use Simmondsia californica. Schneider (1907), following the priority rules of international botanical nomenclature, retained the original specific name, chinensis, and left jojoba in the genus Simmondsia, emphasizing its distinctness from Buxus. Dayton (1927) and Kelsey and Dayton (1942) have argued that the name chinensis is inappropriate (referring to China) and that californica should be retained. As a result of confusion and reluctance by some authors to use the name chinensis for a plant only found in North America, both names appear throughout the literature to this day. Over the years, numerous authors have pointed out that the international rules of nomenclature require the retention of the earlier species name chinensis (Standley, 1920-26; Johnston, 1924; McMinn, 1951; Gentry, 1965) and this name is employed by the vast majority of botanists today. In spite of this, recent authors are still utilizing the name californica (Elliger, Waiss, and Lundin, 1973; Miwa, 1973a). The essence of the Linnean system of binomial nomenclature is the establishment of stable names to be used primarily as tools of identification. Earlier systems of nomenclature based on descriptions of characteristics proved to be failures. Although it might be convenient to have a specific term describing where the plant is found, californica, there is presently no valid justification for its use as a substitute for the name Simmondsia chinensis.

Jojoba was also described by Mauri in 1845 as Brocchia dichotoma Mauri, but it was later recognized as being synonymous with Simmondsia californica Nuttall (Cesati, 1873). Kellogg (1859) described a population from Cerros [i.e. Cedros] Island as Simmondsia pabulosa Kellogg, but this is now considered to be a synonym (Standley, 1920-26; Johnston, 1924). The name Simmondsia chrysophylla Hort. has also been employed (Hooker and Jackson, 1906-10; Gentil, 1907).

The systematic position of the monotypic genus Simmondsia has been the subject of considerable difference of interpretation. Frequently it has been placed in the family Buxaceae (Davidson and Moxley, 1923; Metcalfe and Chalk, 1950; Gail, 1964; Hutchinson, 1967) but other authors prefer to use the monotypic family Simmondsiaceae, designated by Van Tieghem in 1897 (Takhtajan, 1959, 1966, 1969; McGinnies, 1968; Melikyan, 1968). It is sometimes referred to as a subfamily of Buxaceae, the Simmondsieae (Muller, 1869; Pax, 1896; Croizat, 1952; Hegnauer, 1964). Based on an analysis of the taxonomic significance of the seed coat, Wunderlich (1967) states that Simmondsia probably is not in the Buxaceae. After study of floral anatomy and morphology, Gail (1964) retained the genus in the family Buxaceae. Takhtajan (1966, 1967), while recognizing the family Simmondsiaceae, states that it is close to the family Buxaceae. The family Buxaceae,

with or without Simmondsia, has been seen, based on various types of evidence, as allied with several families and in numerous orders (Van Tieghem, 1897, 1898; Davidson and Moxley, 1923; Wiger, 1935; Zacatecas, 1943; Croizat, 1952; Erdtman, 1952; Gail, 1964; Takhtajan, 1966; Hutchinson, 1967; Wunderlich, 1967). Obviously the systematic relationships of the genus Simmondsia and the family Buxaceae require further study.

Evolution

The evolutionary history of S. chinensis is obscure. If it is related to the Buxaceae, a worldwide family in distribution (Croizat, 1952), its relationships and origins are not clear. Stebbins and Major (1965) have classified jojoba as a peleoendemic, ancient and perhaps on the way to extinction. Gentry (1958, 1973) has questioned this view and notes that growth in jojoba is linked with the winter-spring rains, not with the summer rain of Arizona. This indicates that jojoba has its historical origins in the Mediterranean-type climate.

Considerable morphological diversity has been described in both vegetative and reproductive organs between populations and plants (Gentry, 1958, 1965; Gail, 1964). Ani et al. (1972) have discussed drought and temperature tolerance with respect to the development of ecological races. A trend of ecotypic differentiation exists from the Pacific Coast in California to the Sonoran Desert in Arizona. The liquid wax from jojoba nuts from coastal California has been shown to have a higher molecular size than liquid wax from the California desert or from Arizona specimens (Miwa, 1971). Gail (1964) suggests that Simmondsia, although relatively specialized, is presently undergoing intensive speciation and expansion of range, retaining considerable heterozygosity and evolutionary plasticity. Simmondsia appears to have only recently evolved wind pollination (Gail, 1964). Because of its wide ecological distribution and its genetic, morphological, and physiological diversity, jojoba would appear to be an ideal subject for further evolutionary studies.

Ethnobotany

The earliest written record of jojoba, by the Italian Jesuit Clavijero (1789, 1852, 1937), detailed use of jojoba "berries" by the inhabitants of Baja California. "This berry has become celebrated for its medicinal value, especially for curing the suppression of the urine arising from mucus concretions, for facilitating childbirth, and for wounds. The oil which is derived from it is an excellent remedy for cancer; and, on the other hand, as it has

good flavor, some in California are accustomed to use it in salads instead of olives." (Clavijero, 1937). It is not surprising that the native peoples of the Sonoran Desert and southern Baja California utilized the abundant, large, dark brown oily seeds of this remarkable bush. Present-day efforts at industrialized uses of jojoba oil and cultivation of the plant are based on utilization of a natural resource whose potential has been realized for hundreds, if not thousands, of years by the peoples of the Sonoran Desert.

Evidently medicinal uses of jojoba were widespread before the arrival of European peoples. Clavijero's report (1789) from Baja California at the southwestern extreme of the plant's range, is matched by Patterson's (19__) report of how jojoba was used in treating sores among the Apaches near the northern edge of jojoba's distribution. Ned Anderson (personal communication) has informed us that certain individuals still employ this remedy on the San Carlos Apache Indian Reservation today. This same treatment of sores with jojoba seeds and oil was also known to the Papago Indians (Castetter and Underhill, 1935). Jojoba seeds were also used to cure stomach problems (Escobar, 1935) and other medicinal problems (Martinez, 1959a; Aschmann, 1966). Numerous authors have referred to the supposed hair restorer properties of jojoba oil (Saunders, 1930; Escobar, 1935; Martinez, 1959a; Warth, 1956; Balls, 1962).

Jojoba seeds have probably been eaten raw or roasted by all of the peoples living within the range of the plant: Southern California (Palmer, 1878; Barrows, 1967), Baja California (Clavijero, 1789; Meigs, 1939; McMinn, 1951; Warth, 1956), Sonora (Zacatecas, 1943; Sanchez, 1944; Martinez, 1959b), Arizona (Russell, 1908; Castetter and Underhill, 1935; Bohrer, 1957; Lumholtz, 1971). Reference has been made to their use by the Papagos, Pimas, Kiliwas, Yavapais, Coras, and Yaquis. Undoubtedly other groups also utilized the seeds as food, but few ethnobotanical studies of the various tribes are available with the exception of Castetter and Underhill's (1935) study of the Papago. Several individuals have reported either that jojoba seeds are hardly edible (Hedrick, 1919), or that they may have a nauseous aftertaste and are apt to cause purging (Howes, 1948; Vaughan, 1970).

The seeds of jojoba have also been ground and mixed with water, sugar, etc., in various folk recipes to create a number of beverages, particularly in Mexico. Among these are a coffee substitute (Wickson, 1912; Howes, 1948; Gentry, 1949; Balls, 1962; Burgess, 1966; Barrows, 1967; Kirk, 1970) and a chocolate-like drink (Saunders, 1930; McMinn, 1951; Martinez, 1959b; Balls, 1962).

The oil has been used as an olive oil substitute (Dayton, 1937) and made into a pomade for women's eyelashes and men's moustaches (Gentry, 1949). The stems of the plant were sometimes used as fuel (Record and Hess, 1943), and the seeds are used by the Seri Indians in the manufacture of necklaces for trade (personal observation).

Use by Wildlife, Domestic Animals, and as an Ornamental

Gentry (1958) has described the insects, rodents, and birds associated with jojoba plants. Ground squirrels, desert chipmunks, and rabbits gather or feed on the seeds. Large birds, such as jays, crows, pigeons, and doves, have also been reported to feed on the seeds. Van Dersal (1938) notes that they are eaten by squirrels, mule deer, and white-winged doves. Huey (1945) described a gopher, Thomomys bottae jojobae apparently associated with jojoba, although it is not known if it feeds on the roots. Thornber (1910) has suggested tbat by collecting and storing the seeds, squirrels spread the plant. Rosenzweig and Winakur (1969) noted a relationship between the distribution of jojoba and the pocket-mouse Perognathus baileyi in their study area near Superior, Arizona.

The seeds and foliage of jojoba are of importance to at least two wildlife species in Arizona, and undoubtedly in other areas also. Jojoba seeds are a major mast crop in javelina habitat (Knipe, 195_) and are "relished" by the desert peccaries (Eddy, 1959). Deer also utilize the nuts (Kellogg, 1859) and feed heavily on the foliage (Clark, 1953; McCulloch and Urness, 1973).

It is widely recognized that jojoba is an important browse plant for domesticated animals, cattle, sheep, and goats (Kellogg, 1959; Thornber, 1910; Escobar, 1935; Dayton, 1937; Zacatecas, 1943; Benavides, 1950; Felger, 1966). Unfortunately, we know of no detailed studies on this important aspect of jojoba utilization. Gentry (1973) not only notes that it is nutritious browse, but that man's cattle can consume jojoba faster than it grows.

Simmondsia chinensis has many characteristics, such as evergreen foliage, drought tolerance, growth form, etc., that suggest that it could be utilized by horticulturalists as an ornamental plant (Hodge, 1961; Gentry, 1965; Anonymous, 1973; Natural Vegetation Committee, 1973). In fact, it has been used as such on a limited basis for several decades. Gentry (1965) has pointed out the characteristics of several forms that could be used as genetic stock for the selection of varieties. Thompson (1973) has outlined the needs for horticultural research on the propagation, culture, and breeding of jojoba. Jojoba has also been successfully employed in erosion control (Crosswhite, 1973).

UTILIZATION OF WAX

Knowledge of and interest in jojoba and the uses of its seed quickly spread from the native peoples of the Sonoran Desert to the European settlers, and were particularly taken up by the early residents of Sonora during Colonial times. Its use has extended to present day. The first pharmaceutical chemical analysis of the seeds (Roehr, 1910) failed to disclose the radical nature of the seed oil, but did note that it contained a purging agent. Interest in the shrub was strong at the Boyce Thompson Southwestern Arboretum at Superior, Arizona, where it grows abundantly in the wild (Baird, 1948; Crosswhite, 1973). The first request for jojoba seed from cultivated plants at the Arboretum was from an Apache Indian, for medicinal use. Seed was also sent to numerous investigators across the country and around the world. Chemical analysis by Greene and Foster (1933) at the University of Arizona revealed that jojoba seeds were largely composed of a liquid wax, unique to the plant world, principally fatty acid esters of decyl alcohol.

The closeness of its chemical composition and characteristics to sperm whale oil led to the immediate suggestion that jojoba oil had potential as a valuable lubricant. Soon more detailed analyses were available on the chemical and physical composition of jojoba oil (McKinney and Jamieson, 1936; Green et al., 1936). It was confirmed that the oil was not a glyceride fat, but a liquid wax composed almost entirely of esters of high molecular weight, mono-ethylenic acids, and alcohols. The unsaturated acids were identified as a mixture of eicosanoic and dicosanoic acids, along with small quantities of palmitoleic and oleic acids. The unsaturated alcohols are a mixture of eicosanol and dicosanol, with smaller quantities of hexacosanol and alcohols of lower molecular weight. Details of the chemical and physical constants of jojoba oil have been compiled and reviewed (Benavides, 1950; Daugherty et al., 1953; Knoepfler and Vix, 1958; Molaison, O'Connor, and Spadaro, 1959; Miwa, 1973a). Other authors have discussed the history of the discovery of jojoba oil's unique characteristics and possibilities for economic development (Douglas, 1947; Benavides, 1950; Mirov, 1950, 1952; Wells, 1954; Warth, 1956). The nature of the inherent organic compounds, alcohols, esters, and acids, and possibilities of chemically manipulating the oil by hydrogenation, sulfurization, and polymerization, stimulated interest in jojoba oil and spurred investigation of its possible uses. Its chemistry and industrial potential have been the subject of numerous reviews (Daugherty et al., 1953; Knoepfler and Vix, 1958; Vietmeyer, 1971).

The number and diversity of potential uses for which jojoba oil has been proposed are staggering. Some include: 1) high temperature lubricants for high-speed machinery, 2) sulfurization for extreme-pressure lubricants,

3) treatment of leather, 4) factice for rubber, varnishes, linoleum or chewing gum, 5) hydrogenation into hard wax for use as polishing wax, fruit coating, in carbon paper, or as candles, 6) soap making, 7) numerous pharmaceutical uses, 8) dietetic salad oil, 9) in cosmetics and hair oils, 10) resins, 11) plasticizers, 12) evaporation retardants, 13) textile softening agents and 14) sources of straight-chain alcohols and acids as intermediates in the production of several other products. Numerous papers on jojoba mention some use to which the oil has been put, or some potential use to which jojoba seed oil could be put (Standley, 1920-26; Saunders, 1930; Knight, 1936; Dayton, 1937; Jamieson, 1943; Zacatecas, 1943; Douglas, 1947 Duisberg, 1952; Mirov, 1952; Daugherty et al., 1953; Krochmal, 1954; Wells, 1954; Hodge, 1955; Warth, 1956; Jones and Knoepfler, 1957; Knoepfler and Vix, 1958; Baker, 1965; Vaughan, 1970; Gentry, 1972; Cruse, 1973; Jones, 1973; Miwa, 1973a).

Whale Oil Substitute

Because of its chemical similarity to sperm whale oil, jojoba seed oil (liquid wax) has long been recognized as a possible substitute (Anonymous, 1936a,b, and c; Jamieson and McKinney, 1936; Anonymous, 1937). Sperm whale oil has several properties that have made it valuable to industrialized societies. It is widely used for many types of lubrication, for the oiliness and metallic wetting properties that it imparts and its non-drying characteristics that prevent gumming and tackiness. It is also important as a chemical intermediate since it can be sulfonated, oxidized, sulfurized, sulfur-chlorinated and chlorinated to give products that are used as wetting agents and extreme pressure additives (Thompson, 1972). Jojoba oil possesses several advantageous characteristics over sperm whale oil: 1) it has no fishy odor, 2) the crude oil contains no stearins and requires little or no treatment for most industrial purposes, 3) it is a native vegetable product of North America, not subject to shortages of supply during wartime, etc., 4) it takes up larger amounts of sulfur, 5) it does not darken on sulfurization, and 6) the highly sulfurized oil is liquid, whereas sperm oil, when highly sulfurized, requires additions of mineral oil in order to remain liquid (Wells, 1948; Daugherty et al., 1953; Vietmeyer, 1971).

Frequently, interest in jojoba oil has resulted from threats to the United States' supply of whale oil. This occurred during World War II when international whaling was severly restricted. More recently, jojoba has received much attention, in a roundabout manner, from the passage of the Endangered Species Conservation Act of 1969, under the provisions of which sperm oil whales were subsequently listed as protected animals. This

resulted in a ban on importation into the United States of oil, meat, and other products from sperm whales (Cook, 1971; Vietmeyer, 1971; Anonymous, 1972; Gentry, 1972; Anonymous, 1973). With the supply of sperm whale oil cut off from the United States in an attempt to stop the exploitation that has been driving whales to extinction, a new burst of enthusiasm and effort has been added to the hopes that jojoba will someday realize its vast potentials and become an economically important resource.

But jojoba oil is not the only possible substitute for sperm whale oil. The seed oils of Limnanthes and Crambe, a meadowfoam, could be converted chemically to wax esters comparable to those of jojoba, but the latter would probably require an extra processing polyunsaturation (Cook, 1971; Miwa, 1973a). The details of the oil chemistry of these plants are available (Miwa and Wolff, 1962, 1963; Miwa, 1973a), and a patent has been issued on a wax ester substitute for jojoba oil from the seed of Limnanthes douglasii (Miwa and Wolff, 1965). Gentry (1972) notes that the seeds of these other oils must be converted chemically to waxes and their application to special uses has not been tested. One of the acids occurring in greatest quantity in jojoba oil is eicosenoic acid, which has also been found in hare's-ear mustard seed oil (Hopkins, 1946), but jojoba appears to be a much better source (Hopkins, Chisholm, and Harris, 1949). Yermanos (1973) has noted that because of inadequate supplies of jojoba oil, industries using sperm whale oil may reformulate their products so as to make use of jojoba oil unnecessary, or they may develop synthetic substitutes which will undersell jojoba oil. A report on comparisons of sperm oil-based extreme pressure additives with their replacement products indicates that this change has already begun (Thompson, 1972). Replacement products containing sulfur, sulfur and chlorine, and chlorine have been developed with properties and price-performance relationships equivalent to sperm-based extreme pressure additives.

Sulfurization and Sulfation

Soon after the discovery that jojoba oil was a liquid wax with many similarities to sperm whale oil, a patent was granted on a process for the sulphurization of the oil (Flaxman, 1940). Sulfurized jojoba oil has applications in transmission lubricants and other extreme pressure lubricants. The use of jojoba oil has the advantage of taking up relatively large amounts of sulfur (Daugherty et al., 1953).

Jojoba oil may also be sulfated by the addition of sulfuric acid (98%) (Wells, 1954). Sulfated products have been derived from most of the more important fatty oils, some of which have found wide application in the textile industry where they are used as surfactants (for defatting), textile-softening agents, and as lubricants for spinning operations.

Hydrogenation, Polymerization and Epoxidation

Hydrogenation is one of the several processes by which crude jojoba oil can be altered for use in another form. This process is similar to hydrogenation of corn and other seed oils in the preparation of margarine (Vietmeyer, 1971) and the hydrogenation of cotton seed oil in the preparation of modern shortenings (Warth, 1956). Apparently the process by which the jojoba oil is extracted from the seeds has little effect on the properties of the hydrogenated wax produced (Spadaro and Lambou, 1973). A hard white crystalline wax is formed when hydrogen is added, using nickel-copper catalyst and relatively mild temperatures and pressures (Daugherty et al., 1953). The solubility of hydrogen in jojoba oil has been determined for a range of temperatures and pressures (Wisniak and Stein, 197_). The fully hydrogenated solid wax is very hard, having a melting point of about 70°C (158°F), and a hardness which approaches carnauba wax. The qualities make it desirable for a large number of possible uses: polish waxes, carbon paper, waxing fruits, impregnation of heat-resistant paper containers, and smokeless long-burning candles of brilliant flame (Taussky, 1946; Anonymous, 1950; Mirov, 1950; Steinle, 1952; Daugherty et al., 1953; Warth, 1956; Vietmeyer, 1971). Daugherty et al. (1953) have discussed the economic feasibility of jojoba hydrogenated wax as a replacement or extender of several established waxes on the market: carnauba, candelilla, and ouricuri.

Recently a program for the development of a candlemaking industry has been launched on the San Carlos Apache Indian Reservation in Arizona. This is under the auspices of the U.S. Department of Health, Education and Welfare through the Office of Arid Lands Studies at the University of Arizona (Jojoba Happenings, 1973). It is hoped that a successful Indian candlemaking industry would provide the impetus for further developments and wider utilization of jojoba oil or its derivatives. The only established commercial user at the present time is a company in Guadalajara, Jalisco, Mexico, Laboratorios Jojoba, S.A., producing a hair oil, soap, and several varieties of shampoo.

Jojoba oil reacts with sulphur chloride to form a rubbery compound known as a factice. Varnishes, rubber, adhesives, and linoleum can be prepared from such preparations (Ellis, 1936; Spadaro and Lambou, 1973). A patent covers the use of jojoba factice in the manufacture of printing ink (Whitner, 1940). The polymerization reactions of the acrylate and methacrylate esters of alcohols from jojoba oil have been studied by Marvel at al. (1960) and Paisley (1961).

Epoxidation of jojoba oil could result in the formation of a unique product. Epoxides of unsaturated glycerides and of fatty acid esters are used as

plasticizers and stabilizers for vinyl chloride containing plastics (Spadaro and Lambou, 1973). Fore, Magne, and Bickford (1958) have shown that epoxidized jojoba oil is a satisfactory thermal and ultraviolet stabilizer for certain plastics. It has no adverse effects on the plasticizer properties of these materials. Epoxidized jojoba oil was found to be equivalent to or, in some instances, superior to the other epoxides tested. A number of maleinated derivatives of jojoba oil have been prepared and tested both as plasticizers for polyvinyl chloride-polyvinyl acetate copolymer and as softeners for nitrite rubber (Buna-N)(Fore et al., 1960).

Acids, Alcohols, and Esters

Jojoba seed oil is also an excellent source of straight-chain alcohols and acids (Daugherty et al., 1953; Spadaro and Lambou, 1973). These compounds could be used as intermediates in the preparation of numerous other compounds including disinfectants, surfactants, detergents, lubricants, driers, emulsifiers, resins, plasticizers, protective coatings, fibers, corrosion inhibitors, bases for creams and ointments, antifoamers, and other products. Molaison et al. (1959) have investigated the preparation of long-chain unsaturated alcohols by sodium reduction of the fatty esters of jojoba oil. Also, see Spadaro and Lambou (1973) and Miwa (1973b). Jojoba oil wax esters and derived fatty acids and alcohols have been analysed with gas chromatography (Miwa, 1971, 1973b). It was shown that the biosynthesis of jojoba oil was nonrandom and that the molecular size in the oil composition changes from desert to coastal populations of the plant.

Modern Medicinal Uses

It was noted earlier that jojoba seeds have been utilized for medicinal purposes by the native peoples of the Southwest (see Ethnobotany). The first modern analysis of the pharmaceutical values of jojoba oil revealed that it had a nauseous taste and caused purging (Roehr, 1910). Its chemical nature as a wax probably makes it indigestible to most animals. This quality makes the oil suitable as a carrier for medicinal preparations that must pass through the stomach into the small intestine before assimilation (Daugherty et al., 1953). Hinds (1949) has obtained a patent on a preparation of penicillin in jojoba oil that may be administered either orally, or hypodermically into the blood stream. Jojoba oil has also been investigated as a carrier of various forms of vitamin A in chicks and rats (Week and Sevigne, 1949a and 1949b). It was concluded that it inhibits hydrolysis of the ester forms of vitamin A in these animals.

Tobias, Mazzuco, and Latorre (1947-49) have reported that liquid jojoba wax has an intense inhibitory action on tubercule bacilli. Mycobacterium tuberculosus failed to grow in the usual culture medium when in contact with jojoba oil. Mirov (1950) has noted that jojoba must have an enzyme system that is capable of splitting the liquid wax stored in the seeds into free fatty acids and free alcohols. No known enzyme is capable of splitting jojoba wax. If such an enzyme were isolated, it might be useful in attempting to destroy the waxy sheaths of tuberculosis bacilli.

Miwa (1973a and 1973b) has reported on an investigation by Purex Corporation entitled "A different approach to the treatment of acne vulgaris" (Purex Corporation, Ltd., 1965). Application of jojoba oil as a therapeutic agent to the skin of affected areas may reduce excessive excretions from the sebaceous glands.

Patents

Since the discovery that jojoba oil is a liquid wax (Greene and Foster, 1933), several patents have been issued by the United States Patent Office to cover inventions of its use. These are listed here by author for convenience.

1. Ellis (1936) - Factis and process of making same
2. Flaxman (1940) - Sulphurized lubricating oils
3. Hinds (1949) - Penicillin product
4. Miwa and Wolff (1965) - Wax ester substitute for jojoba oil from the seed of Limnanthes douglasii
5. Taussky (1944) - Composition of matter and preparation and process of producing the same
6. Taussky (1946) - Processes of refining, purifying, and hydrogenating fats, fatty acids, and waxes
7. Wells (1948) - Processes of making sulfurized jojoba oil
8. Whitner (1940) - Factice-containing printing ink

Extraction

Most jojoba seeds contain between 45 and 55% liquid wax, which must be extracted from the seeds before utilization. Numerous authors have stated that cotton seed oil presses or other commercially available presses could be used once a market for jojoba is developed. But only a few studies of preparation and extraction conditions are available. Spadaro and Lambou (1973) have presented data on the results of three types of extraction, namely:

mechanical, solvent, and filtration. Spadaro, Eaves, and Gastrock (1960) described the material preparation and extraction conditions required for the efficient recovery of oil from jojoba seed by the filtration-extraction process. Knoepfler et al. (1959) have studied the effects of six different solvents on the yield and properties of the liquid wax from jojoba seeds, and the subsequent effect of each solvent upon the characteristics of the hydrogenated wax. Carbon tetrachloride, benzene, heptane and hexane extracted essentially the same amount of material from the seed, while isopropyl alcohol extracted more and tetra chloroethylene less.

Jojoba Meal

The by-product of jojoba seed oil extraction known as jojoba meal is high in protein. Numerous authors have suggested that it has potential as a feed for livestock (Wells, 1955; Martinez, 1959b). Wells (1955) notes that when mixed with dry nonfat milk solids it gave good results as a pollen substitute for bees. He also noted satisfactory results with limited feeding trials on white rats. But Booth (1973) found that both the oil and meal in the diets of rats resulted in excessive weight loss. Jojoba oil has been shown to have an extremely low digestibility in laboratory rats (Savage, 1951). A monoglucoside named simmondsin has recently been isolated from jojoba seed (Elliger et al., 1973). It has been shown to inhibit feeding in rats, although the acute oral toxicity was very low.

PRODUCTION OF SEEDS

Jojoba frequently is found in dense stands where seed can be harvested from the female plants when they are mature. Difficulties encountered in harvesting native shrubs include the loss of seeds due to dropping before harvest, loss due to dropping as a result of movement while seeds are being harvested, uncertainty of yield from year to year, high cost of hand labor etc. (Mirov,1950, 1952; Gentry, 1958). Numerous experimental plantations have been started throughout the natural range of jojoba as well as in Israel and Argentina. Cultivation could reduce or overcome many of the problems encountered in the harvest of native populations, but a variety of factors have thwarted the establishment of producing commercial-size plantations to date.

Native Populations

For hundreds of years at least, man in the Southwest has relied upon the native jojoba seed crop for his harvest needs, whether he be an Apache Medicine Man, chemist researching the nature of jojoba seed oil, or researcher working on the establishment of new uses of jojoba wax. In spite of whatever limitations are involved in harvesting the native plants, for now and certainly during the next decade, they will be the only major source of jojoba seed from which significant quantities of seed can be harvested (Haase, 1973; Haase and McGinnies, 1973a).

Crosswhite (1973) has reviewed the role of the Boyce Thompson Southwestern Arboretum in the development of interest in jojoba seed oil. Over many years the Arboretum was responsible for sending tons of jojoba seed from Superior, Arizona, to researchers across the United States and around the world (Gentry, 1973). These harvests were accomplished with the help of many local residents picking seeds from plants among the large native populations of jojoba shrubs that are abundant in the environs of the Arboretum.

In 1972, the Indian Division of the Office of Economic Opportunity initiated renewed interest in development of a jojoba industry to improve the economic conditions on Indian reservations in Arizona and southern California. This resulted in the first International Conference on Jojoba, held in Tucson, Arizona, in June 1972, to document the state of knowledge of jojoba and appraise the future potential for utilization (Haase and McGinnies, 1973b).

More than 87,000 pounds of jojoba seed were harvested by Indians in Arizona and California in the summer of 1972 to provide a large stockpile for

the testing of jojoba seed oil and hydrogenated wax. Members of the San Carlos Apache Tribe harvested more than 75,000 pounds of seed in Arizona alone (Jojoba Happenings, 1972, 1973).

Several authors have noted that native populations of jojoba shrubs might be manipulated in such a way as to increase their yield and facilitate harvest. Cluff (1973) has discussed the possibilities of using runoff farming techniques to increase the yield of jojoba plants in natural areas and under cultivation. It has often been suggested that harvesting procedures could be improved if the lower branches of the shrubs were trimmed, allowing recovery of seed from the ground. This is presently being implemented on an experimental basis by Yermanos (1973), who has also reported on a claw picker he developed as an aid to the harvest of seeds from wild jojoba plants. The costs of harvesting wild populations have been provided from several harvests (Gentry, 1958; Jojoba Happenings, 1972; Crosswhite, 1973; Yermanos, 1973).

Cultivated Plantations

Large-scale cultivation of jojoba could provide an alternative source of jojoba seed. High-yielding varieties could be coupled with optimum irrigation and fertilization treatments to maximize seed production. The development of equipment for efficient machine harvesting would also reduce the high costs associated with hand harvesting. But there are several problems to be solved before successful commercial-scale jojoba plantations can be established. A major drawback is the length of time, up to ten years, before such plantations reach significant production levels. This, together with the lack of a developed market for jojoba seed, has thwarted efforts in the past at establishing plantations of larger than experimental scale. Mirov (1952, 1973), Gentry (1958), and Daugherty et al. (1953) have reviewed information on a number of experimental jojoba plantations.

Even before it was discovered that the seeds of jojoba contained a unique liquid wax, jojoba was being planted around the world. It was in botanical gardens in Europe (Mauri, 1845; Gentil, 1907), and the French Government had plans for establishing jojoba in its colonies in North Africa (Diguet, 1895; Davy, 1903; Wickson, 1903). During the 1920's plants were cultivated at the Boyce Thompson Southwestern Arboretum in Superior, Arizona (Crosswhite, 1973). Evidently, plantings were also attempted in Argentina (Saunders, 1930 ; Mirov, 1952).

After the discovery of the unique nature of jojoba seed oil in 1933, interest grew rapidly in the cultivation of jojoba on plantations. More

plantings were established at the Boyce Thompson Southwestern Arboretum and plantings were also started at the University of Arizona (Arizona Agricultural Experiment Station, 1940, 1941, 1943, 1944, 1948). The most interesting venture into cultivated jojoba in Arizona occurred in Florence. Durkee's Famous Foods, a subsidiary of Glidden Company, began the establishment of a proposed 640-acre plantation of jojoba in 1946. Hardly were the plants growing, when the company reversed its decision and plowed up the recent planting, except for a 20-acre experimental plot (Anonymous, 1943d and 1943e; Anonymous, 1946b and 1946c; Johnson, 1957; Anonymous, 1960; Mirov, 1973).

Interest in jojoba as a cultivate in California also developed early. Seeds were distributed around the state by the California Experiment Station in the early 1900's (Wickson, 1903; Mirov, 1973). Jojoba was also grown at the Rancho Santa Ana Botanical Garden (Everett, 1957). Four of the most important plantings in California were at the Huntington Botanical Garden, the Arlington Plantation, the irrigated Eddy planting near Riverside, and the dry-farmed Coit planting near Vista, California (Mirov, 1952, 1973; Gentry, 1958). From these plantings a great deal of information has been collected over the years regarding the responses of jojoba to cultivation. The records kept at Vista have proven particularly useful (Coit, 1959, 1962; Anonymous, 1960; Yermanos and Holmes, 1973). It was at this site that the first high-yield variety of jojoba was established and named "Vista".

During the 1940's there were numerous attempts to develop interest in the cultivation of jojoba in the arid areas of south Texas (Lundell, 1945; Neiswanger, 1947; Anonymous, 1948; Benavides, 1950), and south of the U.S. border an experimental plantation was established in the Sierra de la Candelaria, Chihuahua, Mexico (Martinez, 1959b). Little is known of the fate of these ventures.

Probably the best results from attempts at establishing plantations beyond the borders of jojoba's range are to be found in the Old World. In Israel, jojoba has found an enthusiastic welcome (Gentry, 1972; Forti, 1973). Experimentation there on the horticultural properties of jojoba has been extensive, including selection for improved genetic material (Forti, 1973). Gindel (1957) has discussed the success of plant introductions and the possibilities of adaptation to new environments.

Plantation Management

Establishment of jojoba as a cultivated crop involves many problems and unknowns. Some of these have been reviewed in the literature (Mirov,

1952, 1973; Daugherty et al., 1953; Gentry, 1958; Jones, 1973; Thompson, 1973). Gentry (1973) notes three requirements that any wild plant must have before it can become a successful cultivate: It must 1) yield a product in relative abundance, 2) be responsive to the artificial environments of man, and 3) have a genetic endowment that will support intensive selection of varieties. Mirov (1973) has noted the qualities for the establishment of a successful plantation. Areas of concern include seedling germination and establishment, soil, irrigation, pollination, spacing, productivity, selection, harvesting, disease and pests, and generally all the concerns of managing a crop in order to maximize yield and reduce costs. Most of our information on the anticipated problems in cultivation come from the few experimental plantings studied over the years and from observation and experiments on wild populations.

Jojoba's drought resistant properties and its preference for rocky well drained soils have led to the suggestion that it could become a valuable crop in marginal lands (Neiswanger, 1947; Baird, 1948; Benavides, 1950; Cluff, 1973). Also, lands that had previously been irrigated, but have lost their former agricultural potential due to drops in water tables or increases in salinity, are possible areas for jojoba cultivation.

The most successful seed germination requires darkness, warm temperatures, and high moisture availability over considerable periods of time, approximately 20 days, before seedlings break above ground (Burden, 1970). Germination success under proper conditions is usually very high (U.S. Forest Service, 1948). Seedlings that are first established in potted situations and are then transplanted to the field have not always proved successful, probably as a result of root growth patterns of jojoba, since a deep-growing radicle with few side roots develops at an early age (Gentry, 1958). The Arizona Agricultural Experiment Station (1941) reports that transplanting success can be increased by root pruning. Cold tolerance of young plants is another important factor in establishment of jojoba plantations. As with most plants, seedlings will incur serious frost damage at higher temperatures than adult plants (Wickson, 1903; Maisari, 1966; Yermanos et al., 1968).

Since jojoba is a dioecious plant, the sex of plantings is important. Since no way as yet is known to establish the sex of a plant until it flowers, methods must be established for controlling the sex ratio of plants in a plantation. One method is the planting of several seeds at each plant site, with the later elimination of the excess male plants to a level compatible with their roles as pollinators.

The only way of establishing plants of known sex is by vegetative propagation. This method also allows for the establishment of clones of genetically selected plants of superior quality. For these reasons, much interest has been generated on the possibilities of vegetative reproduction in jojoba. However, the importance of genetically superior pollen producers in enhancing aspects of seed production has not apparently received attention. Maisari (1966) has studied factors affecting the rooting and transplanting of jojoba that has been established vegetatively. Wieland, Frolich, and Wallace (1971) have experimented with vegetative propagation in jojoba and other woody desert shrubs. Thompson (1973) reports that vegetative reproduction occurs readily from softwood stem cuttings. This may change the rooting habits of the plant from one of taproot predominance to one with a lateral spreading habit, development that could prove advantageous in irrigated plantations. If not, the rooting habit might be modified by root pruning if necessary.

The design, spacing, and management of a plantation are very important to its eventual success. Problems such as the spacing of individuals, the placing of males in the population, irrigation practices, and pruning can all affect the productivity of the operation (Gentry, 1958). These practices must also take into account the methods of harvesting that might be employed since the cost of manual labor to harvest jojoba seed is presently one of the major factors thwarting its development (Gentry, 1958; Yermanos, 1973).

It has been widely suggested in the literature that the productivity of jojoba plants may be greatly increased under cultivation if the plants are irrigated. McGinnies and Arnold (1939) have investigated the water requirements of Arizona range plants, including jojoba. Cluff (1973) has proposed a method of runoff farming for increasing jojoba yield. However, Gentry (1958, 1972, 1973) notes that several plantings have suffered heavily from overwatering. Much work still remains to be done on the effects of irrigation on cultivated jojoba plantations. In many arid regions of the world crop production is limited by the salinity of either irrigation water or the soil. Forti (1973) has experimented with the use of saline water for irrigation of jojoba. Yermanos, Francois, and Tammadoni (1967) have investigated the effects of soil salinity on the development of jojoba. Phenological changes can be expected to occur in plants under irrigation. These have been noted (Coit, 1962; Yermanos et al., 1968; Yermanos and Holmes, 1973) and studied in detail by Forti (1973).

Jojoba's genetic diversity allows the possibility of genetic selection, either through seeds or vegetatively. Numerous authors have expressed the importance of this aspect of developing the economic potential of jojoba as a

cultivated plant (Gentry, 1958, 1965; Coit, 1962; Boyce Thompson Southwestern Arboretum, 1972; Forti, 1973; Haase, 1973; Jones, 1973; Thompson, 1973). The "Vista" variety has been established from plants grown by Coit (1959, 1962) in California. Plants of this variety have been used by Yermanos and co-workers in several studies (Yermanos et al., 1967; Yermanos et al., 1968; Yermanos and Holmes, 1973). Forti (1973) has carried out hybridization experiments in Israel and has selected for varieties of high yield and a growth habit suitable to manual or mechanical harvesting.

One of the major problems of developing a jojoba industry based on the harvest of wild plants is the great fluctuation in yield year to year. With cultivated plantations and carefully planned irrigation, the productivity of jojoba plants could be increased and stablized. Numerous authors have commented on seed yields from jojoba plants from various areas under differing conditions (Sanchez, 1944; Coit, 1959; Anonymous, 1960; Yermanos et al., 1968; Mirov, 1973). Gentry (1958) and Daugherty et al. (1953) have discussed the yield characteristics of jojoba in detail, and Forti (1973) notes the yield responses to various irrigation schedules. Perhaps the most complete data on yield over a long period of time is that from the Coit plantation in Vista, California (Coit, 1959; Yermanos and Holmes, 1973).

Jojoba appears to be relatively free of disease and insect pests (Gentry, 1958). One moth, a microlepidopteron, appears to be the only serious pest, with larvae chewing out the young ovules (Baird, 1948; Daugherty et al., 1953; Gentry, 1958). This pest seems to be confined to areas of over 2,500 ft elevation. One fungus is known to occur on the leaves, calyxes, and peduncles of jojoba (Bonar, 1942).

CURRENT RESEARCH ACTIVITIES

In a project which began in 1972, the Office of Native American Programs in the U.S. Department of Health, Education and Welfare now supports Indian Jojoba Research and Development Programs through the Office of Arid Lands Studies (OALS) at the Universtiy of Arizona, Tucson, and the Department of Plant Sciences at the University of California, Riverside. The Indian Jojoba Programs in Arizona and California have greatly intensified jojoba research and development activities. Out of the 1972 International Jojoba Conference in Tucson came the publication of the proceedings, Jojoba and Its Uses, and the establishment of an International Committee on Jojoba Research and Development. The OALS, in cooperation with the Committee, publishes a quarterly newsletter, Jojoba Happenings, to maintain a flow of current information. It contains news and data emmanating from the Indian Jojoba Programs in Arizona and California, and reports on the activities of jojoba researchers in the United States and other countries. A library of jojoba publications has been established at the OALS, and annotated abstracts of documents have been incorporated into a computerized information retrieval system. With the renewed interest in jojoba, the National Academy of Sciences established a Jojoba Utilization Committee to study the feasibility of developing commercial products from jojoba and recommend priorities for large-scale testing.

In addition to acting as a clearinghouse for information on jojoba activity, the OALS arranges for processing and distribution of jojoba seed, liquid wax, hydrogenated wax, and meal for testing their potential usefulness in marketable products. OALS is also conducting an economic feasibility study and environmental impact study of an Indian jojoba industry. The economic feasibility study includes short-term, high-cost, low-volume markets and long-term, low-cost, high-volume markets. The environmental impact study evaluates both utilization of the wild harvest and plantation development. In a continuing project, the OALS is investigating ecological relationships, yield variability, and possibilities for increasing harvest efficiency on experimental areas on Arizona Indian reservations. This includes a wealth of data from an annual experimental harvest of about 50 acres of jojoba. The OALS is evaluating alternative legal vehicles by which the Indians might develop jojoba as a commercial enterprise. The Apache Marketing Cooperative Association has now been incorporated on the San Carlos Indian Reservation, and the OALS is helping develop an Indian jojoba industry based on a wild harvest, the sale of jojoba seed and oil, as well as the production and marketing of Indian-made jojoba products such as candles.

The Department of Plant Sciences at the University of California, Riverside, is establishing 20 acres of jojoba plantation on Indian lands in California, including clearing, surveying, leaching, and planting. Wild jojoba plants growing on other lands in California are being pruned to induce a tree-like growth habit and to clear areas beneath plants to facilitate harvesting from the ground. Research is also being conducted on jojoba development relating to culture, propagation, pruning, grafting, weed control, yield, quality and quantity of oil in seed, protein and carbohydrates in meal, and genetic and ecotypic variability. The University of California, Riverside, also maintains a 5-acre experimental jojoba plantation which will serve as a laboratory for the development of technical back-up information and a training ground for further plantation development and manipulation of wild plants.

During the summer of 1972, jojoba seed was harvested by Indians in Arizona and California. Of the total harvest of about 87,000 pounds, 75,000 pounds (about 36,000 pounds dried and thrashed) was collected by the San Carlos Apache Indians in Arizona. The harvest and other contacts with tribal leaders, in Arizona and California, have demonstrated an interest among the Indians in the development of jojoba industries on their reservations. In addition, it has provided relatively large quantities of jojoba seed, oil, hydrogenated wax, and meal for distribution by OALS to researchers and companies interested in testing their potential usefulness in marketable products.

Active research on jojoba is continuing at the U.S. Department of Agriculture Regional Research Laboratories. At the Northern Regional Laboratory in Peoria, Illinois, T.K. Miwa, who is also Chairman of the International Committee on Jojoba Research and Development, is involved in several projects relating to the chemistry of jojoba. The Western Regional Laboratory in Albany, California, has provided facilities and supervision for the processing of jojoba seed by Indians. Active researchers at that Laboratory include Carl A. Elliger, Anthony C. Waiss, and Robert E. Lundin, working with various aspects of the chemistry of jojoba meal and its potential as an animal feed.

Research on the floral anatomy of jojoba is being conducted by Rudolf Schmid, Department of Botany, University of California, Berkeley, and a doctoral research problem on the vegetative anatomy of jojoba has been started by A. Daniel Simper, Department of Botany, University of California, Davis.

At the University of Arizona, in Tucson, a wide variety of research investigations on jojoba development are underway in addition to the Indian

Jojoba Project at the Office of Arid Lands Studies. Most of the research involves personnel and departments in the College of Agriculture where a considerable amount of jojoba research has taken place in the past. In the Department of Horticulture and Landscape Architecture, A.E. Thompson and LeMoyne Hogan are evaluating asexual propagation techniques. Hogan has had success propagating stem tip cuttings with viability varying with the source plant and the time of year. A small experimental planting of jojoba seedlings and cuttings has been established. B.L. Reid, Department of Poultry Science, has been investigating the use of jojoba meal in the diets of poultry, and C.W. Weber, of the same department, is investigating the potential of jojoba meal as a feed. In the Department of Dairy and Food Sciences, W.J. Stull is investigating nutrition and food applications for jojoba oil, and R.L. Caldwell and S.M. Alcorn, of the Department of Plant Pathology, are researching the possibilities that toxic products associated with jojoba seed are fungal in origin. It appears that the resources of the College of Agriculture will be utilized to an even greater degree for future jojoba research, particularly in the area of successful plantation development. Interest in jojoba research and development continues at the Boyce Thompson Southwestern Arboretum of the University of Arizona. F.S. Crosswhite has established new experimental jojoba plantings. Seed is being collected from a wide variety of sources for the development of a germ plasm nursery.

Considerable research on jojoba plantation development and product application is continuing at the Ben Gurion University of the Negev in Israel. In Mexico, several different organizations are investigating various aspects of jojoba development. Jojoba research is also underway in several other countries including Japan, Australia, West Germany, Iraq, Iran, and Denmark.

Several companies which have received jojoba oil for testing and evaluation from OALS or the University of California, Riverside, have forwarded favorable reports for potential use in a wide variety of products. More detailed information and data on current research activities on jojoba are contained in the Jojoba Happenings newsletters. These newsletters are available, without charge, from the Office of Arid Lands Studies, University of Arizona.

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1

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1951

ILLUSTRATED FLORA OF THE PACIFIC STATES, WASHINGTON, OREGON, AND CALIFORNIA. VOL. III: GERANIACEAE TO SCROPHULARIACEAE, GERANIUMS TO FIGWORTS.

STANFORD UNIVERSITY PRESS, STANFORD, CALIFORNIA, 866 P.

A SHORT DESCRIPTION OF THE GENUS SIMMONDSIA AND ITS ONE SPECIES S. CHINENSIS, FAMILY BUXACEAE (P. 45).

OALS/SIMMONDSIA CHINENSIS/BUXACEAE/CALIFORNIA

2

ANI, H.A., AL- ET AL

1972

THE PHYSIOLOGICAL ECOLOGY OF DIVERSE POPULATIONS OF THE DESERT SHRUB SIMMONDSIA CHINENSIS.

JOURNAL OF ECOLOGY 60:41-57.

THE PRIMARY OBJECTIVES OF THIS STUDY WERE TO GAIN AN UNDERSTANDING OF THE MECHANISMS BY WHICH A BROAD-LEAVED EVERGREEN CAN PERSIST IN SEVERE DESERT ENVIRONMENTS. TO PROVIDE AN EVOLUTIONARY DIMENSION, COMPARISONS WERE MADE BETWEEN POPULATIONS EXISTING IN HABITATS REPRESENTING DIFFERENT DEGREES OF ARIDITY AND TEMPERATURE EXTREMES, BOTH COASTAL (SAN DIEGO) AND DESERT HABITATS (MORONGO CANYON, TWENTYNINE PALMS, TUCSON). THE SEASONAL PHYSIOLOGICAL MEASUREMENTS RECORDED INCLUDED LEAF WATER POTENTIAL, NET PHOTOSYNTHESIS, DARK RESPIRATION, AND CARBOHYDRATE CONTENT. POSITIVE NET PHOTOSYNTHESIS WAS MAINTAINED THROUGH THE DAY EVEN UNDER LOW LEAF WATER POTENTIALS DURING EXTENSIVE DROUGHT PERIODS. DURING HIGH DROUGHT PERIODS PLANTS GREATLY REDUCED RESPIRATION RATES. BY MAINTAINING CARBON GAIN DURING THE DROUGHT PERIOD AND BY REDUCING CARBON LOSS, THESE PLANTS MAINTAIN A FAVORABLE CARBOHYDRATE BALANCE. ANOTHER REMARKABLE FEATURE OF THEIR PHOTOSYNTHETIC APPARATUS IS THEIR ABILITY TO MAINTAIN ACTIVE PHOTOSYNTHESIS EVEN UNDER EXTREMELY HIGH SUMMER TEMPERATURES OF 40-47 DEGREES CENTIGRADE. ECOTYPIC DIFFERENTIATION BASED ON PHOTOSYNTHETIC CAPACITY IN RELATION TO DROUGHT WAS ESTABLISHED BY BOTH FIELD AND LABORATORY TESTS.

OALS/SHRUBS/XEROPHYTES/SIMMONDSIA CHINENSIS/PHYSIOLOGICAL ECOLOGY / PLANT PHYSIOLOGY /STRESS(PHYSIOLOGY)/DROUGHT TOLERANCE/ADAPTATION/ PLANT POPULATIONS/CARBOHYDRATES/MOISTURE STRESS/PHOTOSYNTHESIS/ RESPIRATION/PLANT ECOLOGY/ECOTYPES/ARIZONA/CALIFORNIA/SONORAN DESERT/ MOJAVE DESERT/THERMAL STRESS/SEASONAL/SYNECOLOGY/EVOLUTION

3

ANONYMOUS

1936 A

FIND JOJOBA SHRUB YIELDS OIL MUCH LIKE SPERM OIL OF WHALE.

U.S. DEPARTMENT OF AGRICULTURE, OFFICE OF INFORMATION, INFORMATION FOR THE PRESS, PRESS SERVICE (809-837), P. 3.

DESCRIBES THE PLANT, DISCOVERY OF ITS UNIQUE LIQUID WAX, AND THE CHEMISTRY OF THIS WAX WHICH DIFFERENTIATES IT FROM OTHER PLANT OILS.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/SPERM WHALE OIL

4

ANONYMOUS

1936 B

JOJOBA SHRUB YIELDS OIL LIKE SPERM OIL.

CHEMICAL AND METALLURGICAL ENGINEERING 43(12):676.

NOTE ANNOUNCING THE DISCOVERY THAT JOJOBA OIL IS REALLY A LIQUID WAX SIMILAR TO SPERM WHALE OIL.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/SPERM WHALE OIL

5

ANONYMOUS

1936 C

JOJOBA SHRUB YIELDS OIL LIKE THAT OF SPERM WHALE.

OIL, PAINT, AND DRUG REPORTER 130:5, 26. NOVEMBER 30.

A BRIEF OUTLINE OF THE NATURAL HISTORY OF THE JOJOBA IS FOLLOWED BY A REVIEW OF THE PROCEDURES AND FINDINGS OF JAMIESON AND MCKINNEY ON THE CHEMICAL NATURE OF JOJOBA OIL.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/ORGANIC COMPOUNDS/SPERM WHALE OIL

6

ANONYMOUS

1937

SHRUB RIVALS WHALE IN PRODUCING PRIZED OIL.

SCIENCE NEWS LETTER 31(823):39.

VERY BRIEF ANNCUNCEMENT THAT THE OIL OF JOJOBA HAS BEEN DISCOVERED TO BE A LIQUID WAX SIMILAR TO SPERM WHALE OIL.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/SPERM WHALE OIL

7

ANONYMOUS

1942

THE COMPOUNDER S CORNER, JOJOBA OIL.

DRUG AND COSMETIC INDUSTRY 51(5):579, 581.

BRIEFLY DESCRIBES THE JOJOBA PLANT, ITS LIQUID WAX AND ITS POTENTIAL USES. PREDICTS THAT JOJOBA WILL BECOME AN IMPORTANT COMMERCIAL PRODUCT BECAUSE OF THE UNIQUE PROPERTIES OF THE LIQUID WAX OBTAINED FROM THE SEEDS. THIS WAX IS VERY STABLE AT HIGH TEMPERATURES.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/PLANT USES

8

ANONYMOUS

1943 A

DESERT NUTS YIELD MAGIC WAX-VAST NEW INDUSTRIES FORESEEN.

ARIZONA FARMER 22(13):1, 3/DESERT PLANT LIFE 15(9):133-137.

BRIEFLY OUTLINES THE HISTORY OF DISCOVERIES OF THE UTILIZATION OF JOJOBA OIL, THEN TRACES THE EFFORTS OF T.H. SIMPSON, OF DURKEE S FAMOUS FOODS, TO ESTABLISH JOJOBA AS A CULTIVATED CROP. PROJECTS A VERY FAVORABLE OUTLOOK FOR THE FUTURE OF JOJOBA CULTIVATION.

OALS/SIMMONDSIA CHINENSIS/CROP PRODUCTION/CULTIVATION/PLANT USES/ LIQUID WAX/LIPIDS/ARIZONA

9

ANONYMOUS

1943 B

DESERT PLANT YIELDS PLASTICS.

CENTRAL MANUFACTURING DISTRICT MAGAZINE, SEPTEMBER, P. 25.

A JOJOBA PLANTATION WAS RECENTLY PLANTED AT SUPERIOR, ARIZONA. THE WAX HAS MANY REMARKABLE PROPERTIES WHICH ALLOW ITS USE IN PLASTICS AND SEMI-SOLIDS WHICH CAN BE APPLIED TO THOUSANDS OF PURPOSES. THE BUSH IS IMPORTANT BROWSE FOR CATTLE. JOJOBA COULD BECOME THE BASE FOR AUTOMOBILE OR FLOOR FINISHES MORE DURABLE THAN ANYTHING KNOWN.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/PLANT USES/ARIZONA/CULTIVATION

10

ANONYMOUS

1943 C

JOJOBA BUSH, SOURCE OF WAX YIELDS DOLLARS FOR MEXICO.

FOREIGN COMMERCE WEEKLY 12(7):26.

BRIEF REPORT OF POSSIBILITIES OF JOJOBA EXPORTATION TO THE U.S., PRICE 200 DOLLARS/TON OF SEED.

OALS/SIMMONDSIA CHINENSIS/MEXICO

11

ANONYMOUS

1943 D

NUT YIELDS WAX.

BUSINESS WEEK (721):60.

BRIEF ANNOUNCEMENT THAT GLIDDEN CO. WILL CULTIVATE 640 ACRES OF JOJOBA IN FLORENCE, ARIZONA, UNDER IRRIGATION. THE VALUE OF JOJOBA NUTS IS SET AT 200 DOLLARS/TON. ALSO MENTIONS AN ADHESIVE PRODUCT, MYCRENE, BEING DEVELOPED FROM TURPENTINE.

OALS/SIMMONDSIA CHINENSIS/CULTIVATION/ARIZONA

12

ANONYMOUS

1943 E

RUBBER-LIKE MATERIAL FROM JOJOBA NUT REPORTED BY GLIDDEN.

RUBBER AGE 53:344.

A SHORT NOTE ON THE ESTABLISHMENT OF A JOJOBA PLANTATION AT FLORENCE, ARIZONA, WITH BRIEF COMMENTS ON USE OF THE LIQUID WAX OF THE SEEDS.

OALS/SIMMONDSIA CHINENSIS/ARIZONA/CULTIVATION/CROP PRODUCTION/LIQUID WAX

13

ANONYMOUS

1946 A

CALIFORNIA NOTES.

AMERICAN NURSERYMAN, AUGUST 15, 1946, P. 34-35.

IN ONE BRIEF PARAGRAPH NOTES THAT JOJOBA, A NOVELTY HORTICULTURAL PLANT, IS BEING DEVELOPED INTO A COMMERCIAL CROP.

OALS/SIMMONDSIA CHINENSIS/CALIFORNIA/ORNAMENTAL PLANTS

14

ANONYMOUS

1946 B

JOJOBA NUT FARM EXPANDING TO 640 ACRES NEAR MAGMA.

ARIZONA FARMER 25(12):19.

REPORTS ON RECENT EXPANSION OF JOJOBA PLANTATION AND PROBLEMS ENCOUNTERED IN ESTABLISHING PLANTS. EARLY PROBLEMS RESULTED FROM RODENT DAMAGE. A COTTON PLANTER WAS UTILIZED TO SPACE SEEDS 12 INCHES APART ONE INCH DEEP, IT TAKES THREE IRRIGATIONS AND 30 DAYS TO BRING MOST OF THE SEEDLINGS UP.

OALS/SIMMONDSIA CHINENSIS/ARIZONA/CULTIVATION/PLANTING MANAGEMENT/ IRRIGATION PRACTICES/RODENTS

15

ANONYMOUS

1946 C

DURKEE CO. DROPS JOJOBA PROGRAM.

ARIZONA FARMER 25(25):21.

DURKEE S FAMOUS FOODS RECENTLY SOLD AND PLOWED UP A SEVERAL HUNDRED ACRE PLANTATION OF JOJOBA THAT WAS PLANTED THE PREVIOUS SPRING. OFFICIALS FELT THAT IT WOULD TAKE TOO LONG TO GET JOJOBA ESTABLISHED AS A COMMERICAL CROP. TWENTY ACRES OF JOJOBA WERE RETAINED BY DURKEE PRESIDENT N. BEATTY.

OALS/SIMMONDSIA CHINENSIS/CULTIVATION/ARIZONA

16

ANONYMOUS

1948

JOJOBA: COMMERCIAL POSSIBILITIES MAY BE IN STORE FOR THIS OIL-BEARING SHRUB THAT GROWS IN SEMI-ARID REGIONS.

CHEMURGIC DIGEST 7(11):13.

DR. C.I. LUNDELL, IN HIS SEARCH FOR NEW PLANTS WHICH MIGHT PROVE OF ECONOMIC VALUE TO TEXAS, FOUND THE NATIVE JOJOBA. SEEDS FROM MEXICO WERE DISTRIBUTED TO THE COUNTY AGRICULTURAL AGENTS OF 31 SOUTH TEXAS COUNTIES WHO IN TURN PLACED THEM WITH FARMERS FOR TEST PLANTING. MARGINAL LAND CAN BE USED, EVEN IN LOW RAINFALL REGIONS NEAR LAREDO AND DEL RIO. UTILIZATION OF JOJOBA SEED OIL IS POSSIBLE IN THE PAINT AND VARNISH INDUSTRIES.

OALS/SIMMONDSIA CHINENSIS/TEXAS/CULTIVATION

17

ANONYMOUS

1950

COMPETITION FOR THE BEE.

SCIENCE NEWS LETTER 58(4):50.

BRIEFLY DISCUSSES THE WAX PRODUCING POTENTIAL OF THE BARK OF THE DOUGLAS FIR TREE AND THE SEEDS OF JOJOBA.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/PLANT SUBSTANCES/LIPIDS/ PSEUDOTSUGA MENZIESII/BEES

18

ANONYMOUS

1951

NON MELTING WAXES (TITLES VARY).

CHEMICAL AND ENGINEERING NEWS 29(15):1438/CHEMICAL ENGINEERING 58(5):206/BUSINESS WEEK (1126):61.

NOTES ANNOUNCING THAT THE FLEXROCK CO. HAS DEVELOPED A SERIES OF WAXES WHICH THEY SAY IF HEATED TO THE COMBUSTION POINT WILL NOT MELT. JOJOBA IS NOT MENTIONED.

OALS/LIPIDS/LIQUID WAX

19

ANONYMOUS

1956

FINDING NEW CROPS, SAVING OLD STOCKS.

AGRICULTURAL RESEARCH 5(3):6.

A PARAGRAPH ON THE POSSIBILITIES OF USING JOJOBA LIQUID WAX IN PLACE OF SEVERAL IMPORTED WAXES.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX

20

ANONYMOUS

1957

THOUGHTS ON NEW CROPS.

ARIZONA FARMER-RANCHMAN 36(20):4.

BRIEFLY POINTS OUT SEVERAL EXOTIC CROPS THAT WOULD GROW WELL IN ARIZONA IF THE ECONOMIC CLIMATE WERE MORE FAVORABLE: JOJOBA, GUAR SEED, SAFFLOWER, SESAME, AND CANAIGRE.

OALS/ARIZONA/SIMMONDSIA CHINENSIS/INTRODUCED SPECIES/CULTIVATION

21

ANONYMOUS

1960

DESERT NUT STILL HAS CHANCE TO BE COMMERCIAL CROP.

ARIZONA FARMER-RANCHMAN 39(2):32.

REPORTS ON A SMALL PLANTATION (12 PLANTS) OF JOJOBA IN VISTA, CALIFORNIA. FIVE-YEAR-OLD PLANTS PRODUCED NUTS WITHOUT IRRIGATION, BUT PRODUCTIVITY VARIED GREATLY FROM PLANT TO PLANT. A PLANTATION IN MAGMA, ARIZONA WAS ABANDONED AFTER THREE YEARS. RATS AND OTHER RODENTS DESTROYED THE SEEDLINGS.

OALS/CALIFORNIA/ARIZONA/SIMMONDSIA CHINENSIS/CULTIVATION/PLANTING MANAGEMENT/RODENTS/PRODUCTIVITY

22

ANONYMOUS

1962

JOJOBA NUT STILL SHOWING PROMISE AS ARIZONA CROP.

ARIZONA FARMER-RANCHMAN 41(3):9.

BRIEFLY DESCRIBES RECENT ATTEMPTS AT CULTIVATION, PARTICULARLY THE COIT PLANTATION IN VISTA, CALIFORNIA.

OALS/SIMMONDSIA CHINENSIS/CULTIVATION/CALIFORNIA

23

ANONYMOUS

1972

IT S A SPERM WHALE, IT S SUPERBEAN.

SMITHSONIAN 3(1):54-55.

IN 1970 THE SPERM WHALE WAS PLACED ON THE U.S. LIST OF ENDANGERED SPECIES, WITH THE RESULTANT CESSATION OF THE IMPORTATION OF CRITICALLY IMPORTANT SPERM WHALE OIL. A SUBSTITUTE IS BEING SOUGHT IN A SEED OF THE DESERT PLANT JOJOBA OF THE SOUTHWEST. THE LIQUID WAX OF THIS PLANT IS CHEMICALLY VERY SIMILAR TO SPERM OIL, AND IT HAS MANY POTENTIAL USES. THE OFFICE OF ECONOMIC OPPORTUNITY RECENTLY MADE A GRANT OF 100,000 DOLLARS TO GET JOJOBA DEVELOPMENT UNDERWAY. SINCE IT GROWS ON SEVERAL INDIAN RESERVATIONS, IT IS HOPED THAT DEVELOPMENT OF THIS NEW RESOURCE CAN BE ACCOMPLISHED IN A FASHION THAT WILL DIRECTLY BENEFIT THE ECONOMIC DEVELOPMENT OF THE RESERVATIONS.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/ECONOMIC DEVELOPMENT/INDIANS OF NORTH AMERICA/SOUTHWEST U.S./SOCIAL ASPECTS/MAMMALS /CONSERVATION/ SPERM WHALE OIL/NATIVE AMERICANS

24

ANONYMOUS

1973

IN THE DESERT...GOOD FOR SPERM WHALES AND FOR GARDENERS.

SUNSET 151(6):194.

A POPULAR ARTICLE DESCRIBING JOJOBA, THE POSSIBILITY OF REPLACING SPERM WHALE OIL WITH JOJOBA OIL, AND USE OF JOJOBA AS AN ORNAMENTAL IN LANDSCAPING.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/PLANT USES/ORNAMENTAL PLANTS/ SPERM WHALE OIL

25

ARIZONA AGRICULTURAL EXPERIMENT STATION

1933

ANNUAL REPORT, 44TH.

SAME AS AUTHOR. UNIVERSITY OF ARIZONA, TUCSON. 133 P.

NOTES (P. 62) THAT SHORT INVESTIGATIONS ON THE WAX AND SEEDS OF JOJOBA WERE MADE DURING THE YEAR.

OALS/SIMMONDSIA CHINENSIS/ARIZONA

26

ARIZONA AGRICULTURAL EXPERIMENT STATION

1940

ANNUAL REPORT, 51ST.

SAME AS AUTHOR. UNIVERSITY OF ARIZONA, TUCSON. 112 P.

NOTES (P. 56) THAT JOJOBA SURVIVAL IS POOR FOR SEEDLING TRANSPLANTS. DEVELOPMENT FROM SEEDS IS GOOD; ROOT CUTTING PROPAGATION IS STILL BEING INVESTIGATED.

OALS/ARIZONA/SIMMONDSIA CHINENSIS/SEEDLINGS/PLANTING MANAGEMENT/ GERMINATION/ROOTS

27

ARIZONA AGRICULTURAL EXPERIMENT STATION

1941

ANNUAL REPORT, 52ND.

SAME AS AUTHOR. UNIVERSITY OF ARIZONA, TUCSON. 99 P.

LIMITED TRANSPLANTING TESTS WITH JOJOBA SEEDLINGS INDICATE THAT THEY SURVIVE TRANSPLANTING READILY IF THE ROOTS ARE PRUNED. (P. 48).

OALS/ARIZONA/SIMMONDSIA CHINENSIS/SEEDLINGS/ROOTS/PLANTING MANAGEMENT

28

ARIZONA AGRICULTURAL EXPERIMENT STATION

1943

ANNUAL REPORT, 54TH.

SAME AS AUTHOR. UNIVERSITY OF ARIZONA, TUCSON. 95 P.

BRIEFLY MENTIONS (P. 45-46) INVESTIGATIONS UNDERWAY ON JOJOBA, EARLY DETERMINATION OF THE SEX OF SEEDLING PLANTS, SEED GERMINATION, SEEDLING DEVELOPMENT, FLORAL DEVELOPMENT, AND SEED SETTING.

OALS/SIMMONDSIA CHINENSIS/NATURAL HISTORY/CULTIVATION/SEEDLINGS/ GERMINATION/PHENOLOGY/ARIZONA/PLANTING MANAGEMENT

29

ARIZONA AGRICULTURAL EXPERIMENT STATION

1944

ANNUAL REPORT, 55TH.

SAME AS AUTHOR. UNIVERSITY OF ARIZONA, TUCSON. 100 P.

A BRIEF REPORT (P. 45) ON THE PROGRESS OF 100 JOJOBA PLANTS ESTABLISHED IN 1939. AGE AT FLOWERING AND SEX RATIOS OF PLANTS ARE PRESENTED.

OALS/SIMMONDSIA CHINENSIS/ARIZONA/CULTIVATION/PHENOLOGY/FLOWERING

30

ARIZONA AGRICULTURAL EXPERIMENT STATION

1948

ANNUAL REPORT, 59TH.

SAME AS AUTHOR. UNIVERSITY OF ARIZONA, TUCSON. 50 P.

REPORTS (P. 27-29) ON 94 SEEDLINGS OF JOJOBA PLANTED IN 1940. MALE FLOWERS FIRST APPEARED AT FOUR YEARS, FEMALE FLOWERS AT FIVE YEARS OF AGE. MAJOR PROBLEMS WITH CULTIVATION ARE THE LONG PERIOD BEFORE PRODUCTION BEGINS AND THE HIGH NUMBER OF NON-PRODUCTIVE MALE PLANTS.

OALS/ARIZONA/SIMMONDSIA CHINENSIS/CULTIVATION/FLOWERS/PHENOLOGY/FLOWERING

31

ASCHMANN, H.

1959

THE CENTRAL DESERT OF BAJA CALIFORNIA: DEMOGRAPHY AND ECOLOGY.

IBERO-AMERICANA 42. 282 P.

BRIEF MENTION OF JOJOBA ON PAGE 90.

OALS/BAJA CALIFORNIA/SIMMONDSIA CHINENSIS

32

ASCHMANN, H. ED.

1966

THE NATURAL AND HUMAN HISTORY OF BAJA CALIFORNIA: FROM MANUSCRIPTS BY JESUIT MISSIONARIES.

DAWSON S BOOK SHOP, LOS ANGELES. 101 P.

IN REFERENCE TO JOJOBA (P. 53): IT GROWS IN GREATEST ABUNDANCE IN THE AREA THAT DRAINS TOWARD THE PACIFIC. IT YIELDS MOST PROLIFICALLY IN THOSE YEARS IN WHICH THERE ARE WINTER RAINS, AND WHEN RAINFALL IS SCARCE OR ABSENT IT YIELDS VERY LITTLE. THE SIZE AND SHAPE OF THE SEED RESEMBLE THE HAZELNUT; IT IS VERY OILY AND SLIGHTLY BITTER. ON THE BASIS OF EXPERIMENTS THESE SEEDS HAVE BEEN FOUND TO BE MEDICINAL. TWO OR THREE JOJOBA SEEDS TAKEN IN THE MORNING ARE SAID TO BE GOOD FOR THE STOMACH; GROUND AND MIXED WITH CHOCOLATE THEY FACILITATE PARTURITION FOR WOMEN: TOASTED AND GROUND THEY ARE SPECIFIC AGAINST SORES THAT ERUPT ON THE FACE. THE UNGUENT OIL STOPS CHILLS, AND IF EATEN IN SOME QUANTITY GRADUALLY ELIMINATES THEM.

OALS/SIMMONDSIA CHINENSIS/BAJA CALIFORNIA/FOODS/MEDICINAL PLANTS/PLANT USES/NATURAL HISTORY/PHENOLOGY/SEASONAL/SEED PRODUCTION

33

BAILLON, H.

1880

THE NATURAL HISTORY OF PLANTS. VOL. 6.

L. REEVE AND CO., LONDON. 524 P.

THE MONOTYPIC GENUS IS GIVEN A BRIEF BOTANICAL DESCRIPTION (P. 50).

OALS/SIMMONDSIA CHINENSIS/PLANT MORPHOLOGY/SIMMONDSIA

34

BAIRD, R.O.

1948

JOJOBA-POTENTIAL DESERT CROP.

RECLAMATION ERA, JULY, P. 121-122.

THE HISTORY OF THE DISCOVERY OF THE USEFULNESS OF THE LIQUID WAX IN THE SEEDS IS RECOUNTED. MANY IMPROVED PRODUCTS ARE POSSIBLE BY UTILIZATION OF THE OIL, BUT SOURCES ARE PRESENTLY LIMITED. THE AUTHOR SUGGESTS USING MARGINAL LANDS FOR CULTIVATION OF LOW WATER REQUIRING JOJOBA PLANT. HE CALCULATES THAT THE RETURN ON INVESTMENT WOULD JUSTIFY THE VENTURE.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/CULTIVATION/LIPIDS/PLANT USES/ COST-BENIFIT ANALYSIS

35

BAKER, H.G.

1965

PLANTS AND CIVILIZATION.

WADSWORTH PUBLISHING CO., BELMONT, CALIFORNIA, FUNDAMENTALS OF BOTANY SERIES. 183 P.

ON PAGES 173-175, SIMMONDSIA CHINENSIS IS DISCUSSED, AND ITS CONSIDERABLE ECONOMIC POTENTIAL IS REVIEWED. THE UNIQUENESS OF THE LIQUID WAX OF THE SEEDS PROVIDES MANY POSSIBILITIES FOR INDUSTRIAL UTILIZATION.

OALS/SIMMONDSIA CHINENSIS/PLANT USES/LIQUID WAX/LIPIDS/MEDICINAL PLANTS

36

BALLS, E.K.

1962

EARLY USES OF CALIFORNIA PLANTS.

UNIVERSITY OF CALIFORNIA PRESS, BERKELEY AND LOS ANGELES. 103 P. (CALIFORNIA NATURAL HISTORY GUIDES, 10).

MENTIONS THAT JOJOBA SEEDS WERE EATEN BY INDIANS, CHILDREN, SHEEP, AND GOATS. A DRINK WAS MADE BY GRINDING AND BOILING THE SEEDS IN COAHUILA, MEXICO. ANOTHER RICH CONCOCTION WAS MADE BY GRINDING ROASTED NUTS TOGETHER WITH THE YOLK OF A HARD-BOILED EGG, WITH THE PASTY MASS THEN BOILED WITH WATER, MILK, AND SUGAR. TO IMPROVE THE FLAVOR, A VANILLA BEAN WAS ADDED, MAKING A DRINK SOMETHING LIKE THICK CHOCOLATE. ALSO MENTIONS BRIEFLY USES OF OIL AND MEAL, AND THE UTILIZATION OF SEEDS BY SUCH WILDLIFE AS JAYS, CROWS, PIGEONS, AND RODENTS (P. 33-34, 89).

OALS/SIMMONDSIA CHINENSIS/CALIFORNIA/FOODS/SEEDS/MEXICO/FOOD HABITS/ LIQUID WAX/WILDLIFE/RODENTS/NATIVE AMERICANS/ETHNOBOTANY/JOJOBA MEAL/ INDIANS OF NORTH AMERICA

37

BARROWS, D.P.

1967

THE ETHNO-BOTANY OF THE COAHUILLA INDIANS OF SOUTHERN CALIFORNIA.

MALKI MUSEUM PRESS, MORONGO RESERVATION, BANNING, CALIFORNIA. 82 P.

SIMMONDSIA CALIFORNICA IS KNOWN AS COFFEE BERRY, AS IT SPLITS IN HALF IN SUCH A WAY AS TO RESEMBLE A COFFEE BERRY. THE COAHUILLA NAME FOR THE PLANT IS KOW-A-NUK-AL. THE NUTS ARE GROUND AND BOILED TO MAKE A BEVERAGE.

OALS/SIMMONDSIA CHINENSIS/PLANT USES/FOODS/ETHNOBOTANY/INDIANS OF NORTH AMERICA/CALIFORNIA/NATIVE AMERICANS

38

BENAVIDES, G.A.

1950

LA JOJOBA.

SOCIEDAD BOTANICA DE MEXICO, BOLETIN 10:26-32.

THE HISTORY OF THE PLANTS DISCOVERY AND THE DETERMINATION OF THE CHEMICAL COMPOSITION OF THE LIQUID WAX IN THE SEEDS ARE TRACED. ITS DISTRIBUTION, HABITAT AND PHYTO-ASSOCIATIONS IN MEXICO ARE OUTLINED. THE ECONOMIC POTENTIAL OF THE WAX IS CONSIDERED TO BE LARGE ENOUGH TO WARRANT INVESTIGATION. THE FORAGE VALUE OF THE PLANT IS GREAT IN MEXICO. CULTIVATION PROJECTS ARE REVIEWED; THE AUTHOR RECOMMENDS PROPAGATION BY SEEDS IN SITU. PLANTATIONS MIGHT BE POSSIBLE IN AREAS OF MEXICO WHERE SOILS ARE TOO POOR FOR OTHER CROPS, SUCH AS TEHUACAN IN THE STATE OF PUEBLA.

OALS/SIMMONDSIA CHINENSIS /FORAGE PLANTS/SEEDS/LIQUID WAX/MEXICO/ SONORAN DESERT/CROP PRODUCTION/PLANT ECOLOGY/ORGANIC COMPOUNDS/ CULTIVATION/SYNECOLOGY

39

BENDER, C.L.

1963

NATIVE ANIMALS AND PLANTS AS RESOURCES. IN C. HODGE AND P.C. DUISBERG, EDS., ARIDITY AND MAN, 309-338.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, PUBLICATION 74. 584 P.

ADAPTATIONS BY ANIMALS (DESERT RAT, SQUIRRELS, BIRDS AND INVERTEBRATES) AND PLANTS TO THE DRY HOT CONDITIONS OF THE SOUTHWEST U.S. ARE REVIEWED. THE SAGUARO CACTUS HAS BEEN WIDELY UTILIZED FOR ITS FRUIT AND THE TUBERS OF THE CANAIGRE PLANT HAVE BEEN USED FOR THE EXTRACTION OF TANNIN. POSSIBLE NEW USES OF PLANTS, SUCH AS JOJOBA, AND THE INTRODUCTION OF EXOTICS, PROMISE CHANGE IN THE FUTURE AGRICULTURE OF THE REGION. ANIMALS AS BIG GAME RESOURCES HAVE BEEN SUBJECTED TO MUCH STUDY AND ARE AN IMPORTANT RESOURCE.

OALS/DESERT PLANTS/DESERT ANIMALS/ADAPTATION/CARNEGIEA GIGANTEA/PLANT USES/AGAVE/SIMMONDSIA CHINENSIS/INTRODUCED SPECIES/WILDLIFE MANAGEMENT /OVIS CANADENSIS/PECARI TAJACU/CENTROCERCUS UROPHASIANUS/PLANT SUBSTANCES

40

BENSON, L.D./DARROW, R.A.

1954

THE TREES AND SHRUBS OF THE SOUTHWESTERN DESERTS. 2ND ED.

UNIVERSITY OF ARIZONA PRESS, TUCSON, AND UNIVERSITY OF NEW MEXICO PRESS, ALBUQUERQUE. 437 P.

THE AUTHORS PROVIDE A BRIEF DESCRIPTION OF JOJOBA, ITS DISTRIBUTION AND USES (P. 247-248).

OALS/SOUTHWEST U.S./TREES/SHRUBS/DESERT PLANTS/XEROPHYTES/SIMMONDSIA CHINENSIS/PLANT DISTRIBUTION

41

BENTHAM, G./HOOKER, J.D.

1880 - 1883

GENERA PLANTARUM. 3, PARS I.

L. REEVE AND CO., LONDINI.

SIMMONDSIA IS BOTANICALLY DESCRIBED, P. 265, IN THE TRIBE BUXEAE, FAMILY EUPHORBIACEAE.

OALS/SIMMONDSIA CHINENSIS/SYSTEMATICS/SIMMONDSIA/BUXACEAE

42

BOHRER, V.L.

1957

NATURE AND INTERPRETATION OF ETHNOBOTANICAL MATERIALS FROM TONTO NATIONAL MONUMENT. IN L.R. CAYWOOD, ED., ARCHAEOLOGICAL STUDIES AT TONTO NATIONAL MONUMENT, ARIZONA, P. 75-114.

SOUTHWESTERN MONUMENTS ASSOCIATION, TECHNICAL SERIES 2. 176 P.

REPORTS ON THE EXTENSIVE ETHNOBOTANICAL MATERIAL RECOVERED DURING ARCHAEOLOGICAL EXCAVATIONS OF THIS LOWER SONORAN LIFE-ZONE SITE. MATERIALS AND USES ARE DISCUSSED UNDER THE FOLLOWING TOPICS: STRUCTURAL MATERIALS, HOUSEHOLD ITEMS, WEAPONS, RELIGIOUS ITEMS, MEDICINAL PLANTS, LEAF TIES, CORDAGE, TEXTILES, SANDALS, BASKETRY AND MATTING, WILD FOOD PLANTS, CULTIVATED CROPS, AND AGRICULTURAL WEEDS. HUSKS AND SEEDS OF JOJOBA WERE FOUND IN THE RUINS. WOODRATS MAY HAVE BROUGHT THE SEEDS INTO THE RUIN OR THEY COULD HAVE BEEN USED AS FOOD BY THE ORIGINAL INHABITANTS. THEY MIGHT HAVE BEEN EATEN EITHER RAW, OR PARCHED AND GROUND TO THE CONSISTENCY OF PEANUT BUTTER. THE OILY NUTS ARE KNOWN TO HAVE BEEN EATEN BY THE PIMA, PAPAGO, AND YAVAPAI INDIANS.

OALS/SIMMONDSIA CHINENSIS/NATIONAL PARKS/ARCHAEOLOGY/ETHNOBOTANY/ PLANT USES/DESERT PLANTS/FOODS/ARIZONA/TONTO NATIONAL MONUMENT/INDIANS OF NORTH AMERICA/NATIVE AMERICANS

43

BONAR, L.

1942

STUDIES ON SOME CALIFORNIA FUNGI II.

MYCOLOGIA 34:180-192.

PRESENTS DESCRIPTIONS OF NEW SPECIES AND NOTES ON KNOWN SPECIES WORTHY OF NOTICE. ONE NEW SPECIES, STRUMELLA SIMMONDSIAE, HAS BEEN DISCOVERED ON THE LIVING LEAVES, CALYXES AND PEDUNCLES OF JOJOBA (P. 190).

OALS/CALIFORNIA/SIMMONDSIA CHINENSIS/FUNGI/PLANT PATHOLOGY

44

BOOTH, A.N.

1973

JOJOBA OIL AND MEAL SUBACUTE TOXICITY STUDY WITH RATS. IN E.F. HAASE AND W.G. MCGINNIES, EDS., JOJOBA AND ITS USES; AN INTERNATIONAL CONFERENCE, JUNE 1972, P. 73-74.

UNIVERSITY OF ARIZONA, OFFICE OF ARID LANDS STUDIES, TUCSON. 81 P.

ALTHOUGH MANY OIL SEED MEALS ARE SOLD AS PROTEIN FEED SUPPLEMENTS, MANY HAVE POSED PROBLEMS OF TOXICITY; CASES ARE REVIEWED. IN SPITE OF FREQUENT REFERENCE IN THE LITERATURE TO THE FACT THAT JOJOBA MEAL COULD BE USED AS A LIVESTOCK FEED, EXPERIMENTS ON RATS INDICATE THAT THE MEAL IS TOXIC TO SOME ANIMALS. RATS DIED ON DIETS OF 30 PERCENT AND 15 PERCENT MEAL, PROBABLY DUE TO STARVATION. ON DIETS OF 10 PERCENT OR LESS MEAL, RATS SURVIVED, BUT GROWTH WAS INHIBITED. HEATING OF THE MEAL APPEARED TO DECREASE THE GROWTH-INHIBITING EFFECT. AUTOPSY REVEALED 1) SEVERE TESTICULAR ATROPHY WITH CESSATION OF SPERMATOGENESIS, 2) LARGE CYTOPLASMIC VACUOLES IN THE ACINAR CELLS OF THE PANCREAS, AND 3) FATTY INFILTRATION OF THE LIVER. JOJOBA MEAL COULD BE TOXIC TO SWINE AND POULTRY, BUT IT IS POSSIBLE THAT MEAL MIGHT BE DETOXIFIED IN THE RUMEN OF SHEEP AND CATTLE. THE FEEDING OF JOJOBA OIL (10 PERCENT) TO RATS ALSO RESULTED IN POOR GROWTH. DIGESTIBILITY OF THE OIL BY RATS WAS LESS THAN 20 PERCENT. MASSIVE EDEMA OF THE TESTES ALSO RESULTED.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/SEEDS/TOXICITY/DIETS/NUTRIENTS/PROTEINS/REPRODUCTION/RODENTS/INJURY, POISONING, AND IMMUNOLOGY/DIGESTION/JOJOBA MEAL

45

BOYCE THOMPSON SOUTHWESTERN ARBORETUM, SUPERIOR, ARIZONA

1972

ANNUAL REPORT, 1972, TO BOARD OF DIRECTORS.

SAME AS AUTHOR. 11 P.

IN THE REPORT OF THE CURATOR OF BOTANY JOJOBA ACTIVITIES AT THE ARBORETUM ARE DISCUSSED (P. 8-11). THE ACTIVITIES OF THE ARBORETUM OVER THE LAST 45 YEARS WERE REVIEWED IN A PAPER, STUDIES OF SIMMONDSIA CHINENSIS AT THE BOYCE THOMPSON SOUTHWESTERN ARBORETUM, PRESENTED AT THE INTERNATIONAL CONFERENCE ON JOJOBA AT THE UNIVERSITY OF ARIZONA. PLANS FOR THE ESTABLISHMENT OF A GENE-BANK ARE OUTLINED. IT IS SUGGESTED THAT SUCH A PLANTATION OF JOJOBA COULD BE COMBINED WITH THE GROWING OF NATIVE PLANTS IN RECEPTACLES BETWEEN ROWS OF JOJOBA ON INDIAN RESERVATIONS. THESE COULD BE SOLD AS ORNAMENTALS, THUS INCREASING THE INCOME OF AMERICAN INDIANS. LOCATING THESE PLANTATIONS ON SOUTH-FACING SLOPES WOULD PROVIDE INCREASED SOLAR RADIATION IN WINTER.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/ECONOMIC DEVELOPMENT/PLANTING MANAGEMENT/BOYCE THOMPSON SOUTHWESTERN ARBORETUM/PLANT BREEDING/GENETICS/INDIANS OF NORTH AMERICA/ORNAMENTAL PLANTS/SLOPE EXPOSURE/NATIVE AMERICANS/VARIABILITY(GENETIC)/CULTIVATION

46

BURDEN, J.D.

1970

ECOLOGY OF SIMMONDSIA CHINENSIS (LINK) SCHNEID. AT ITS LOWER ELEVATIONAL LIMITS.

ARIZONA STATE UNIVERSITY, TEMPE, (M.S. THESIS). 71 P.

THE PHYTOSOCIOLOGICAL RELATIONSHIPS OF S. CHINENSIS WERE DETERMINED AT 25 SITES. A SIMPLE CORRELATION MATRIX ANALYSIS INDICATED THAT THE DENSITY OF S. CHINENSIS WAS POSITIVELY CORRELATED WITH THE DENSITIES OF CERCIDIUM MICROPHYLLUM AND ERIOGONUM FASCICULATUM, ALSO WITH ASPECT AND SLOPE ANGLE. A LINEAR MULTIPLE REGRESSION ANALYSIS SHOWED THAT 45 PERCENT OF THE DENSITY VARIABILITY WAS ACCOUNTED FOR BY TOPOGRAPHIC AND EDAPHIC FACTORS. MICROENVIRONMENTAL INVESTIGATIONS AT THREE STATIONS (TOP, MID, AND BASE) INDICATE: 1) SUMMER TEMPERATURES DIFFER ONLY SLIGHTLY, 2) WINTER TEMPERATURES ARE 2.5 DEGREES COOLER AT TOP THAN AT BASE STATION, 3) MAXIMUM WATER STRESS IS IN EARLY SUMMER, 4) THE TOP STATION HAD A LONGER PERIOD OF MOISTURE AVAILABILITY THAN THE BASE STATION, AND 5) WINTER RAINS ARE MORE EFFICIENT AT RECHARGING SOIL MOISTURE THAN ARE SUMMER RAINS. OPTIMAL CONDITIONS FOR SEED GERMINATION WERE DARKNESS, CONSTANT MOISTURE SUPPLY, AND TEMPERATURES OF 26 TO 30 DEGREES CENTIGRADE.

OALS/ARIZONA/SIMMONDSIA CHINENSIS/SONORAN DESERT/PLANT ECOLOGY/ NATURAL HISTORY/MICROENVIRONMENT/PLANT COMMUNITIES/SYNECOLOGY / VEGETATION ESTABLISHMENT/SHRUBS/DESERT PLANTS/XEROPHYTES/LIMITING FACTORS /GERMINATION/VIABILITY/LIGHT/TEMPERATURE/SOIL MOISTURE/DENSITY /ASPECT/SLOPE EXPOSURE/PRECIPITATION(ATMOSPHERIC) /WINTER PRECIPITATION/SEASONAL

47

BURGESS, R.L.

1966

UTILIZATION OF DESERT PLANTS BY NATIVE PEOPLES: AN OVERVIEW OF SOUTHWESTERN NORTH AMERICA. IN J.L. GARDNER, ED., NATIVE PLANTS AND ANIMALS AS RESOURCES IN ARID LANDS OF THE SOUTHWESTERN UNITED STATES.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, SOUTHWESTERN AND ROCKY MOUNTAIN DIVISION, COMMITTEE ON DESERT AND ARID ZONES RESEARCH, CONTRIBUTION 8:6-21.

AN EXCELLENT REVIEW OF THE LITERATURE ON THE SUBJECT. THE REASONS FOR THE RELATIVELY GREAT AMOUNT OF ETHNOBOTANICAL KNOWLEDGE OF THE SOUTHWESTERN DESERTS ARE MANY: 1) IT WAS THE LAST STRONGHOLD OF THE UNSUBJUGATED AMERICAN INDIAN, 2) A DIVERSITY OF ETHNIC GROUPS LED TO A VARIETY OF CULTURAL PATTERN DEVELOPMENTS, 3) THE FLORISTIC DIVERSITY IS GREAT, 4) A DIVERSITY OF LIFE-FORMS OF PLANTS HAS PLAYED A SUBSTANTIAL PART IN INCREASING SPECIES UTILIZATION, AND 5) LOW DENSITIES OF BOTH PEOPLE AND PLANTS IMPOSED AT LEAST A SEMINOMADIC CULTURAL PATTERN ON MANY INHABITANTS WHICH ALLOWED REGENERATION. FOOD USES ARE DISCUSSED UNDER FIVE CATAGORIES: 1) FRUITS AND THEIR VARIOUS DERIVATIVES, 2) ROOTS, RHIZOMES, BULBS, CORMS, AND TUBERS HIGH IN STARCH CONTENT, 3) MESCAL, 4) PINOLE AND DRIED SEEDS, AND 5) GREENS

AND FLAVORING POT HERBS OF VARIOUS KINDS. OTHER USES TO WHICH NATIVE PLANTS WERE PUT ARE: DRINK PLANTS, FIBER PLANTS, BUILDING MATERIALS, AND MISCELLANEOUS USES. THE USE OF JOJOBA SEEDS AS A FOOD IS NOTED. ALSO, IT AND THE BERRIES OF MISTLETOE WERE USED AS COFFEE SUBSTITUTES. GOOD BIBLIOGRAPHY.

OALS/SIMMONDSIA CHINENSIS/FOODS/PLANT USES/MEXICO/SOUTHWEST U.S./ INDIANS OF NORTH AMERICA/SEEDS/NATIVE AMERICANS/ETHNOBOTANY/ BIBLIOGRAPHIES

48

CASTETTER, E.F.

1935

ETHNOBIOLOGICAL STUDIES IN THE AMERICAN SOUTHWEST. 1: UNCULTIVATED NATIVE PLANTS USED AS SOURCES OF FOOD.

UNIVERSITY OF NEW MEXICO BULLETIN (WHOLE NUMBER 266), BIOLOGICAL SERIES 4(1). 62 P.

BRIEF MENTION (P. 50) THAT PIMA INDIANS ATE JOJOBA NUTS, QUININE PLANT OR COFFEE BERRY, EITHER RAW OR PARCHED.

OALS/SIMMONDSIA CHINENSIS/INDIANS OF NORTH AMERICA/SEEDS/FOODS/PLANT USES/ETHNOBOTANY/NATIVE AMERICANS

49

CASTETTER, E.F./UNDERHILL, R.M.

1935

ETHNOBIOLOGICAL STUDIES IN THE AMERICAN SOUTHWEST. II: THE ETHNOBIOLOGY OF THE PAPAGO INDIANS.

UNIVERSITY OF NEW MEXICO BULLETIN, BIOLOGICAL SERIES 4(3):1-84.

JOJOBA IS MENTIONED (P. 18-19) AS A FOOD SOURCE. IT IS SAID THAT THE PARCHED PULVERIZED NUTS WERE APPLIED TO SORES (P. 65).

OALS/SIMMONDSIA CHINENSIS/MEDICINAL PLANTS/FOODS/ETHNOBOTANY/INDIANS OF NORTH AMERICA/NATIVE AMERICANS

50

CESATI, V.

1873

NOTE BOTANICHE DI VERIO ARGOMENTO: ILLUSTRAZIONE DELLA BROCCHIA DICHOTOMA DEL MAURI, ORA SIMMONDISIA [SIC] CALIFORNICA, NUTTALL (BOTANIC NOTES ON VARIOUS TOPICS: ILLUSTRATION OF BROCCHIA DICHOTOMA OF MAURI, NOW CALLED SIMMONDSIA CALIFORNICA, NUTTALL).

ACCADEMIA DELLE SCIENZE FISICHE E MATEMATICHE, (NAPOLI) ATTI 5(21):1-9.

THE AUTHOR REVIEWS THE USE OF THE NAME BROCCHIA DICHOTOMA, NOTING THAT TENORE USED MAURI S DESCRIPTION BASED ON A SINGLE PLANT AFTER THE LATTER S DEATH. AFTER CONSIDERABLE EFFORT TRYING TO GET THE ONE FEMALE PLANT IN THE BOTANICAL GARDEN TO REPRODUCE, THE AUTHOR DISCOVERED THAT MUELLER HAD CLASSIFIED BROCCHIA UNDER SIMMONDSIA CALIFORNICA. THE AUTHOR FELT THAT SIMMONDSIA DID NOT BELONG TO ANY EXISTENT GROUP. A CHRONOLOGICAL SERIES OF DESCRIPTIONS MADE BY VARIOUS AUTHORS (LINK, NUTTALL, TENORE, WALPERS, ROLLI, LE MAOUT AND DECAESNE, AND MUELLER) IS PRESENTED WITH ANNOTATIONS. THE PLANT AND ITS FLOWERS ARE ILLUSTRATED.

OALS/SIMMONDSIA CHINENSIS/SYSTEMATICS/FLOWERS

51

CLARK, E.D.

1953

A STUDY OF THE BEHAVIOR AND MOVEMENTS OF THE TUCSON MOUNTAIN MULE DEER.

UNIVERSITY OF ARIZONA (M.S. THESIS). 111 P.

PRESENTS DATA ON FORAGE UTILIZATION COMPILED FROM SIGHT RECORDS ON FEEDING DEER. JOJOBA WAS THE PLANT MOST FREQUENTLY OBSERVED TO BE UTILIZED BY DEER THE YEAR AROUND. PERCENTAGES OF INDEPENDENT FEEDING OBSERVATIONS NOTED FOR JOJOBA WERE: JANUARY 1-APRIL 30, 27 PERCENT; MAY 1-AUGUST 31, 34 PERCENT; SEPTEMBER 1-DECEMBER 31, 46 PERCENT. JOJOBA, BECAUSE OF ITS EVERGREEN CHARACTERISTICS, ITS ABUNDANCE, AND ITS YEAR-ROUND USE, WAS CONSIDERED TO BE THE KEY FORAGE SPECIES.

OALS/SIMMONDSIA CHINENSIS/ODOCOILEUS HEMIONUS/FOOD HABITS/FORAGE PLANTS/TUCSON MOUNTAINS/ARIZONA/BROWSE/WILDLIFE

52

CLAVIJERO, F.J.

1789

STORIA DELLA CALIFORNIA, OPERA POSTUMA DEL NOB. SIG. ABATE.

M. FENZO, VENEZIA (VENICE).

THE FIRST RECORDED OBSERVATIONS ON JOJOBA. SEE ALSO TRANSLATION 1937.

OALS/BAJA CALIFORNIA/SIMMONDSIA CHINENSIS/MEDICINAL PLANTS/FOODS/ ETHNOBOTANY

53

CLAVIJERO, F.J.

1852

HISTORIA DE LA ANTIGUA O BAJA CALIFORNIA (THE HISTORY OF LOWER CALIFORNIA).

IMPRENTA DE JUAN R. NAVARRO, MEXICO. 252 P.

A SPANISH TRANSLATION OF CLAVIJERO (1789), WITH A MENTION OF JOJOBA ON P. 8. SEE ALSO ENGLISH TRANSLATION (CLAVIJERO, 1937).

OALS/BAJA CALIFORNIA/SIMMONDSIA CHINENSIS/MEDICINAL PLANTS/FOODS/ ETHNOBOTANY

54

CLAVIJERO, F.J.

1937

THE HISTORY OF [LOWER] CALIFORNIA. TRANSLATED FROM THE ITALIAN (1789) AND EDITED BY SARA E. LAKE AND A.A. GRAY.

STANFORD UNIVERSITY PRESS, CALIFORNIA. 413 P.

PAGE 40-41: THE JOJOBA IS ONE OF THE MOST VALUABLE BERRIES OF CALIFORNIA. THE PLANT WHICH PRODUCES IT IS A SHRUB WHICH GROWS ON THE DRY SLOPES OF THE MOUNTAINS. ITS LEAVES ARE OBLONG, NOTCHED, AND SMOOTH; THEY ARE THE SIZE OF ROSE LEAVES, AND A GREEN COLOR THAT SHADES TO GRAY. THE SEED IS AN OBLONG BERRY, THE SIZE OF THE KERNEL OF A HAZEL NUT, RED-BROWN OUTSIDE, WHITE INSIDE, AND OF AN OILY BUT NOT DISAGREEABLE TASTE. THIS BERRY HAS BECOME CELEBRATED FOR ITS MEDICINAL VALUE, ESPECIALLY FOR CURING THE SUPPRESSION OF THE URINE ARISING FROM MUCOUS CONCRETIONS, FOR FACILITATING CHILD BIRTH, AND FOR WOUNDS. THE OIL WHICH IS DERIVED FROM IT IS AN EXCELLENT REMEDY FOR CANCER; AND ON THE OTHER HAND, AS IT HAS A GOOD FLAVOR, SOME IN CALIFORNIA ARE ACCUSTOMED TO USE IT IN SALADS INSTEAD OF OLIVES. THIS PLANT DOES NOT BEAR EVERY YEAR BUT ONLY WHEN AT LEAST ONE HEAVY SHOWER HAS FALLEN DURING THE WINTER.

OALS/BAJA CALIFORNIA/SIMMONDSIA CHINENSIS/MEDICINAL PLANTS/FOODS/ ETHNOBOTANY/PHENOLOGY

55

CLUFF, C.B.

1973

RUNOFF FARMING FOR INCREASED JOJOBA YIELDS. IN E.F HAASE AND W.G. MCGINNIES, EDS., JOJOBA AND ITS USES: AN INTERNATIONAL CONFERENCE, JUNE 1972, P. 39-45.

UNIVERSITY OF ARIZONA, OFFICE OF ARID LANDS STUDIES, TUCSON. 81 P.

OBSERVATIONS OF JOJOBA GROWTH IN AREAS OF HIGH NATURAL RUNOFF INDICATE THAT RUNOFF FARMING TECHNIQUES ARE POSSIBLY OF USE IN INCREASING PRODUCTIVITY IN NATIVE STANDS AND IN ESTABLISHING CULTIVATED PLANTATIONS. A BRIEF HISTORY OF RUNOFF FARMING ON THE NEGEV DESERT AND OTHER AREAS IS FOLLOWED BY A DISCUSSION OF RUNOFF FARMING TECHNIQUES PRESENTLY UNDER INVESTIGATION AT THE UNIVERSITY OF ARIZONA. THE MICROCATCHMENT SYSTEM IS MOST EASILY APPLICABLE TO EXISTING JOJOBA PLANTS. THE SHAPED RUNOFF FARMING TECHNIQUE WOULD REQUIRE A PLANTATION OF NEW PLANTS. THE JOJOBA IS IDEAL FOR THESE TECHNIQUES BECAUSE IT IS DROUGHT RESISTENT. IT IS SUGGESTED THAT JOJOBA COULD BE GROWN IN FIELDS NOW BEING ABANDONED BECAUSE DROPS IN GROUNDWATER LEVELS HAVE ELIMINATED PUMP-IRRIGATED AGRICULTURE.

OALS/SIMMONDSIA CHINENSIS/IRRIGATION PRACTICES/NEGEV /RAINFALL-RUNOFF RELATIONSHIPS/RUNOFF FARMING/CATCHMENTS/WATER SPREADING/SURFACE WATER RUNOFF/SOIL-WATER-PLANT RELATIONSHIPS/ARIZONA/ISRAEL

56

COIT, J.E.

1959

PROGRESS REPORT ON JOJOBA INVESTIGATIONS.

RITTENHOUSE DEMONSTRATION ORCHARD, VISTA, CALIFORNIA, NOVEMBER, 1959. (UNPUBLISHED).

DESCRIBES THE ORIGINAL PLANTING OF 14 PLANTS IN 1953, AND THE DEVELOPMENT OF THIS EXPERIMENTAL JOJOBA PLANTATION AT VISTA. DATA ON SEED HARVEST IN 1957, 1958, AND 1959 ARE PRESENTED. ESTABLISHMENT OF PLANTS OF THE VISTA VARIETY, AND OTHERS ARE NOTED. PROBLEMS TO BE OVERCOME BY THOSE WISHING TO ESTABLISH JOJOBA AS AN ECONOMICALLY FEASIBLE CULTIVATE ARE OUTLINED.

OALS/SIMMONDSIA CHINENSIS/CALIFORNIA/CULTIVATION/SEED PRODUCTION/ PLANTING MANAGEMENT/PLANT BREEDING/VARIABILITY(GENETIC)/GENETICS

57

COIT, J.E.

1962

HORTICULTURAL ASPECTS OF JOJOBA.

FRUIT VARIETIES AND HORTICULTURAL DIGEST 16:32-34.

REPORTS ON THE CULTIVATION PRACTICES AND RESULTS OF A SMALL PLANTATION AT VISTA, CALIFORNIA. FOURTEEN SEEDLINGS WERE ESTABLISHED IN 1953. WEIGHTS OF HARVESTED SEED AFTER 6 YEARS OF NON-IRRIGATED GROWTH ARE GIVEN. ONE PLANT, OUTSTANDING IN PRECOSITY, YIELD, AND HABIT WAS UTILIZED TO PROPAGATE BY ROOT CUTTINGS A VARIETY TERMED VISTA. THESE SEEDLINGS WERE IRRIGATED WITH RESULTANT RAPID GROWTH AND FRUITING AT 18 MONTHS. IT APPEARS THAT SOME IRRIGATION WILL RESULT IN BETTER GROWTH AND EARLIER BEARING THAN IS USUAL WITH FERAL POPULATIONS. OTHER GENETIC STOCK IS BEING GROWN EXPERIMENTALLY.

OALS/SIMMONDSIA CHINENSIS/CALIFORNIA/CULTIVATION/IRRIGATION PRACTICES /SEEDLINGS/PHENOLOGY/PLANT GROWTH/SEED PRODUCTION/PLANTING MANAGEMENT/ /VARIABILITY(GENETIC)/PLANT BREEDING

58

COOK, A.A.

1971

THAR SHE GROWS.

U.S. DEPARTMENT OF AGRICULTURE, FARM INDEX 10:4-6.

THE ENDANGERED SPECIES CONSERVATION ACT OF 1969 WILL RESULT IN THE CESSATION OF IMPORTATION OF SPERM WHALE OIL INTO THE U.S. USDA PLANT SCIENTIST ARE CONSIDERING THREE CROPS AS POSSIBLE REPLACEMENT SOURCES OF THIS UNIQUE OIL. THE JOJOBA SEED OIL IS VERY CLOSE IN CHEMICAL NATURE TO SPERM WHALE OIL. BUT BECAUSE OF THE LENGTHY PERIOD NEEDED TO ESTABLISH PLANTATIONS AND THE ECONOMIC UNFEASIBILITY OF HARVESTING WILD PLANTS, LITTLE DEVELOPMENTAL RESEARCH IS PLANNED. LIMNANTHES (MEADOW FOAM) IS SUGGESTED BY USDA SCIENTISTS AS THE MOST PROMISING PINCH HITTER FOR SPERM OIL. ITS SEED OIL, A MIXTURE OF TRIGLYCERIDES, CAN BE CONVERTED CHEMICALLY TO WAX ESTERS COMPARABLE IN QUALITY TO THOSE OF JOJOBA. CRAMBE IS ANOTHER PROMISING NEW OILSEED CROP ON WHICH EXPERIMENTATION IS UNDER WAY.

OALS/SIMMONDSIA CHINENSIS/LIPIDS/LIQUID WAX/PLANT USES/SEEDS/ CONSERVATION/SPERM WHALE OIL

59

CROIZAT, L.

1952

MANUAL OF PHYTOGEOGRAPHY.

W. JUNK, THE HAGUE. 587 P. +106 FIGS.

THE FAMILY BUXACEAE (P. 269, 333-338) IS PLACED CLOSE TO THE HAMAMELIDACEAE. SIX GENERA OF BUXACEAE ARE RECOGNIZED: 1) SARCOCOCCA, 2) PACHYSANDRA, 3) BUXUS (INCLUDING TRICERAS), 4) NOTOBOXUS, 5) STYLOCERUS AND 6) SIMMONDSIA. THE PHYTOGEOGRAPHIC HISTORIES OF THE VARIOUS GENERA ARE RELATED TO THE SPREAD OF THE FAMILY AROUND THE WORLD; ROUTES OF MIGRATION ARE PROPOSED.

OALS/SIMMONDSIA CHINENSIS/SIMMONDSIA/PHYTOGEOGRAPHY/PLANT DISTRIBUTION/DISTRIBUTION PATTERNS/SYSTEMATICS/BUXACEAE

60

CROSSWHITE, F.S.

1973

STUDIES OF SIMMONDSIA CHINENSIS AT THE BOYCE THOMPSON SOUTHWESTERN ARBORETUM. IN E.F. HAASE AND W.G. MCGINNIES, EDS., JOJOBA AND ITS USES: AN INTERNATIONAL CONFERENCE, JUNE 1972, P. 5-10.

UNIVERSITY OF ARIZONA, OFFICE OF ARID LANDS STUDIES, TUCSON. 81 P.

THIS PAPER REVIEWS THE ACTIVITIES OF THE ARBORETUM WITH JOJOBA OVER THE LAST NEARLY 50 YEARS. CULTIVATION OF JOJOBA HAS BEEN IN PROGRESS THERE SINCE 1925; INFORMATION HAS BEEN ACCUMULATED ON GERMINATION, GROWTH (IRRIGATED AND NON-IRRIGATED), ROOT GROWTH, YIELD OF SEEDS, ETC. THE ARBORETUM HAS LONG BEEN ACTIVE IN PROVIDING RESEARCHERS WITH SEED FROM SUPERIOR, ARIZONA, FOR EXPERIMENTATION. ALSO, UNDER THE DIRECTION OF F. GIBSON, IT HAS BEEN ACTIVE AT PROMOTING COMMERCIAL INTERESTS IN JOJOBA.

BOYCE THOMPSON SOUTHWESTERN ARBORETUM/OALS/SIMMONDSIA CHINENSIS/ GERMINATION/CULTIVATION/SEEDLING MANAGEMENT/IRRIGATION PRACTICES/ LIQUID WAX/SEEDS/SEED PRODUCTION/ARIZONA/INDIANS OF NORTH AMERICA/ NATIVE AMERICANS/EROSION CONTROL

61

CRUSE, R.R.

1949

A CHEMURGIC SURVEY OF THE DESERT FLORA IN THE AMERICAN SOUTHWEST.

ECONOMIC BOTANY 3(2):111-131.

POSSIBLITIES OF UTILIZING XEROPHYTIC PLANTS OF THE REGION IN THE FOLLOWING WAYS ARE CONSIDERED: STOCK FEED, ALCOHOL, PAPER AND CELLULOSE, SUGARS AND STARCHES, RESINS AND GUMS, PHARMACEUTICAL PRODUCTS, OILS, AND MISCELLANEOUS EXTRACTIVES AND PRODUCTS. CURRENT RESEARCH ACTIVITES ARE DISCUSSED, INCLUDING THE DISCOVERY OF JOJOBA LIQUID WAX (P. 122).

OALS/YUCCA/SOUTHWEST U.S./LIPIDS/ALCOHOLS/XEROPHYTES/DESERT PLANTS/ PLANT USES/PLANT SUBSTANCES/MEDICINAL PLANTS/FORAGE PLANTS/AGAVE/ OPUNTIA/NOLINA/PROSOPIS JULIFLORA/LARREA/CACTACEAE /CUCURBITA/ SIMMONDSIA CHINENSIS

62

CRUSE, R.R.

1973

DESERT PLANT CHEMURGY: A CURRENT REVIEW.

ECONOMIC BOTANY 27:210-230.

REVIEWS RESEARCH AND DEVELOPMENT ACTIVITIES TAKING PLACE IN THE GENERAL FIELD OF DESERT PLANT CHEMURGY SINCE THE PREVIOUS SUMMARIES BY THE SAME AUTHOR (1952, 1953). MENTIONS A RECENT PRESS RELEASE INDICATING THAT RESEARCH IN THE U.S.S.R. HAS DETERMINED THAT JOJOBA OIL, UTILIZED AS A SALAD OR COOKING OIL, IS NON-FATTENING. 236 REFERENCES.

OALS/SIMMONDSIA CHINENSIS/PLANT USES/DESERT PLANTS/LIPIDS/LIQUID WAX/ /MEDICINAL PLANTS/FOODS/XEROPHYTES/BIBLIOGRAPHIES

63

DAUGHERTY, P.M./SINEATH, H.H./WASTLER, T.A.

1953

INDUSTRIAL RAW MATERIALS OF PLANT ORIGIN. IV: A SURVEY OF SIMMONDSIA CHINENSIS.

ECONOMIC BOTANY 12:296-306(1958)/GEORGIA INSTITUTE OF TECHNOLOGY, ENGINEERING EXPERIMENT STATION, BULLETIN 17:1-36.

THE HISTORY OF JOJOBA S DISCOVERY AND THE REALIZATION OF ITS USES ARE DISCUSSED. ADVANTAGES OF SIMMONDSIA OIL (LIQUID WAX) OVER SPERM WHALE OIL ARE LISTED. USES IN OTHER PRODUCTS INCLUDE LINOLEUM, PRINTING INK, PAINT, VARNISH, POLISHING WAXES, DIETETIC SALAD DRESSING, STABLIZATION OF PENICILLIN PRODUCTS, COSMETICS, FOOD PREPARATIONS, DETERGENTS AND LUBRICANTS. IT MAY HAVE MEDICAL APPLICATIONS IN INHIBITING GROWTH OF TUBERCLE BACILLI. IT S ECONOMIC POTENTIAL IS RELATED TO SPERM WHALE OIL AND CARNAUBA WAX. THE RESIDUAL MEAL MAY BE SOLD AS A LIVESTOCK FEED. IN A SUPPLEMENTARY NOTE IT IS MENTIONED THAT OZONOLYSIS FOLLOWED BY OXIDATION WOULD YIELD SEVERAL POTENTIALLY VALUABLE COMPOUNDS NOT AVAILABLE FROM COMMERCIAL VEGETABLE OILS. 90 REFERENCES. (ABSTPACT-ECONOMIC BOTANY 8(2):165.)

OALS/SIMMONDSIA CHINENSIS/LIPIDS/PLANT SUBSTANCES/SEEDS/ORGANIC COMPCUNDS/PLANT USES/LIQUID WAX/BIBLIOGRAPHIES/JOJOBA MEAL/NEW MEXICO

64

DAVIDSON, A./MOXLEY, G.L.

1923

FLORA OF SOUTHERN CALIFORNIA.

TIMES-MIRROR PRESS, LOS ANGELES. 452 P.

SIMMONDSIA IS DESCRIBED VERY BRIEFLY UNDER THE ORDER EUPHORBIALES, FAMILY BUXACEAE (P. 217).

OALS/SIMMONDSIA CHINENSIS/CALIFORNIA/SIMMONDSIA

65

DAVY, J.B.

1903

PLANTS RECEIVED FOR IDENTIFICATION, P. 131-135.

CALIFORNIA AGRICULTURAL EXPERIMENT STATION, SACRAMENTO, REPORT OF WORK, 1901-1903. 222 P.

BRIEFLY NOTES (P. 132) SOME FOOD USES OF JOJOBA IN LOWER CALIFORNIA. ALSO MENTIONS THAT THE FRENCH GOVERNMENT IS INTERESTED IN UTILIZING THIS PLANT IN NORTH AFRICA.

OALS/SIMMONDSIA CHINENSIS/CALIFORNIA/FOODS/NORTH AFRICA/BAJA CALIFORNIA

66

DAYTON, E.F.

1937

RANGE PLANT HANDBOOK.

U.S. FOREST SERVICE, WASHINGTON, D.C. 842 P.

PAGES B148-149 CONTAIN A DESCRIPTION OF JOJOBA. ITS VALUE AS A BROWSE PLANT IS EXPLAINED. ALSO, SEVERAL OTHER USES ARE MENTIONED SUCH AS FOOD, HAIR-RESTORER, LUBRICANT.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/PLANT USES/RANGE MANAGEMENT/ BROWSE/FORAGE PLANTS/RODENTS

67

DAYTON, W.A.

1927

A FEW NOTES ON PLANT NAMES.

BIOLOGICAL SOCIETY OF WASHINGTON, PROCEEDINGS 40:117-118.

THE AUTHOR SUGGESTS A DEPARTURE FROM NOMINA PRIORA, THAT NAMES WHICH ARE OBVIOUSLY AND COMPLETELY UNSCIENTIFIC BE REJECTED. UNDER SUCH A RULING SIMMONDSIA CHINENSIS (LINK) SCHN. WOULD NOT BE PERMITTED TO OUST S. CALIFORNICA NUTT..

OALS/SIMMONDSIA CHINENSIS/SYSTEMATICS

68

DAYTON, W.A.

1931

IMPORTANT WESTERN BROWSE PLANTS.

U.S. DEPARTMENT OF AGRICULTURE, MISCELLANEOUS PUBLICATION 101. 214 P.

PAGES 94-95 CONTAIN A BRIEF DESCRIPTION OF JOJOBA AND ITS USES.

OALS/SIMMONDSIA CHINENSIS/FORAGE PLANTS/BROWSE/PLANT USES

69

DIGUET, M.L.

1895

LE JOJOBA (SIMMONDSIA CALIFORNICA NUTT) C.A.

SOCIETE NATIONALE D ACCLIMATATION DE FRANCE, BULLETIN 42:685-687.

THE AUTHOR CONSIDERS THAT JOJOBA S ADAPTATIONS FOR ARID ENVIRONMENTS AND ECONOMIC USEFULNESS MAKE IT WORTHY OF INTRODUCTION INTO THE DESERT REGIONS OF FRENCH COLONIES IN NORTH AFRICA. THE SEEDS ARE EATEN, AND A HIGH QUALITY OIL, THAT DOES NOT BECOME RANCID, IS OBTAINED FROM THEM. LEAVES PERSIST ON THE PLANT EVEN DURING DRY PERIODS, POSSIBLY UTILIZING ATMOSPHERIC MOISTURE. THE DEVELOPMENT OF THE FRUIT AFTER FLOWERING IS DEPENDENT ON SUMMER RAINFALL. METHODS ARE GIVEN FOR PREPARATION OF THE FRUIT AND THE OIL AND THE AUTHOR SUGGESTS THAT THE PLANT WILL RESPOND WELL TO IRRIGATION.

OALS/SIMMONDSIA CHINENSIS/SEEDS/PHENOLOGY/FOODS/LIQUID WAX/LIPIDS/ PLANT USES/ADAPTATION/LEAVES/NORTH AFRICA/SEASONAL

70

DOUGLAS, E.

1959

OF NUTS AND SUCH.

ARIZONA FARMER-RANCHMAN 38(3):5.

NOTES THAT ALTHOUGH JOJOBA OIL HAS MANY POTENTIAL USES, RODENTS HAVE BLOCKED EFFORTS AT ESTABLISHING PLANTATIONS.

OALS/SIMMONDSIA CHINENSIS/CULTIVATION/PLANTING MANAGEMENT/RODENTS/ ARIZONA

71

DOUGLAS, M.

1947

JOJOBA, AN OIL PRODUCING PLANT OF THE SOUTHWESTERN STATES.

NEW YORK BOTANICAL GARDEN, JOURNAL 48:29-32/CHEMURGIC DIGEST 6(6):106-107.

DESCRIBES THE PLANT AND ASPECTS OF ITS NATURAL HISTORY. THE DISCOVERY OF A LIQUID WAX IN THE SEEDS IS RECOUNTED. A NUMBER OF PATENTS FOR ITS UTILIZATION HAVE BEEN FILED. OTHER USES ARE ALSO MENTIONED. (ABSTRACT-ECONOMIC BOTANY 1(4):401.)

OALS/SIMMONDSIA CHINENSIS/ARIZONA/SOUTHWEST U.S./PLANT USES/PLANT SUBSTANCES/LIQUID WAX/LIPIDS/NATURAL HISTORY

72

DUISBERG, P.C.

1952

DESERT PLANT UTILIZATION.

TEXAS JOURNAL OF SCIENCE 4(3):269-283.

A DISCUSSION OF DESERT PLANTS AND THEIR ACTUAL OR POTENTIAL ECONOMIC IMPORTANCE. INCLUDES PERTINENT CHEMICAL AND INDUSTRIAL DATA. JOJOBA (P. 279) IS NOTED AS HAVING MANY POTENTIALS.

OALS/SIMMONDSIA CHINENSIS/DESERT PLANTS/PLANT USES/RUBBER PLANTS/ FIBER PLANTS/FOODS/ECONOMIC DEVELOPMENT/EUPHORBIACEAE /AGAVE/NOLINA/ LARREA/YUCCA/CUCURBITA/RUMEX/PROSOPIS/TAMARIX

73

DUISBERG, P.C.

1953

CHEMICAL COMPONENTS OF USEFUL OR POTENTIALLY USEFUL DESERT PLANTS OF NORTH AMERICA AND THE INDUSTRIES DERIVED FROM THEM. DESERT RESEARCH, PROCEEDINGS INTERNATIONAL SYMPOSIUM HELD IN JERUSALEM, MAY 7-14, 1952, RESEARCH COUNCIL OF ISRAEL AND UNESCO.

RESEARCH COUNCIL OF ISRAEL, SPECIAL PUBLICATION 2:281-294.

CONSIDERS SEVERAL SPECIES OF DESERT PLANTS, OUTLINING PRESENT UTILIZATION AND SPECULATING ON POTENTIAL DEVELOPMENT. (ABSTRACT-ECONOMIC BOTANY 9(1):93.)

OALS/DESERT PLANTS/XEROPHYTES/PLANT USES/MEDICINAL PLANTS/PLANT SUBSTANCES/MEXICO/SOUTHWEST U.S./EUPHORBIACEAE/LIPIDS/LIQUID WAX/FIBER PLANTS/AGAVE/YUCCA/NOLINA/LARREA/PARTHENIUM ARGENTATUM /RUBBER PLANTS/ /SIMMONDSIA CHINENSIS/CUCURBITA/OPUNTIA/TAMARIX/PROSOPIS JULIFLORA/ OLNEYA

74

DUISBERG, P.C.

1963

INDUSTRIAL UTILIZATION OF DESERT PLANTS (UTILIZACION INDUSTRIAL DE LAS PLANTAS DEL DESIERTO).

UNESCO, LATIN AMERICAN CONFERENCE FOR THE STUDY OF ARID REGIONS, BUENOS AIRES, FINAL REPORT, P. 139-167.

THE AUTHOR SUGGESTS APPLIED SCIENTIFIC RESEARCH FOR THE DEVELOPMENT OF INDUSTRIAL UTILIZATION OF DESERT PLANTS IN TWO AREAS: 1) EMPHASIS ON THE VAST UNDERDEVELOPED LANDS WITH THE DEVELOPMENT OF PRACTICAL FORMS OF CULTIVATION IN ARID SOILS (WITHOUT IRRIGATION) WHICH HAVE AS BASIS THE UTILIZATION OF DESERT PLANTS, AND 2) EMPHASIS ON USEFUL CHEMICAL COMPONENTS AND NEW CROP DEVELOPMENT OF DESERT PLANTS. THE IMPORTANCE OF DESERT PLANTS IN RELATION TO ECONOMIC DEVELOPMENT IS EXPLORED, AND PRODUCTIVE VALUE COMPARISONS ARE MADE WITH CATTLE PRODUCTION. CHANGING ECONOMIC CLIMATE AND ITS EFFECT ON INDUSTRIAL UTILIZATION OF DESERT PLANTS IS DISCUSSED. EXISTING INDUSTRIES ARE DESCRIBED: 1) BASED ON WILD DESERT PLANTS: A. AGAVE FOR HARD FIBERS, B. YUCCA FOR IXTLE, C. EUPHORBIA FOR AMENT WAX, D. ASTRAGALUS FOR TRAGACANTH GUM, E. EPHEDRA FOR EPHEDRIN DRUG; 2) BASED ON CULTIVATION OR SEMICULTIVATED DESERT PLANTS: A. AGAVE FOR HARD FIBER, B. ACACIA FOR RUBBER, C. ACACIA FOR TANNIN, D. AGAVE FOR ALCOHOL, E. NOPALS (OPUNTIA) FOR FOOD ETC. A NUMBER OF POSSIBLE NEW PLANTS FOR INDUSTRIAL USE AND THE PROBLEMS ENCOUNTERED IN LAUNCHING A NEW INDUSTRY ARE TREATED. THE POSSIBILITIES OF JOJOBA CULTIVATION ARE EXPLORED BRIEFLY.

OALS/DESERT PLANTS/XEROPHYTES/AGAVE/ACACIA/SIMMONDSIA CHINENSIS/YUCCA /LARREA/PROSOPIS/OPUNTIA/ARID LANDS/DESERTS/SEMIARID CLIMATE/ ASTRAGALUS/PLANT USES/FIBER PLANTS/RUBBER PLANTS/LAND USE/ECONOMIC DEVELOPMENT/CROP PRODUCTION/DRY FARMING/CULTIVATION

75

DUISBERG, P.C./HAY, J.L.

1971

ECONOMIC BOTANY OF ARID REGIONS. IN W.G. MCGINNIES, B.J. GOLDMAN, AND P. PAYLORE, EDS., FOOD, FIBER, AND THE ARID LANDS, P. 247-270.

UNIVERSITY OF ARIZONA PRESS, TUCSON. 437 P. SWRA W72-03664.

PRIMITIVE PEOPLES OF THE DESERTS HAVE ALWAYS EXISTED IN HARMONY WITH THEIR ENVIRONMENT, PARTLY BY EXTENSIVE UTILIZATION OF NATIVE PLANT PRODUCTS. IN THE PAST FEW DECADES, THE COMBINATION OF RISING ASPIRATIONS AND OUTMIGRATIONS OF DESERT PEOPLES TOGETHER WITH SYNTHETIC SUBSTITUTES HAVE DIMMED THE PROSPECTS OF ARID REGION ECONOMIC BOTANY. MUCH OF THE PROBLEM LIES WITH THE PLANT-INDUSTRIES THEMSELVES, WHO HAVE NOT USED SYSTEMATIC SCIENTIFIC EVALUATION TECHNIQUES, ALTHOUGH A START HAS BEEN MADE BY THE U.S. DEPARTMENT OF AGRICULTURE NEW CROPS PROGRAM. SUCH A NEGLECT OF DESERT PLANT POTENTIALS CAN ONLY BE AFFORDED BY THE MORE AFFLUENT COUNTRIES WITH ARID ZONES. IN THE UNDERDEVELOPED COUNTRIES WHERE NO RESOURCE CAN BE IGNORED, RESEARCH IN THIS AREA MAY BE CRITICALLY IMPORTANT. IN MEXICO, A COUNTRY WITH AN IMPORTANT TRADITION OF DESERT PLANT USE AND DESERT PLANT INDUSTRIES, MUCH IMPORTANT RESEARCH, THOUGH INADEQUATELY FUNDED, GOES ON. THE ECONOMIC HISTORY AND FUTURE PROSPECTS OF MANY PLANTS ARE DISCUSSED. AN EXTENSIVE APPENDIX IS INCLUDED CONTAINING A PARTIAL LISTING OF ECONOMIC DESERT PLANTS AND PROVIDES INFORMATION ON KNOWN USES OF THESE PLANTS. (OALS)

OALS/PLANT USES/FIBER PLANTS/FORAGE PLANTS/MEDICINAL PLANTS/DESERT PLANTS/DESERTS/ARID LANDS

76

ECKEY, E.W.

1954

VEGETABLE FATS AND OILS.

REINHOLD, NEW YORK. 836 P.

CHAPTER 17 OF THIS BOOK TREATS FATS FROM PLANTS OF THE TWO ORDERS SAPINDALES AND RHAMNALES, THE FIRST OF WHICH INCLUDES THE BOX FAMILY BUXACEAE. THE NATURAL HISTORY, CHEMICAL PROPERTIES OF THE SEED OIL, AND UTILIZATION OF THE OIL, OF THE PLANT JOJOBA ARE BRIEFLY DISCUSSED ON PAGES 612-613.

OALS/SIMMONDSIA CHINENSIS/LIPIDS/ORGANIC COMPOUNDS/LIQUID WAX

77

EDDY, T.A.

1959

FOODS OF THE COLLARED PECCARY PECARI TAJACU SONORIENSIS (MEARNS) IN SOUTHERN ARIZONA.

UNIVERSITY OF ARIZONA (M.S. THESIS). 102 P.

JOJOBA SEEDS WERE OBSERVED TO BE EATEN BY PECCARY, THE ANIMALS UTILIZING 8 PERCENT OF THE TOTAL OBSERVED FEEDING TIME DURING JULY, AUGUST, AND SEPTEMBER FEEDING ON JOJOBA FRUITS. PALATABILITY TESTS WERE RUN ON CAPTIVE ANIMALS FOR SEVERAL FOODS; JOJOBA SEEDS RECEIVED THE HIGHEST OF FOUR RATINGS, RELISHED.

OALS/SIMMONDSIA CHINENSIS/FOOD HABITS/PECARI TAJACU/SEEDS/TUCSON MOUNTAINS/WILDLIFE/PALATABILITY

78

ELDER, J.B.

1953

UTILIZATION OF MAN-MADE WATERHOLES BY WILDLIFE IN SOUTHERN ARIZONA.

UNIVERSITY OF ARIZONA (M.S. THESIS). P. 114.

NOTES THAT JOJOBA IS A KEY DEER BROWSE PLANT AND IS AN IMPORTANT FACTOR IN THE WELFARE OF THE TUCSON MOUNTAIN MULE DEER HERD. JOJOBA WAS ONE OF NINE DEER BROWSE PLANTS THAT WERE ANALYZED FOR MOISTURE CONTENT. PERCENTAGE WEIGHT LOSS IN DRYING JOJOBA LEAVES IS GIVEN FOR 20 SAMPLES SPREAD OVER 12 MONTHS. LOSS VARIED FROM A HIGH OF 75 PERCENT IN MARCH TO A LOW OF 41 PERCENT IN APRIL 1952.

OALS/SIMMONDSIA CHINENSIS/FOOD HABITS/FORAGE PLANTS/ODOCOILEUS HEMIONUS/LEAVES/MOISTURE CONTENT/ARIZONA/WILDLIFE/BROWSE

79

ELLIGER, C.A./WAISS, A.C./LUNDIN, R.E.

1973

SIMMONDSIN, AN UNUSUAL 2-CYANOMETHYLENECYCLOHEXYL GLUCOSIDE FROM SIMMONDSIA CALIFORNICA.

CHEMICAL SOCIETY (JOURNAL), PERKIN TRANSACTIONS I(19):2209-2212.

EXTRACTION OF GROUND JOJOBA SEED IN SUCCESSION WITH HEPTANE, BENZENE, ETHYL ACETATE, AND METHANOL CONCENTRATED A SUBSTANCE, IN THE ETHYL ACETATE FRACTION. THIS SUBSTANCE EXHIBITED ACTIVITY IN THE INHIBITION OF FEEDING, ALTHOUGH THE ACUTE ORAL TOXICITY WAS EXTREMELY LOW. TERMED SIMMONDSIN, IT HAS BEEN SHOWN TO BE 2-(CYANOMETHYLENE)-3-HYDROXY-4,5-DIMETHOXYCYCLOHEXYL BETA-D-GLUCOSIDE. ANALYSIS OF THE N.M.R. SPECTRA OF THIS COMPOUND AND ITS PENTA-ACETATE PERMITTED ASSIGNMENT OF THE STEREOCHEMISTRY AS WELL AS ESTABLISHING THE POINT OF ATTACHMENT OF THE GLUCOSE.

OALS/SIMMONDSIA CHINENSIS/JOJOBA MEAL/SEEDS/ORGANIC COMPOUNDS/ TOXICITY

80

ELLIS, C.

1936

FACTIS AND PROCESS OF MAKING SAME.

UNITED STATES PATENT 2,054,283, SEPTEMBER 15, 1936.

THE PRESENT INVENTION CONTEMPLATES THE PRODUCTION OF A MUCH MORE SOLUBLE FORM OF FACTIS WHICH MAY BE MORE READILY INCORPORATED WITH VARIOUS SOLUTIONS AND WHICH ALSO MAY HAVE A MORE POWERFUL SOLVENT ACTION ON SUBSTANCES, SUCH AS RUBBER, SO THAT A BETTER BLENDING EFFECT IS SECURED. THE PREPARATION OF SUCH A FACTIS UTILIZING JOJOBA OIL AND SULPHUR CHLORIDE IS DESCRIBED. VARIATION OF PROPORTIONS ALLOWS UTILIZATION IN A WIDE RANGE OF PRODUCTS. EXAMPLES (13) OF DIFFERENT PREPARATIONS AND THEIR USES ARE GIVEN. IT HAS BEEN INCORPORATED IN RUBBER, RUBBER CEMENTS AND SOLUTIONS, LINOLEUM, PAINTS AND VARNISHES, PLASTICS, AND THE LIKE.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/ORGANIC COMPOUNDS/PLANT USES/PATENTS/POLYMERIZATION

81

ERDTMAN, G.

1952

POLLEN MORPHOLOGY AND PLANT TAXONOMY. ANGIOSPERMS (AN INTRODUCTION TO PALYNOLOGY. 1).

CHRONICA BOTANICA CO., WALTHAM, MASS., 539 P. REPRINTED 1966, HAFNER PUBLISHING CO., N.Y. AND LONDON.

THE POLLEN OF 5 GENERA OF BUXACEAE ARE DESCRIBED. SIMMONDSIA IS DIFFERENT, HAVING THE SEXINE DETAILS MUCH THE SAME AS IN CENTROSPERMAE.

OALS/SIMMONDSIA CHINENSIS/SYSTEMATICS/POLLEN/BUXACEAE

82

ESCOBAR, R.

1935

LA JOJOBA (SIMMONDSIA CALIFORNICA).

ESCUELA PARTICULAR DE AGRICULTURA, CD. JUAREZ, CHIHUAHUA, BOLETIN 20, SER. 2:1-8./AGRICULTOR MEXICANO (JUAREZ) 51(4):49-56.

THIS PAPER GATHERS TOGETHER GENERAL INFORMATION ON THE PLANT JOJOBA AND ITS USES IN MEXICO. TOPICS INCLUDE NATURAL HISTORY, USE AS FOOD AND HAIR TONIC, FORAGE VALUE, MEDICINAL VALUE, GERMINATION OF SEEDS, ANALYSIS OF SEEDS AND PROPERTIES OF OIL, BOTANICAL DESCRIPTION, AND RECOMMENDATIONS. IT IS RECOMMENDED THAT PLANTINGS BE PROPAGATED EAST OF THE CONTINENTAL DIVIDE IN CLIMATICALLY APPROPRIATE AREAS.

OALS/SIMMONDSIA CHINENSIS/MEXICO/PLANT USES/FOODS/FORAGE PLANTS/SEEDS /CULTIVATION/BROWSE/MEDICINAL PLANTS

83

EVERETT, P.C.

1957

A SUMMARY OF THE CULTURE OF CALIFORNIA PLANTS AT THE RANCHO SANTA ANA BOTANICAL GARDEN 1927-1950.

RANCHO SANTA ANA BOTANICAL GARDEN, CLAREMONT, CALIFORNIA. 223 P.

OF A TOTAL OF 903 JOJOBA PLANTED, ONLY 275 WERE ALIVE IN 1950. ALTHOUGH DIFFICULT TO ESTABLISH, THE PLANTS, ONCE SETTLED, WERE ENTIRELY HARDY IN EVERY RESPECT AND NEEDED NO FURTHER ATTENTION. YEARLY RECORDS WERE KEPT ON MOST PLANTS. OF 181 PLANTED AT POTRERO GRANDE, SAN DIEGO COUNTY, IN 1929, 141 WERE ALIVE IN 1948. NO LOSSES HAD BEEN RECORDED FOR TEN YEARS, PLANTS WERE 6 FEET HIGH AND SPREAD 10 FEET. USUALLY, GOOD GERMINATION RESULTED WITHIN 14-18 DAYS AFTER SOWING THE SEED IN 4 INCH POTS OR TAR PAPER PLANT BANDS. THE LATTER TYPE OF CONTAINER PROVED TO BE UNSATISFACTORY; THE SOIL MIXTURES BECAME TOO SOGGY AND CAUSED THE SEED TO ROT. AT AGUANGA, SAN DIEGO COUNTY, 96 SEEDS WERE PLANTED IN POTS, TRANSFERRED TO GALLON CANS AND THEN PLANTED; 60 SURVIVED IN GOOD CONDITION.

OALS/SIMMONDSIA CHINENSIS/CALIFORNIA/CULTIVATION/GERMINATION/PLANTING MANAGEMENT/PLANT GROWTH

84

FELGER, R.S.

1966

ECOLOGY OF THE GULF COAST AND ISLANDS OF SONORA, MEXICO.

UNIVERSITY OF ARIZONA, TUCSON (PH.D. DISSERTATION). 460 P.

AN ECOLOGICAL AND DISTRIBUTION ANALYSIS IS GIVEN FOR THE NATURAL DESERTSCRUB AND THORNSCRUB VEGETATION ON THE ISLANDS OF SONORA IN THE GULF OF CALIFORNIA, MEXICO, AND ON THE ADJACENT MAINLAND OF SONORA BETWEEN PUNTA SARGENTO AND GUAYMAS-EMPALME. IN ADDITION TO ANALYSIS OF THE FLORA AND VEGETATION THE INSULAR, REPTILIAN AND MAMMALIAN FAUNAS ARE REPORTED. THE ECOLOGICAL AND GEOGRAPHICAL DISTRIBUTION OF SPECIES AND THEIR LIFE-FORMS ARE DISCUSSED, AND AN ANALYSIS OF THE CONTINUUM AND MOSAIC PATTERNS ASSOCIATED WITH CONTINUOUS AND DISCONTINUOUS ENVIRONMENTAL GRADIENTS IS GIVEN. SPECIES, LIFE-FORMS, COMMUNITIES, CONTINUA, AND MOSAICS IN THE DESERTSCRUB OF THE SONORAN DESERT ARE DISCUSSED IN RELATION TO CONCEPTS PERTAINING TO THE NATURE AND EVOLUTION OF NATURAL COMMUNITIES. NUMEROUS TABLES PRESENT DATA ON OCCURRENCE, DENSITY, AND HEIGHT OF JOJOBA PLANTS THROUGHOUT THE AREA (P. 26, 74, 77, 81, 83, 87, 97, 98, 101, 105, 109, 112, 176, 189, 196, 200, 202, 204, 236, 239, 256, 259, 261, 263, 287, 300, 326, 330, 332, 338). AT BAHIA SAN CARLOS, CATTLE GRAZING HAS ELIMINATED SIMMONDSIA CHINENSIS FROM OPEN AREAS AND IT SURVIVES ONLY IN THE PROTECTION OF LARGER COLONIES OF SPINY DESERT SHRUBS, E.G., CONDALIA LYCOIDES (P. 33). JOJOBA MAY BE TARDILY DROUGHT-DECIDUOUS, BUT ULTIMATELY BECOMES LEAFLESS OR ESSENTIALLY SO DURING SEVERE DROUGHT (P. 96, 280). FREQUENCY DISTRIBUTION OF JOJOBA ACROSS AN ENVIRONMENTAL GRADIENT, MIDDLE BAJADA, UPPER BAJADA, SOUTH-FACING SLOPE WAS STUDIED (P. 362). APPENDIX NOTES THAT JOJOBA OCCURS AT THE FOLLOWING LOCALITIES: INFERNILLO, ISLA TIBURON, ISLA DATIL, ISLA SAN ESTEBAN, LLANURAS, GUAYMAS, ISLA SAN PEDRO NOLASCO (P. 415).

OALS/SIMMONDSIA CHINENSIS/MEXICO/SONORA/SONORAN DESERT/GULF OF CALIFORNIA/ISLANDS/PLANT DISTRIBUTION/PLANT COMMUNITIES/BIOGEOGRAPHY/ PLANT ECOLOGY/DROUGHT TOLERANCE/FORAGE PLANTS/BROWSE/ISLANDS

85

FLAXMAN, M.T.

1940

SULPHURIZED LUBRICATING OILS.

UNITED STATES PATENT 2,212,899, AUGUST 27, 1940 (TO UNION OIL COMPANY OF CALIFORNIA).

THIS INVENTION RELATES TO THE PREPARATION OF SULPHURIZED OILS, PARTICULARLY SULPHURIZED PETROLEUM LUBRICATING OILS. THE PRIMARY OBJECTIVE IS TO PROVIDE A SULPHUR-OIL BASE WHICH WILL BE STABLE, MAY BE INCORPARATED READILY EITHER IN SUBSTANTIAL PREPARATIONS TO PRODUCE EXTREME PRESSURE LUBRICANTS OR THE LIKE OR IN VERY SMALL PROPORTIONS TO OVERCOME CORROSION TENDENCIES WHICH EXIST IN CERTAIN TYPES OF LUBRICATING OILS, AND WILL NOT CAUSE THE PRODUCTS TO TURN BLACK DURING MANUFACTURE OR STORAGE. BRIEFLY STATED THE INVENTION RESIDES IN A SULPHURIZED VEGETABLE OIL KNOWN AS JOJOBA OIL, AND MIXTURE OF IT WITH MINERAL LUBRICATING OILS. VARIOUS PREPARATIONS AND USES ARE MENTIONED.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/PLANT USES/ORGANIC COMPOUNDS/PATENTS/SULFURIZATION

86

FORE, S.P./MAGNE, F.C./BICKFORD, W.G.

1958

EPOXIDIZED JOJOBA OIL AS A STABILIZER FOR VINYL CHLORIDE CONTAINING PLASTICS.

AMERICAN OIL CHEMISTS SOCIETY, JOURNAL 35(9):469-472.

EPOXIDIZED JOJOBA OIL HAS BEEN EVALUATED AS A LIGHT AND HEAT STABILIZER FOR VINYL CHLORIDE CONTAINING PLASTICS AND ITS PROPERTIES, INTERCOMPARED WITH THOSE OF OTHER EPOXIDES REPRESENTATIVE OF 3 MAJOR CLASSES OF OXIRANE STABILIZERS. THE RESULTS OBTAINED SHOW THAT EPOXIDIZED JOJOBA OIL IS A SATISFACTORY THERMAL AND ULTRAVIOLET STABILIZER FOR BOTH TRICRESYL PHOSPHATE (TCP) AND DI-2-ETHYLHEXYL PHTHALATE (DOP) PLASTICIZED STOCKS AND HAS NO ADVERSE EFFECTS ON THE PLASTICIZER PROPERTIES OF THESE MATERIALS. IN GENERAL, EPOXIDIZED JOJOBA OIL WAS FOUND TO BE EQUIVALENT TO OR, IN SOME INSTANCES, SUPERIOR TO THE OTHER EPOXIDES TESTED.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/ORGANIC COMPOUNDS/PLANT USES/EPOXIDATION

87

FORE, S.P. ET AL

1960

DERIVATIVES OF JOJOBA OIL AS PLASTICIZERS FOR VINYL POLYMERS AND BUNA-N RUBBER.

AMERICAN OIL CHEMISTS SOCIETY, JOURNAL 37(8):387-390.

TEN MALEINATED JOJOBA OIL DERIVATIVES WERE SCREENED AS PLASTICIZERS IN A STANDARD POLYVINYL RESIN FORMULATION AND AS SOFTENERS FOR BUNA-N RUBBER. THREE OF THESE, THE METHYL AND BUTYL ESTERS AND HYDROGENATED METHYL ESTERS OF MALEINATED JOJOBA ACIDS, WERE COMPARABLE TO THE REFERENCE STANDARD DI-2-ETHYLHEXYL PHTHALATE (DOP) AS PRIMARY PLASTICIZERS FOR THE VINYL RESIN. THREE OTHERS WERE SATISFACTORY ONLY AS SECONDARY PLASTICIZERS. SIX OF THE DERIVATIVES WERE COMPARABLE TO THE REFERENCE SOFTENER, DIBUTYL SEBACATE, AS SOFTENERS,IN A BUNA-N FORMULATION AND YIELDED RUBBERS MEETING THE LOW TEMPERATURE FLEXIBILITY REQUIREMENTS (-40 DEGREES CENTIGRADE) OF THE AUTOMOBILE INDUSTRY. TWO OF THE 6, THOSE MADE WITH THE BUTYL AND HYDROGENATED BUTYL ESTERS OF MALEINATED JOJOBA ACIDS, MET THE MORE STRINGENT REQUIREMENTS OF THE AIRCRAFT INDUSTRY (-55 DEGREES CENTIGRADE).

OALS/SIMMONDSIA CHINENSIS/TEMPERATURE/LIPIDS/LIQUID WAX/ORGANIC COMPOUNDS/PLANT USES/PLANT SUBSTANCES

88

FORTI, M.

1973

SIMMONDSIA STUDIES IN ISRAEL. IN E.F. HAASE AND W.G. MCGINNIES, EDS., JOJOBA AND ITS USES; AN INTERNATIONAL CONFERENCE, JUNE 1972, P. 13-25.

UNIVERSITY OF ARIZONA, OFFICE OF ARID LANDS STUDIES, TUCSON. 81 P.

THIS PAPER REVIEWS AND SUMMARIZES THE INVESTIGATIONS BEGUN IN 1958 INTO THE POSSIBILITY OF UTILIZING SIMMONDSIA IN ISRAEL. EXPERIMENTS WERE IN THE NORTHERN NEGEV; THE CLIMATE TOPOGRAPHY AND LAND USE ARE DESCRIBED. SEVEN PLOTS WERE ESTABLISHED, 5 OF WHICH ARE GROWING SATISFACTORILY AND ARE REPORTED ON IN DETAIL. SEVERAL ASPECTS OF PHENOLOGY ARE TREATED: SEX DIFFERENTIATION, FLORAL BUD FORMATION AND FLOWERING, FRUIT RIPENING AND VEGETATIVE AND REPRODUCTIVE CYCLE. YIELD WAS FOUND TO BE AN INDIVIDUAL CHARACTERISTIC THAT IS INFLUENCED BY FACTORS SUCH AS IRRIGATION PRACTICE. EXPERIMENTS ON GERMINATION AND SEED PROPAGATION ARE REPORTED. THE LARGE AMOUNT OF VARIABILITY IN SIMMONDSIA PROVIDES MATERIAL FOR SELECTION, BUT COULD CAUSE CONFUSION IF ANALYSIS OF CHARACTERISTICS IS NOT CHECKED ON A UNIFORM BASIS. HYBRIDIZATION EXPERIMENTS ARE UNDERWAY, F1 PROGENY HAVE BEEN CROSSED. ROOTING OF UP TO 30 PERCENT WAS OBTAINED IN VEGETATIVE PROPAGATION. PLANTS HAVE BEEN GROWN HYDROPONICALLY IN SALINE WATER TO DETERMINE IF THIS WATER COULD BE USED FOR IRRIGATION. PRELIMINARY CONCLUSIONS FROM 10 YEARS OF EXPERIMENTAL CULTIVATION OF SIMMONDSIA ARE PRESENTED.

OALS/SIMMONDSIA CHINENSIS/ISRAEL/NEGEV/CULTIVATION/INTRODUCED SPECIES /SEED PRODUCTION/SEEDS/CROP PRODUCTION/IRRIGATION PRACTICES/SOIL-WATER-PLANT RELATIONSHIPS /SALINE WATER/SALT TOLERANCE/PLANTING MANAGEMENT/GERMINATION/PHENOLOGY/FRUITING/FLOWERING/PLANT GROWTH/ SEASONAL/ENVIRONMENTAL EFFECTS/REPRODUCTION/PRODUCTIVITY/ VARIABILITY(GENETIC)/GENETICS/PLANT BREEDING

89

GAIL, P.A.

1964

SIMMONDSIA CHINENSIS (LINK) SCHNEIDER: ANATOMY AND MORPHOLOGY OF FLOWERS.

CLAREMONT COLLEGE, CLAREMONT, CALIFORNIA (M.A. THESIS), 40 P.

FLORAL ORGANOGRAPHY, VASCULAR ANATOMY AND HISTOLOGY ARE DESCRIBED FROM OBSERVATIONS ON TRANSVERSE AND LONGITUDINAL SECTIONS AND ALSO CLEARED RECEPTACLES AND TEPALS. THE AUTHOR CONCLUDES THAT JOJOBA IS A RELATIVELY HIGHLY SPECIALIZED TAXON WITH MANY SIMILARITIES, ANATOMICALLY AND MORPHOLOGICALLY, TO BUXACEAE. THOSE TRAITS IN WHICH DIFFERENCES ARE NOTED CAN BE LARGELY ATTRIBUTED TO SPECIALIZATION OF THE GENUS EITHER FOR ITS XERIC HABITAT OR FOR ITS RECENTLY ACQUIRED WIND POLLINATED HABIT. SIMMONDSIA SEEMS EVOLUTIONARILY QUITE YOUNG, JUDGING FROM ITS LARGE DEGREE OF HETEROZYGOSITY AND VARIATION BETWEEN POPULATIONS, AND IS QUITE PROBABLY UNDERGOING INTENSIVE SPECIATION AND RANGE EXTENSION. ESTABLISHMENT OF A MEANINGFUL PHYLOGENY BETWEEN SIMMONDSIA AND OTHER BUXACEAE AWAITS FURTHER INVESTIGATIONS. FOR THE PRESENT, SIMILARITIES TO CENTROSPERMAE MUST BE ATTRIBUTED TO CONVERGENCE.

OALS/SIMMONDSIA CHINENSIS/EVOLUTION/SYSTEMATICS/PLANT MORPHOLOGY/POLLEN/POLLINATION/FLOWERS/INSECTS/REPRODUCTION/PHENOLOGY/SEED PRODUCTION/SEEDS/SPECIATION/ADAPTATION/GENETICS/STOMATA/CYTOLOGY/XEROPHYTES/BUXACEAE/VARIABILITY(GENETIC)/BEES

90

GENTIL, L.

1907

LISTE DES PLANTES CULTIVEES DANS LES SERRES CHAUDES ET COLONIALES DU JARDIN BOTANIQUE DE L ETAT A BRUXELLES.

P. WEISSENBRUCH, BRUXELLES. 196 P.

LISTS SIMMONDSIA, FAMILY EUPHORBIACEAE: S. CALIFORMICA [SIC] AND S. CHRYSOPHYLLA, P. 177.

OALS/SIMMONDSIA CHINENSIS/SYSTEMATICS/CULTIVATION/INTRODUCED SPECIES

91

GENTRY, H.S.

1949

LAND PLANTS COLLECTED BY THE VELERO III, ALLAN HANCOCK PACIFIC EXPEDITIONS, 1937-1941.

UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES, ALLAN HANCOCK PACIFIC EXPEDITIONS 13(2). 245 P.

BRIEF DISCUSSION OF JOJOBA, UNDER THE FAMILY BUXACEAE, AS SIMMONDSIA CHINENSIS (INCLUDES S. CALIFORNICA AND S. PABULOSA). THE PRESENCE OF JOJOBA ON THE FOLLOWING GULF OF CALIFORNIA ISLANDS IS NOTED: CEDROS, ESPIRITU SANTO, CARMEN, SAN PEDRO NOLASCO, AND TIBURON. NOTES THAT JOJOBA IS NOT FOUND SOUTH OF THE RIO YAQUI, SAN CARLOS BAY, SONORA BEING NEAR THE SOUTHERN LIMIT ON THE MAINLAND. REPORTS THAT THE SEEDS ARE EATEN BY DESERT PEOPLES, USED IN MAKING A KIND OF COFFEE, AND ARE MADE INTO A POMADE BY WOMEN FOR THEIR EYELASHES AND BY MEN FOR THEIR MUSTACHES (P. 54-55, 108, 141).

OALS/SIMMONDSIA CHINENSIS/MEXICO/SONORA/PLANT DISTRIBUTION/GULF OF CALIFORNIA/PLANT USES/FOODS/SYSTEMATICS/ETHNOBOTANY/ISLANDS

92

GENTRY, H.S.

1955

APOMIXIS IN BLACK PEPPER AND JOJOBA.

JOURNAL OF HEREDITY 46(1):8.

THE AUTHOR NOTES THAT NO POLLINATING AGENTS, SUCH AS INSECTS OR BIRDS, ARE KNOWN FOR THE DIOECIOUS PLANT SIMMONDSIA CHINENSIS OF THE SONORAN DESERT. THE POLLEN IS COARSE AND HEAVY, NOT OF THE WIND-BORNE TYPE. ISOLATED PISTILLATE PLANTS FREELY FRUIT, EVEN WITH THE NEAREST STAMINATE PLANTS AS MUCH AS TWO OR THREE MILES DISTANCE. THE AUTHOR HYPOTHESIZES THAT UNISEXUAL FLOWERS DEVELOP NORMAL FRUITS QUITE IRRESPECTIVE OF POLLINATION.

OALS/SIMMONDSIA CHINENSIS/FLOWERS/POLLINATION/SEED PRODUCTION/ REPRODUCTION/PHENOLOGY

93

GENTRY, H.S.

1958

THE NATURAL HISTORY OF JOJOBA (SIMMONDSIA CHINENSIS) AND ITS CULTURAL ASPECTS.

ECONOMIC BOTANY 12(3):261-295.

PRESENTS A GENERAL ACCOUNT OF THIS ENDEMIC PLANT OF THE SONORAN DESERT. ITS DISTRIBUTION, MICRO-CLIMATIC PREFERENCES AND GROWTH FORMS ARE DISCUSSED. IT PREFERS WELL-DRAINED, COARSE, DESERT SOILS AND ANNUAL PRECIPITATION OF 12 OR MORE INCHES. PLANT ASSOCIATES AND GROWTH FORM VARY WITH CONDITIONS. A MICROLEPIDOPTERON IS THE ONLY SERICUS PEST KNOWN. SEEDS ARE UTILIZED BY RODENTS. THE SEASONAL CYCLE OF GROWTH, FLOWERING AND FRUITING CHANGES SLIGHTLY FROM LOCATION TO LOCATION AND YEAR TO YEAR. GROWTH IS ALMOST ENTIRELY IN RESPONSE TO WINTER AND SPRING RAINS. VARIABLE CHARACTERS ARE DISCUSSED IN RELATION TO CULTIVATION PRACTICES FOR SEED OIL PRODUCTION. CHARACTERISTICS OF HABIT, ROOTS, LEAVES, FLOWERS, CAPSULES, AND SEEDS COULD BE SUBJECTED TO SELECTION. THE YIELD OF SEED PER PLANT IS COMPARED IN WILD AND CULTIVATED POPULATIONS, THE LAST OF DIFFERENT KNOWN AGES. JOJOBA S FUTURE AS A CULTIVATE IS CONSIDERED IN RELATION TO PROPAGATION, FIELD PRACTICES, SPACING, PRUNING AND HARVESTING.

OALS/SIMMONDSIA CHINENSIS/SONORAN DESERT/ADAPTATION/PLANT ECOLOGY/ NATURAL HISTORY/PHENOLOGY/ROOTS/FLOWERS/SEEDS/REPRODUCTION/LEAVES/ COMPETITION/PESTS(INSECTS) /RODENTS/PRECIPITATION(ATMOSPHERIC) /PLANT BREEDING/CROP PRODUCTION/PLANT GROWTH/PLANT MORPHOLOGY/WINTER PRECIPITATION/CULTIVATION/MICROENVIRONMENT/PLANTING MANAGEMENT/BURNING /SEED PRODUCTION/VARIABILITY(GENETIC)/DISEASES/MAPS/BIRDS/WILDLIFE/ INSECTS

94

GENTRY, H.S.

1965

A DESERT BOXWOOD STILL IN THE DESERT.

BOXWOOD JOURNAL 5:32-36.

THE TAXONOMIC HISTORY OF SIMMONDSIA IS BRIEFLY TRACED. THE CONSENSUS OF MODERN OPINION RETAINS THE GENUS IN THE FAMILY BUXACEAE, IN PLACE OF CREATING A MONOTYPIC FAMILY SIMMONDSIACEAE. RECENT EXPERIMENTS BY THE AUTHOR HAVE LEAD HIM TO REVISE HIS PREVIOUS CONCLUSION THAT JOJOBA WAS APOMICTIC, POLLEN IS PROBABLY WIND-BORNE. AS A PROSPECTIVE ORNAMENTAL, SOME OF ITS FEATURES AND VARIABLE CHARACTERS ARE DESCRIBED; POPULATIONS AT ARIZONA (CAMP CREEK, TUCSON MOUNTAINS) AND BAJA CALIFORNIA (SANTA MARGA, SANTO TOMAS, SAN TELMO, UPPER SAN TELMO VALLEY). NOTES ARE GIVEN FOR GERMINATION, CUTTINGS AND SEEDLING CARE. (THIS ISSUE OF BOXWOOD JOURNAL IS A BOTANICAL-HORTICULTURAL CONSPECTUS OF THE BUXACEAE EXCEPT FOR BUXUS ITSELF).

OALS/SIMMONDSIA CHINENSIS/BAJA CALIFORNIA/ARIZONA/PLANTING MANAGEMENT /MINIMUM TEMPERATURE/PLANT INJURY/PLANT POPULATIONS/REPRODUCTION/ POLLINATION/GERMINATION/CULTIVATION/SYSTEMATICS/GENETICS/SEEDLINGS/ ORNAMENTAL PLANTS/VARIABILITY(GENETIC)/BUXACEAE/SIMMONDSIACEAE

95

GENTRY, H.S.

1972

PLANT A SEED AND SAVE A WHALE.

SAGUAROLAND BULLETIN 26:44-47.

THE ENDANGERED SPECIES STATUS OF SPERM OIL WHALES (DECEMBER 1971) HAS FORCED INDUSTRY TO SEARCH FOR ANOTHER SOURCE TO SUBSTITUTE FOR THE 55 MILLION POUNDS OF WHALE OIL ANNUALLY USED IN THE UNITED STATES. THREE POSSIBILITIES ARE JOJOBA (SIMMONDSIA CHINENSIS), MEADOW FOAMS (LYMNANTHES SPP.), AND CRAMBE ABYSSINICA. RECENT DEVELOPMENTS WITH JOJOBA IN ISRAEL AND THE SOUTHWEST U.S ARE DISCUSSED. ONE PROGRAM IN ARIZONA COULD HELP MEET THE NEEDS OF INDUSTRY, OF WHALE CONSERVATION, AND OF INDIAN WELFARE. THE CHARACTERISTICS OF JOJOBA OIL, ITS USES, AND USES OF THE HYDROGENATED WAX ARE OUTLINED. HORTICULTURAL DEVELOPMENT IS PRESENTLY IN AN EXPERIMENTAL STAGE.

OALS/SIMMONDSIA CHINENSIS/PLANT USES/LIQUID WAX/LIPIDS/ECONOMIC DEVELOPMENT/CONSERVATION/MAMMALS/CULTIVATION/ARIZONA/SOCIAL ASPECTS/ SPERM WHALE OIL/ISRAEL

96

GENTRY, H.S.

1973

SUPPLEMENT TO THE NATURAL HISTORY OF JOJOBA. IN E.F. HAASE AND W.G. MCGINNIES, EDS., JOJOBA AND ITS USES; AN INTERNATIONAL CONFERENCE, JUNE 1972, P. 11-12.

UNIVERSITY OF ARIZONA, OFFICE OF ARID LANDS STUDIES, TUCSON. 81 P.

NOTES THAT JOJOBA, FAMILY BUXACEAE, IS A REGIONAL ENDEMIC OF THE SONORAN DESERT CAPABLE OF RESISTING DROUGHTS OF 1-2 YEARS BY RELAPSING INTO LEAFLESS DORMANCY. IT HAS PREVIOUSLY BEEN LABELED A PALECENDEMIC, BUT THE AUTHOR QUESTIONS THIS BY NOTING THAT IT IS ABSENT IN COAHUILA. FACTORS CONTROLLING ITS GEOGRAPHIC DISTRIBUTION ARE NOTED. JOJOBA IS AN IMPORTANT BROWSE FOR HERBIVOROUS MAMMALS. IT IS SUGGESTED THAT GRAZING PRESSURE DURING THE PLEISTOCENE MAY HAVE SOMETHING TO DO WITH THE PRESENT DAY DISTRIBUTION OF THE SHRUB. JOJOBA COULD HAVE SURVIVED IN AREAS TOO DRY FOR MOST LARGE MAMMALS. JOJOBA IS DISCUSSED IN TERMS OF THREE REQUIREMENTS TO BECOME A SUCCESSFUL CULTIVATE: 1) MUST YIELD A PRODUCT IN ABUNDANCE, 2) MUST RESPOND TO ARTIFICIAL ENVIRONMENTS OF MAN, 3) MUST HAVE A GENETIC ENDOWMENT FOR SELECTION. JOJOBA IS SEEN AS MEETING ALL THESE REQUIREMENTS.

OALS/SIMMONDSIA CHINENSIS/NATURAL HISTORY/PHYTOGEOGRAPHY/PLANT DISTRIBUTION/SONORAN DESERT/RELICT VEGETATION/PLEISTOCENE EPOCH/ DROUGHT TOLERANCE/BROWSE/WILDLIFE/MAMMALS/CULTIVATION/GENETICS/FORAGE PLANTS/VARIABILITY(GENETIC)/DISTRIBUTION PATTERNS

97

GIBSON, F.

1938

SIMMONDSIA CALIFORNICA NUTTAL IS DIOECIOUS.

BOYCE THOMPSON INSTITUTE, CONTRIBUTIONS 10:45-46.

ATTENTION IS HERE DRAWN TO THE FACT THAT THE PLANTS ARE STRICTLY DIOECIOUS. THE SEX RATIO IN NATURE APPEARED BALANCED. CONFUSION AS TO THE DIOECIOUS HABIT MIGHT HAVE RESULTED FROM TWO OPPOSITE SEXED PLANTS GROWING TOGETHER. THIS EVIDENCE OF DIOECIOUSNESS WOULD BE IMPORTANT TO THOSE CONTEMPLATING SEED PRODUCTION ON PLANTATIONS FOR THE OIL.

OALS/SIMMONDSIA CHINENSIS/SEEDS/LIPIDS/FLOWERS/PHENOLOGY/REPRODUCTION /PLANTING MANAGEMENT

98

GINDEL, .J

1957

ACCLIMATIZATION OF EXOTIC WOODY PLANTS IN ISRAEL: THE THEORY OF PHYTO-PLASTICITY.

MATERIAE VEGETABILIS 2(2):81-101.

THE PHYTOGEOGRAPHY, CLIMATE AND RESULTS OF ACCLIMATIZATION OF 600 EXOTIC TREES AND SHRUBS IN ISRAEL ARE DISCUSSED. AUSTRALIA IS THE MAIN SOURCE OF INTRODUCTIONS. MANY EXOTICS ARE USED FOR REFORESTATION AND CHECKING SOIL EROSION, WITH DIFFERENT SPECIES UTILIZED FOR DIFFERING SOIL CONDITIONS. ISRAEL S CLIMATE FREQUENTLY IS VERY DIFFERENT FROM THAT OF THE PLANT S NATIVE HABITAT; THIS PROVIDES THE BASIS FOR ACCLIMATIZATION. IN GENERAL, TEMPERATURES LOWER THAN THOSE FOUND IN THE NATURAL HABITAT ARE SOMEWHAT MORE CRITICAL THAN HIGHER TEMPERATURES AND LESSENED PRECIPITATION. THIS IS PARTICULARLY SERIOUS

WHEN THE TEMPERATURE DROPS RAPIDLY WHILE THE PLANT IS STILL PHYSIOLOGICALLY ACTIVE. SUCCESSFUL ACCLIMATIZATION DEPENDS ON SURVIVAL DURING EXCEPTIONAL YEARS WHEN THE TWO MOST IMPORTANT FACTORS, MOISTURE FOR MESOPHYTIC SPECIES AND LOW TEMPERATURE FOR THERMOPHILIC SPECIES, REACH CRITICAL VALUES. MODIFICATIONS OF PHENOLOGY, ROOT SYSTEMS LEAF STRUCTURE AND BARK ARE NOTED. THE THEORY ON PHYTO-PLASTICITY IS BASED ON THREE MAIN CONCEPTS: 1) THE PHENOMENA OF LIFE IS EXPRESSED BY CONTINUAL METABOLISM WHICH IS STRONGLY INFLUENCED BY ENVIRONMENTAL FACTORS, 2) EVERY PLANT HAS, TO A GREATER OR LESSER DEGREE, THE ABILITY TO CHANGE ITS METABOLISM IN ORDER TO CONFORM WITH THE CHANGED PATTERN OF THE ENVIRONMENT, 3) THE PROCESS OF EVOLUTION IS SUPPORTED BY A CONTINUING SELECTION OF INDIVIDUALS WHICH SHOW THE GREATEST PLASTICITY, I.E., ABILITY TO ADAPT, WHILE ACCLIMATIZATION IS TAKING PLACE. THIS CONCEPT IS DISCUSSED IN TERMS OF METABOLIC CHANGES AND THE EFFECT OF ECOLOGICAL FACTORS ON PLASTICITY. THE THEORIES OF PHYTO-PLASTICITY AND CLIMATIC ANALOGIES ARE CONTRASTED. GENERAL PRINCIPLES AND PRACTICAL METHODS OF ACCLIMATIZATION ARE DISCUSSED IN RELATION TO SEEDS, SEEDLINGS AND PLANTATION MAINTENANCE. JOJOBA NOT SPECIFICALLY MENTIONED.

OALS/SHRUBS/TREES/ISRAEL/ADAPTATION/ACCLIMATIZATION/ENVIRONMENTAL EFFECTS/PHYSIOLOGICAL ECOLOGY/STRESS(PHYSIOLOGY)/SURVIVAL/ VARIABILITY(ENVIRONMENTAL)/INTRODUCED SPECIES/MINIMUM TEMPERATURE/ TEMPERATURE RANGES/PRECIPITATION(ATMOSPHERIC) /DROUGHTS/PHENOLOGY/ ROOTS/LEAVES/STEMS/PLANT MORPHOLOGY/PLANT GROWTH/PLANTING MANAGEMENT/ PLANT INJURY/VARIABILITY(GENETIC)/SEEDLINGS

99

GREEN, T.G./HILDITCH, T.P./STAINSBY, W.J.

1936

THE SEED WAX OF SIMMONDSIA CALIFORNICA.

CHEMICAL SOCIETY, JOURNAL (2):1750-1755.

THE FATTY MATTER PRESENT IN THE SEEDS IS A MIXTURE OF WAX-ESTERS, AND NOT GLYCERIDES. DETAILED EXAMINATION OF THE ACID AND ALCOHOL COMPONENTS OF THE SEED-WAX HAS SHOWN THAT THESE ARE OF AN UNUSUAL NATURE. THE CHIEF ACID IS DELTA 11:12-EICOSENOIC, PROBABLY ACCOMPANIED BY SMALL QUANTITIES OF A HIGHER (POSSIBLY DOCOSENOIC) ACID AND OF OLEIC AND PALMITIC ACIDS. THE AMOUNT OF THE LATTER TWO ACIDS IS UNUSUALLY SMALL. A MIXTURE OF CARBON SUB 20 AND CARBON SUB 22 UNSATURATED ALCOHOLS FORMS THE ALKYL PORTION OF THE WAX ESTERS. SIMMONDSIA PRESENTS CERTAIN MORPHOLOGICAL ANOMALIES IN THE SEED. ALSO, THE CHEMICAL NATURE OF THE FATTY MATTER IS ABNORMAL BOTH IN ITS GENERAL CHARACTER OF A WAX-ESTER AND IN THE CONSTITUTION OF THE COMPONENT ACIDS AND ALCOHOLS OF THE SEED WAX.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/SEEDS/LIPIDS/ALCOHOLS/ORGANIC COMPOUNDS/ACIDS/ESTERS

100

GREENE, R.A./FOSTER, E.O.

1933

THE LIQUID WAX OF SEEDS OF SIMMONDSIA CALIFORNICA

BOTANICAL GAZETTE 94(4):826-828.

THE EXPRESSED OIL, WHICH WAS TRANSPARENT, A GOLDEN YELLOW COLOR, AND TASTELESS, WAS ANALYZED. IT WAS FOUND THAT, WITH THE EXCEPTION OF THE VALUE FOR THE SAPONIFICATION NUMBER, THE CONSTANTS OF THIS OIL ARE PRACTICALLY IDENTICAL WITH THOSE OF SPERM OIL AND ARCTIC SPERM OIL, WHICH ARE LIQUID WAXES. THE OIL SOLIDIFIES AT 10-12 DEGREES CENTIGRADE. QUALITATIVE TESTS INDICATE THAT THE WAX MIGHT CONSIST PRINCIPALLY OF FATTY ACID ESTERS OF DECYL ALCOHOL.

OALS/SIMMONDSIA CHINENSIS/SEEDS/LIQUID WAX/LIPIDS/SPERM WHALE OIL/ESTERS/ALCOHOLS

101

HAASE, E.F.

1973

RESEARCH NEEDS FOR NATIVE PLANTS. IN E.F. HAASE AND W.G. MCGINNIES, EDS., JOJOBA AND ITS USES; AN INTERNATIONAL CONFERENCE, JUNE 1972, P. 37-38.

UNIVERSITY OF ARIZONA, OFFICE OF ARID LANDS STUDIES, TUCSON. 81 P.

THREE GENERAL GOALS ARE SUGGESTED FOR A COMPREHENSIVE FIELD RESEARCH PROGRAM. THE FIRST IS TO IDENTIFY, MONITOR, AND DOCUMENT PHENOLOGICAL (CLIMATIC) RELATED PHENOMENA IN JOJOBA THROUGHOUT ITS DISTRIBUTIONAL RANGE. THE TYPES OF CHARACTERISTICS THAT COULD BE IMPORTANT ARE DISCUSSED. SEVERAL ASPECTS OF JOJOBA NATURAL HISTORY AND PHENOLOGY ARE PRESENTED AND RELATED TO CULTURAL PRACTICES. THE SECOND GOAL IS THE ESTABLISHEMENT OF A JOJOBA PLANT MATERIAL AND PLANT INFORMATION BANK. THE THIRD SUGGESTED GOAL IS THE MANIPULATION OF NATIVE PLANTS IN THEIR NATURAL ENVIRONMENTS IN ORDER TO ENHANCE JOJOBA SEED PRODUCTIVITY, I.E. SEASONAL IRRIGATION AND PRUNING. THIS COULD PROVIDE SEED IN LARGE QUANTITIES YEARS BEFORE ESTABLISHEMENT OF LARGE PLANTATIONS.

OALS/SIMMONDSIA CHINENSIS/NATURAL HISTORY/PHENOLOGY/VARIABILITY(GENETIC)/ENVIRONMENTAL EFFECTS/MICROENVIRONMENT/GENETICS/INFORMATION RETRIEVAL/PLANT ECOLOGY/IRRIGATION PRACTICES/CULTIVATION/PLANTING MANAGEMENT

102

HAASE, E.F./MCGINNIES, W.G.

1973 A

IMPROVING UTILIZATION OF NATIVE VEGETATION IN THE ARID ZONES.

AAAS-CONACYT MEXICO CITY MEETING, 25-27 JUNE 1973, UNPUBLISHED PAPER PRESENTED AT THE DESERTS AND ARID LANDS SYMPOSIUM.

THE FIRST SECTION REVIEWS THE HISTORY AND PAST UTILIZATION OF FLOODPLAIN VEGETATION. THE GILA RIVER, WHICH WAS A POPULAR TRANSCONTINENTAL ROUTE TO CALIFORNIA, IS USED TO ILLUSTRATE CHANGES CAUSED BY MAN S INFLUENCES. MANY OF THE RIPARIAN TREES WERE CUT, ONLY

TO BE REPLACED BY THE EXOTIC TAMARIX. THE BUILDING OF DAMS AND PUMPING OF GROUNDWATER FOR IRRIGATED AGRICULTURE ENCOURAGED THESE VEGETATION CHANGES. THE LARGE SCALE IRREVERSIBLE ENVIRONMENTAL CHANGES WHICH HAVE TAKEN PLACE IN THE PAST, COMBINED WITH THE GREAT ECONOMIC INVESTMENT IN IRRIGATED AGRICULTURE WHICH CURRENTLY EXISTS, SEVERELY LIMIT THE OPTIONS AVAILABLE FOR POTENTIAL UTILIZATION OF FLOODPLAIN VEGETATION ALONG THE LOWER GILA RIVER. AS OUR VALUES ON LAND UTILIZATION SHIFT THERE IS OBVIOUS IMPORTANCE IN THE PRESERVATION OF ECOLOGICAL DIVERSITY WHICH ALLOWS A WIDE RANGE OF FUTURE ECOLOGICAL OPTIONS, AND GREATLY REDUCES THE PROBABILITY OF UNANTICIPATED IRREVERSIBLE CHANGE. THE SECOND SECTION ATTEMPTS TO EVALUATE THE PAST AND POTENTIAL UTILIZATION OF THE NATIVE DESERT SHRUB JOJOBA IN THE CONTEXT OF THIS FRAMEWORK OF ARID LANDS UTILIZATION. THE UTILIZATION OF JOJOBA PROMISES ECONOMIC DEVELOPMENT WITH A MINIMUM OF DISTURBANCE TO THE SURROUNDING NATURAL ENVIRONMENT AND A POTENTIAL FOR SUCCESSFUL GROWTH IN A WIDE VARIETY OF HABITATS. THE PLANTS NATURAL HISTORY AND PAST UTILIZATION ARE OUTLINED. THE DISCOVERY OF LIQUID WAX IN THE SEEDS AND DEVELOPMENTS POINTING TO POSSIBLE INDUSTRIAL USES ARE REVIEWED. RECENT SUPPORT BY THE OFFICE OF ECONOMIC OPPORTUNITY FOR THE DEVELOPMENT OF AN INDIAN JOJOBA INDUSTRY IN THE SOUTHWESTERN UNITED STATES IS DISCUSSED. BOTH THE POSSIBILITY OF HARVESTING SEEDS FROM NATIVE PLANTS AND ESTABLISHING PLANTATIONS ARE EXPLORED. UTILIZATION OF JOJOBA FROM NATIVE STANDS OR FROM PLANTATIONS PROMISES A MINIMUM OF DISRUPTION TO THE SURROUNDING ENVIRONMENT, PRESERVING MUCH OF THE NATURAL ECOLOGICAL DIVERSITY AND STABILITY WHICH CHARACTERIZE ARID ZONE ECOSYSTEMS. THIS CONTRASTS WITH THE HISTORY OF MAJOR AND SOMETIMES IRREVERSIBLE ADVERSE ENVIRONMENTAL CHANGES ASSOCIATED WITH IRRIGATED FLOODPLAIN AGRICULTURE ALONG THE LOWER GILA RIVER IN SOUTHWESTERN ARIZONA.

OALS/SIMMONDSIA CHINENSIS/ENVIRONMENTAL EFFECTS/LAND USE/LAND MANAGEMENT/WATERSHEDS(BASINS)/RECREATION/ECONOMIC DEVELOPMENT/ PERTURBATION/VEGETATION CHANGE/RIPARIAN VEGETATION/TAMARIX/POPULUS/ TYPHA/PHREATOPHYTES/DAMS/GILA RIVER/ARID LANDS/ARIZONA/LIQUID WAX/ PLANT USES/ECOSYSTEMS/INDIANS OF NORTH AMERICA/NATIVE AMERICANS

103

HAASE, E.F./MCGINNIES, W.G. EDS

1973 B

JOJOBA AND ITS USES; AN INTERNATIONAL CONFERENCE, JUNE 1972.

UNIVERSITY OF ARIZONA, OFFICE OF ARID LAND STUDIES, TUCSON. 81 P.

THE PURPOSE OF THE FIRST INTERNATIONAL CONFERENCE ON JOJOBA, HELD IN TUCSON, ARIZONA, WAS TO BRING TOGETHER SCIENTISTS INTERESTED IN JOJOBA AND ITS POTENTIALITIES FOR PRODUCTION OF USEFUL PRODUCTS. THE CONFERENCE WAS AIMED TOWARD A FULL DISCUSSION OF AVILABLE INFORMATION ON PREVICUS INVESTIGATIONS ON THE PLANT ITSELF, ON CHEMISTRY OF THE SEED, UTILIZATION OF THE WAX CONTAINED IN THE SEED, PROBLEMS INVOLVED IN THE COLLECTION OF SEED AND PRODUCTION UNDER CULTIVATION. THIRTEEN PAPERS WERE DELIVERED. SEVERAL DEAL WITH RESEARCH NEEDS AND ONE SUMMARIZED THE POSITIVE FEELING OF THE CONFERENCE PARTICIPANTS AS TO JOJOBA S FUTURE AND THE DEVELOPMENT OF AN INDIAN JOJOBA INDUSTRY. THIS CONFERENCE, SPONSORED BY THE INDIAN DIVISION OF THE OFFICE OF ECONOMIC OPPORTUNITY AND THE OFFICE OF ARID LAND STUDIES OF THE UNIVERSITY OF ARIZONA, MARKS THE BEGINNING OF RENEWED INTEREST IN THE DEVELOPMENT OF JOJOBA, AND AN EFFORT TO TIE THIS TO IMPROVEMENT OF THE ECONOMIC WELFARE OF NATIVE AMERICANS IN THE SOUTHWESTERN UNITED STATES.

OALS/SIMMONDSIA CHINENSIS/NATIVE AMERICANS/ECONOMIC DEVELOPMENT/ APIZONA/LIQUID WAX/PLANT USES/PLANTING MANAGEMENT/SEEDS/NATURAL HISTORY/REVIEWS/INDIANS OF NORTH AMERICA

104

HALVORSON, W.L./PATTEN, D.T.

1974

SEASONAL WATER POTENTIAL CHANGES IN SONORAN DESERT SHRUBS IN RELATION TO TOPOGRAPHY.

ECOLOGY 55(1):173-177.

WATER POTENTIALS WERE DETERMINED BY USE OF A PRESSURE-BOMB AT A STUDY AREA NEAR CAVE CREEK, ARIZONA. SPECIAL ATTENTION WAS PAID TO RECORDING MAXIMUM AND MINIMUM POTENTIALS ON A SEASONAL BASIS AND DIURNAL FLUCTUATIONS DURING THE WETTEST AND DRIEST PERIODS OF THE YEAR. FRANSERIA DELTOIDEA DEVELOPED THE LOWEST POTENTIAL OF THE SHRUBS RECORDED AND ALSO SHOWED THE GREATEST DEGREE OF RESPONSE TO CHANGES IN SOIL MOISTURE ON A SEASONAL BASIS AND EVAPORATIVE POWER OF AIR ON A DIURNAL BASIS. OF THE OTHER SPECIES TESTED, ERIOGONUM FASCICULATUM SHOWED A HIGH DEGREE OF RESPONSE TO CHANGING CONDITIONS, LARREA TRIDENTATA, KRAMERIA GRAYI, AND SIMMONDSIA CHINENSIS SHOWED A MODERATE RESPONSE; AND CERCIDIUM MICROPHYLLUM SHOWED ONLY A SLIGHT RESPONSE TO DIURNAL OR SEASONAL CHANGES.

OALS/SIMMONDSIA CHINENSIS/MOISTURE STRESS/SOIL MOISTURE/SHRUBS / SEASONAL/SONORAN DESERT/ARIZONA/LARREA/CERCIDIUM/FRANSERIA/SOIL-WATER-PLANT RELATIONSHIPS/ELEVATION/PHYSIOLOGICAL ECOLOGY

105

HARRIS, J.A./LAWRENCE, J.V.

1916

THE CRYOSCOPIC CONSTANTS OF EXPRESSED VEGETABLE SAPS, AS RELATED TO LOCAL ENVIRONMENTAL CONDITIONS IN THE ARIZONA DESERTS.

PHYSIOLOGICAL RESEARCHES 2(1):1-49.

THE AUTHORS CONSIDER 5 LOCAL (TUCSON, ARIZONA) ENVIRONMENTS IN DETERMINING THEIR POSSIBLE RELATIONS TO THE PHYSICO-CHEMICAL PROPERTIES OF PLANT SAPS. THE FIVE TYPES ARE 1) THE FOOT-HILLS CANYONS, 2) CLIFFS OR LEDGES AND STEEPER ROCKY SLOPES, 3) THE BAJADA OR MESA-LIKE SLOPES, 4) THE ARROYO OR WASH, 5) SALT SPOTS. A WIDE VARIETY OF PLANTS WERE STUDIED, TREES AND SHRUBS, DWARF AND HALF-SHRUBS, PERENNIAL HERBS, AND WINTER ANNUALS. THE AUTHORS CONCLUDE THAT IN THE PLANT SPECIES OF THE ARIZONA DESERTS DIFFERENCES IN THE OSMOTIC CONCENTRATIONS OF THE SAP, AS DETERMINED BY THE DEPRESSION OF THE FREEZING POINT OF THE EXPRESSED JUICES, ARE ASSOCIATED WITH DIFFERENCES IN EDAPHIC CONDITIONS.

OALS/ARIZONA/ENVIRONMENTAL EFFECTS/OSMOTIC PRESSURE/PHYSIOLOGICAL ECOLOGY/PLANT CHEMISTRY/ADAPTATION/MICROENVIRONMENT /WATER BALANCE/ SIMMONDSIA CHINENSIS/TREES/SHRUBS/PERENNIALS/ANNUALS

106

HASTINGS, J.R./TURNER, R.M./WARREN, D.K.

1972

AN ATLAS OF SOME PLANT DISTRIBUTIONS IN THE SONORAN DESERT.

UNIVERSITY OF ARIZONA, TUCSON, INSTITUTE OF ATMOSPHERIC PHYSICS, TECHNICAL REPORTS ON THE METEOROLOGY AND CLIMATOLOGY OF ARID REGIONS 21. 255 P.

THIS REPORT IS A PRELIMINARY EDITION OF WHAT, IN TIME, WILL BE A MORE COMPLETE ATLAS SHOWING THE DISTRIBUTION OF THE MAJOR PERENNIAL PLANTS OF THE SONORAN DESERT. IT PRESENTS WHAT IS KNOWN OF THE RANGES OF 238 SPECIES, MOSTLY WOODY OR SUCCULENT. A DISTRIBUTION MAP OF LOCALITIES FOR SIMMONDSIA CHINENSIS IS PRESENTED ON PAGE 194.

OALS/SIMMONDSIA CHINENSIS/PLANT DISTRIBUTION/SONORAN DESERT/MAPS

107

HEDRICK, U.P. ED.

1919

STURTEVANT S NOTES ON EDIBLE PLANTS.

NEW YORK AGRICULTURAL EXPERIMENT STATION, ANNUAL REPORT, 27TH, VOL. 2, PT. 2. 686 P.

NOTES THAT THE FRUIT OF SIMMONDSIA CALIFORNICA CAN HARDLY BE TERMED PALATABLE, TASTING SOMEWHAT INTERMEDIATE BETWEEN THE FILBERT AND THE ACORN. IT IS EMPLOYED BY THE INDIANS AS AN ARTICLE OF DIET (P. 535).

OALS/SIMMONDSIA CHINENSIS/FOODS/PLANT USES/SEEDS/ETHNOBOTANY

108

HEGNAUER, R.

1964

CHEMOTAXONOMIE DER PFLANZEN. BAND 3, DICOTYLEDONEAE: ACANTHACEAE-CYRILLACEAE.

BIRKHAUSER VERLAG, BASEL UND STUTTGART. 743 P.

THE FAMILY BUXACEAE IS DESCRIBED AND THREE SUBFAMILIES RECOGNIZED, INCLUDING SIMMONDSIEAE. THE CHEMICAL NATURE OF THE LIQUID WAX FOUND IN THE SEEDS IS DESCRIBED FROM HILDITCH S WORK. NOTES THAT SINCE THIS WAX IS NOT ASSIMILATED BY MAN, IT COULD BE SUBSTITUTED FOR FATS AND OILS IN REDUCING DIETS.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/ORGANIC COMPOUNDS/PLANT USES/FOODS/BUXACEAE

109

HIGGINS, E.B.

1949

ANNOTATED DISTRIBUTIONAL LIST OF FERNS AND FLOWERING PLANTS OF SAN DIEGO COUNTY, CALIFORNIA.

SAN DIEGO SOCIETY OF NATURAL HISTORY, OCCASIONAL PAPER 8. 174 P.

THE DISTRIBUTION OF SIMMONDSIA CHINENSIS IS GIVEN FOR SAN DIEGO COUNTY (P. 86).

OALS/CALIFORNIA/SIMMONDSIA CHINENSIS/PLANT DISTRIBUTION

110

HILDITCH, T.P.

1964

THE CHEMICAL CONSTITUTION OF NATURAL FATS. 4TH ED.

WILEY, N.Y. 745 P.

PAGES 296-297 CONTAIN A BRIEF DESCRIPTION OF THE CHEMICAL COMPONENTS AND UNIQUE NATURE OF JOJOBA OIL.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/ORGANIC COMPOUNDS/ ALCOHOLS

111

HILL, A.F.

1952

ECONOMIC BOTANY: A TEXTBOOK OF USEFUL PLANTS AND PLANT PRODUCTS. 2ND ED.

MC GRAW HILL, NEW YORK. 560 P.

BRIEFLY MENTIONS THE POSSIBILITIES OF JOJOBA LIQUID WAX IN INDUSTRY, PAGE 208.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX

112

HINDS, W.E.

1949

PENICILLIN PRODUCT.

UNITED STATES PATENT 2,487,336, NOVEMBER 8, 1949.

AN OBJECT OF THE PRESENT INVENTION IS TO PROVIDE A PENICILLIN PRODUCT CONTAINING A STABLE, NON-TOXIC, PROTECTIVE CARRIER FOR THE PENICILLIN, WHICH CAN BE ADMINISTERED EITHER ORALLY OR HYPODERMICALLY. THE CARRIER SHOULD PROTECT THE PENICILLIN FROM THE DESTRUCTIVE AND INACTIVATING ACTION OF THE STOMACH FLUIDS AND FACILITATE THE TRANSMISSION OF THE PENICILLIN OVER TO THE SMALL INTESTINE WHERE IT CAN BE MORE READILY PICKED UP BY THE BLOOD AND ASSIMILATED INTO THE SYSTEM. UPON HYPODERMIC INJECTION THE PRODUCT SHOULD BE READILY ABSORBED INTO THE BLOODSTREAM WITHOUT UNDUE DAMAGE TO THE TISSUE. JOJOBA OIL, EITHER IN ITS LIQUID WAX STATE OR HYDROGENATED FORM, PROVIDES A SUITABLE CARRIER OF PENICILLIN AND MAY BE COMBINED WITH OTHER COMPOUNDS. THE PATENT COVERS OTHER NATURAL OR SYNTHETIC LIQUID WAXES.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/PLANT SUBSTANCES/PLANT USES/PATENTS/MEDICINAL PLANTS

113

HODGE, W.H.

1955

SOME NEW OR NOTEWORTHY INDUSTRIAL RAW MATERIALS OF PLANT ORIGIN.

ECONOMIC BOTANY 9(2):99-107.

IN THIS SELECTIVE REVIEW OF SURVEYS MADE BY THE GEORGIA INSTITUTE OF TECHNOLOGY, ATTENTION IS DRAWN TO SOME NEW OR AS YET LITTLE-EXPLOITED SOURCES OF FATS, OILS, WAXES, GUMS, RESINS AND OLEORESINS THAT MAY SOME DAY BECOME IMPORTANT SUPPLEMENTS TO THE LONGER ESTABLISHED SOURCES OF THESE INDUSTRIALLY VALUABLE PLANT EXTRACTIVES. A BRIEF DISCUSSION POINTS OUT THE INDUSTRIAL POSSIBILITIES OF JOJOBA.

OALS/SIMMONDSIA CHINENSIS/PLANT SUBSTANCES/LIPIDS/ORGANIC COMPOUNDS/ LIQUID WAX

114

HODGE, W.H.

1961

JOJOBA-AN OVERLOOKED ORNAMENTAL SHRUB OF THE ARID SOUTHWEST.

AMERICAN HORTICULTURAL MAGAZINE 40(4):346-347.

THE AUTHOR SUGGESTS THAT JOJOBA HAS GREAT POTENTIAL AS AN ORNAMENTAL PLANT. HE NOTES THAT IT IS A MEMBER OF THE BOX FAMILY, AND SEES IT AS A SOUTHWESTERN SUBSTITUTE FOR THE BOX. THE LOW GROWTH FORM SHOULD FIT IN WELL WITH RANCH-TYPE HOMES WHICH ARE SO WIDESPREAD IN THE SOUTHWEST, WHILE THE DROUGHT-RESISTANT NATURE OF THE PLANT INDICATES THAT IT SHOULD THRIVE WITH A MINIMUM OF WATERING.

OALS/SIMMONDSIA CHINENSIS/ORNAMENTAL PLANTS/DESERT PLANTS/DROUGHT TOLERANCE/SOUTHWEST U.S.

115

HOOKER, J.D./JACKSON, B.D.

1906 - 1910

INDEX KEWENSIS. SUPPLEMENTUM IV.

CLARENDON PRESS, OXFORD.

RECOGNITION IS GIVEN TO THE NAMES SIMMONDSIA CHINENSIS NUTT. AND SIMMONDSIA CHRYSOPHYLLA HORT. EX GENTIL, PL. CULT. SERRES JARD. BOT. BRUX. 177 (1907), NOMEN.-HAB. (P. 221).

OALS/SIMMONDSIA/SIMMONDSIA CHINENSIS/SYSTEMATICS

116

HOPKINS, C.Y.

1946

THE FATTY ACIDS OF HARE S EAR MUSTARD SEED OIL.

CANADIAN JOURNAL OF RESEARCH, BOTANY 24:211-220.

THE FATTY OIL OF CONRINGIA ORIENTALIS L. WAS EXAMINED. CONSTANTS OF THE OIL WERE DETERMINED AND A PARTIAL SEPARATION OF THE FATTY ACIDS WAS CARRIED OUT BY THE METHYL ESTER FRACTIONATION METHOD. PALMITIC, OLEIC, LENOLEIC, EICOSENOIC, ERUCIC, AND LIGNOCERIC ACIDS WERE IDENTIFIED. ERUCIC ACID WAS FOUND TO BE PRESENT IN LARGEST AMOUNTS. THE OIL RESEMBLES RAPESEED AND OTHER CRUCIFERAE SEED OILS IN THIS RESPECT, BUT DIFFERS IN THE PRESENCE OF EICOSENOIC ACID. THE AUTHOR HAS NOT FOUND ANY PREVIOUS REPORT OF THIS ACID IN VEGETABLE OILS. HOWEVER, IT HAS BEEN ISOLATED FROM THE VEGETABLE WAX FROM THE SEEDS OF SIMMONDSIA CHINENSIS.

OALS/LIPIDS/ORGANIC COMPOUNDS/PLANT SUBSTANCES/SIMMONDSIA CHINENSIS/CRUCIFERAE/ACIDS

117

HOPKINS, C.Y./CHISHOLM, M.J./HARRIS, J.

1949

N-EICOS-11-ENOIC ACID.

CANADIAN JOURNAL OF RESEARCH, B, 27:35-41.

NATURAL SOURCES OF CIS-N-EICOS-11-ENOIC ACID, A CONVENIENT METHOD OF ISOLATING THE ACID, AND ITS CONVERSION TO THE TRANS-FORM ARE DESCRIBED. SPECIMENS OF EICOSENOIC ACID WERE PREPARED FROM JOJOBA, HARE S-EAR MUSTARD SEED, AND COD LIVER OIL. JOJOBA SEED IS THE MOST CONVENIENT SOURCE. CARE MUST BE TAKEN TO REMOVE COMPLETELY THE LONG-CHAIN ALCOHOLS WHICH ARE NOT EASY TO SEPARATE FROM THE FATTY ACIDS BY THE ORDINARY PROCEDURES. A METHOD IS DESCRIBED. A NUMBER OF DERIVATIVES ARE REPORTED. SOME NEW PHYSICAL CONSTANTS OF THE CIS-ACID AND ITS METHYL ESTER ARE GIVEN.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/PLANT SUBSTANCES/ORGANIC COMPOUNDS/LIPIDS/ACIDS/ALCOHOLS

118

HOWES, F.N.

1948

NUTS: THEIR PRODUCTION AND EVERYDAY USES.

FABER AND FABER, LONDON. 264 P.

JAJOBA [SIC] NUT (SIMMONDSIA CALIFORNICA) IS A LOW-GROWING EVERGREEN SHRUB (P. 221), WHOSE KERNELS ARE EATEN IN CALIFORNIA. DRIED AND GROUND, THEN MIXED WITH SUGAR AND WATER, THEY SERVE AS A BEVERAGE. SOME SAY THEY HAVE A NAUSEOUS AFTER-TASTE AND ARE APT TO CAUSE PURGING.

OALS/SIMMONDSIA CHINENSIS/CALIFORNIA/FOODS/TOXICITY/SEEDS/ PALATABILITY

119

HUEY, L.M.

1945

THE POCKET GOPHERS OF BAJA CALIFORNIA, MEXICO, WITH DESCRIPTIONS OF NINE NEW FORMS.

SAN DIEGO SOCIETY OF NATURAL HISTORY, TRANSACTIONS 10(14):245-268.

THE BIOGEOGRAPHY OF GOPHER DISTRIBUTION IN BAJA CALIFORNIA IS OUTLINED. 24 SUBSPECIES OF THOMOMYS BOTTAE ARE RECOGNIZED, SOME NEW, INCLUDING ONE NAMED JOJOBAE AFTER THE PLANT SIMMONDSIA CHINENSIS, JOJOBA.

OALS/BAJA CALIFORNIA/SYSTEMATICS/BIOGEOGRAPHY/MAMMALS/THOMOMYS/ RODENTS

120

HUTCHINSON, J.

1967

THE GENERA OF FLOWERING PLANTS: (ANGIOSPERMAE) BASED PRINCIPALLY ON THE GENERA PLANTARUM OF G. BENTHAM AND J.D. HOOKER. DICOTYLEDONES, V. 2.

CLARENDON PRESS, OXFORD. 659 P.

THE FAMILY BUXACEAE (P. 105-109) IS TREATED IN THE ORDER HAMAMELIDALES. THE ECONOMIC PROPERTIES, PHYLOGENY, MORPHOLOGY AND GEOGRAPHIC DISTRIBUTION OF THE FAMILY ARE EACH DISCUSSED. THERE IS A KEY TO THE FIVE GENERA STYLOCERAS, SIMMONDSIA, SARCOCOCCA, BUXUS AND PACHYSANDRA. EACH GENUS IS BOTANICALLY DESCRIBED.

OALS/SIMMONDSIA CHINENSIS/SYSTEMATICS/PLANT MORPHOLOGY/PHYTOGEOGRAPHY /PLANT USES/SIMMONDSIA/BUXACEAE

121

IVANOV, S.

1929

THE SOLID VEGETABLE OILS.

MASLOBOINO-ZHIROVOE DELO 1:32-34.

THE SEEDS OF SIMMONDSIA CALIFORNICA (FROM MEXICO) CONTAIN 6.9 PERCENT MOISTURE AND 44.5 PERCENT SOLID OIL, ACIDITY 5.4, SAPONIFICIATION NO. 165.7, IODINE NO. 79.3-80.2, D SUB 25 0.8990.

OALS/SIMMONDSIA CHINENSIS/SEEDS/LIQUID WAX/LIPIDS/ORGANIC COMPOUNDS

122

JAMIESON, G.S.

1943

VEGETABLE FATS AND OILS, THEIR CHEMISTRY, PRODUCTION, AND UTILIZATION FOR EDIBLE, MEDICINAL AND TECHNICAL PURPOSES.

REINHOLD, NEW YORK. 508 P.

INCLUDES A SHORT SECTION DESCRIBING THE NATURAL HISTORY OF THE JOJOBA PLANT AND THE DISCOVERY THAT THE SEEDS CONTAIN A LIQUID WAX. DATA ON THE CHEMICAL AND PHYSICAL NATURE OF THE JOJOBA OIL ARE GIVEN. A FEW POSSIBLE USES ARE SUGGESTED (P. 88-89).

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/ORGANIC COMPOUNDS/PLANT SUBSTANCES/LIPIDS/PLANT USES

123

JEPSON, W.L.

1966

A MANUAL OF THE FLOWERING PLANTS OF CALIFORNIA.

UNIVERSITY OF CALIFORNIA PRESS, BERKELEY AND LOS ANGELES. 1238 P. (A REPRINT OF THE 1925 EDITION).

PAGES 606-607 HAVE A SHORT BOTANICAL DESCRIPTION OF THE PLANT JOJOBA.

OALS/CALIFORNIA/SIMMONDSIA CHINENSIS

124

JOHNSON, R.

1957

THE ROUNDUP: JOJOBA.

ARIZONA FARMER-RANCHMAN 36(8):5.

REPORTS THAT INTEREST IN JOJOBA FARMING HAS BEEN REINITIATED. ALSO RECALLS THE EARLY ATTEMPTS AT CULTIVATION DURING THE 1940 S IN ARIZONA.

OALS/ARIZONA/SIMMONDSIA CHINENSIS/CULTIVATION

125

JOHNSTON, I.M.

1924

EXPEDITION OF THE CALIFORNIA ACADEMY OF SCIENCES TO THE GULF OF CALIFORNIA IN 1921. THE BOTANY (THE VASCULAR PLANTS).

CALIFORNIA ACADEMY OF SCIENCES, PROCEEDINGS, 4TH SER., 12(30):951-1218.

NOTES LOCALITIES WHERE JOJOBA WAS COLLECTED ON GULF ISLANDS, BAJA CALIFORNIA, AND COASTAL SONORA. REVIEWS STATUS OF SPECIES NAME, ACCEPTING SIMMONDSIA CHINENSIS OVER S. CALIFORNICA (P. 1077-1078).

OALS/SIMMONDSIA CHINENSIS/GULF OF CALIFORNIA/MEXICO/SONORA/BAJA CALIFORNIA/SYSTEMATICS/ISLANDS/PLANT DISTRIBUTION/ISLANDS

126

JOJOBA HAPPENINGS

1972 -

JOJOBA HAPPENINGS, NO. 1, JULY 1972-.

UNIVERSITY OF ARIZONA, OFFICE OF ARID LANDS STUDIES.

THIS NEWSLETTER, ISSUED IRREGULARLY, GREW OUT OF RECOMMENDATIONS AT THE 1972 INTERNATIONAL JOJOBA CONFERENCE IN TUCSON. ITS AIM IS TO COMMUNICATE INFORMATION AND NOTICES ON ACTIVITIES RELATING TO JOJOBA AND ITS ECONOMIC DEVELOPMENT. THE 1972 HARVEST OF JOJOBA SEED ON INDIAN RESERVATIONS IN CALIFORNIA AND ARIZONA RECEIVES CONSIDERABLE TREATMENT, AS DOES THE PROCESSING OF THESE SEED FOR THE EXTRACTION OF LIQUID WAX. NUMEROUS NOTES OF RESEARCH ACTIVITIES, SUGGESTIONS, AND DEVELOPMENTS ARE PRESENTED. PROJECTS AT THE SAN CARLOS APACHE RESERVATION, THE UNIVERSITY OF ARIZONA, AND THE UNIVERSITY OF CALIFORNIA AT RIVERSIDE ARE REPORTED.

OALS/SIMMONDSIA CHINENSIS/ECONOMIC DEVELOPMENT/REVIEWS

127

JONES, M.A./KNOEPFLER, N.B.

1957

WAX USES OF DESERT SHRUB, JOJOBA, SUBJECT OF PROMISING STUDY.

CHEMURGIC DIGEST 16(1):5-6, 11.

UTILIZATION OF JOJOBA OIL AS A SUBSTITUTE OR REPLACEMENT FOR IMPORTED OILS SUCH AS CARNAUBA OR WHALE OIL IS DISCUSSED. ITS UNUSUAL CHEMICAL QUALITIES AND POSSIBLE USES ARE EXPLORED. IT COULD BE USED AS A LUBRICANT IN THE FOOD INDUSTRY. THE CHARACTERISTICS AND CULTIVATION PROBLEMS OF THE PLANT ARE UNDER INVESTIGATION BY THE U.S. DEPARTMENT OF AGRICULTURE.

OALS/SIMMONDSIA CHINENSIS/LIPIDS/ORGANIC COMPOUNDS/CULTIVATION/ ALCOHOLS/PLANT USES/PLANT SUBSTANCES/SPERM WHALE OIL

128

JONES, Q.

1973

OUTLINES OF A RESEARCH AND TRAINING PROGRAM ON JOJOBA. IN E.F. HAASE AND W.G. MCGINNIES, EDS., JOJOBA AND ITS USES: AN INTERNATIONAL CONFERENCE, JUNE 1972, P. 29-32.

UNIVERSITY OF ARIZONA, OFFICE OF ARID LANDS STUDIES, TUCSON. 81 P.

BASED ON HIS LONG EXPERIENCE IN WORKING WITH NEW CROPS, THE AUTHOR HAS PROPOSED AN OUTLINE OF A THREE-PRONGED PROGRAM FOR THE DEVELOPMENT OF JOJOBA: 1) ADDITIONAL INVESTIGATIONS OF FIELD RESEARCH ARE NECESSARY TO INSURE THAT A WIDE BASE OF GERM PLASM IS AT HAND AND PLANT RESPONSES TO VARIOUS CONDITIONS ARE UNDERSTOOD. 2) A VARIETY OF LABORATORY, GREENHOUSE, AND EXPERIMENTAL GARDEN STUDIES WILL BE NEEDED AND IT WILL BE IMPORTANT TO TRAIN PEOPLE FOR THIS AREA, AND 3) ALL AVENUES OF PROCESSING AND END-USE RESEARCH MUST BE FOLLOWED IF JOJOBA IS TO BECOME A COMMERCIALLY CULTIVATED PLANT. NOT ONLY THE OIL, BUT BY-PRODUCTS, SUCH AS THE LEAVES AND TWIGS WHICH CONTAIN AN ANTICANCER COMPOUND, MUST BE EXPERIMENTED WITH.

OALS/SIMMONDSIA CHINENSIS /MEDICINAL PLANTS/PLANT USES/CULTIVATION/ NATURAL HISTORY/ECONOMIC DEVELOPMENT/VARIABILITY(GENETIC)/GENETICS/ PLANTING MANAGEMENT

129

JONES, Q./EARLE, F.R.

1966

CHEMICAL ANALYSIS OF SEEDS. II: OIL AND PROTEIN CONTENT OF 759 SPECIES.

ECONOMIC BOTANY 20(2):127-155.

THIS REPORT PRESENTS DATA REPRESENTING 32 ORDERS, 103 FAMILIES, 465 GENERA AND 759 SPECIES OF SEED PLANTS. DATA ON THE FOLLOWING ARE PRESENTED IN TABULAR FORM: PERCENT OF PROTEIN, PERCENT OF OIL, STARCH TEST, ALKALOID TEST, TANNIN TEST, CARBON-18 ACID, HALPHEN TEST, AND INFRARED ANALYSIS. CERTAIN TRENDS AS TO PERCENT PROTEIN, PERCENT OIL AND SEED SIZE WERE FOUND IN THE FAMILY LEGUMINOSAE. (JOJOBA IS PLANT NO. 593 IN THE TABLE).

OALS/SEEDS/ORGANIC COMPOUNDS/LIPIDS/PROTEINS/CARBOHYDRATES/ LEGUMINOSAE/SIMMONDSIA CHINENSIS

130

KEARNEY, T.H./PEEBLES, R.H.

1960

ARIZONA FLORA.

UNIVERSITY OF CALIFORNIA PRESS, BERKELEY AND LOS ANGELES. 1085 P.

PAGE 521 CONTAINS A BRIEF ACCOUNT OF THE ONLY NATIVE SPECIES OF THE FAMILY BUXACEAE, SIMMONDSIA CHINENSIS.

OALS/ARIZONA/SIMMONDSIA CHINENSIS

131

KELLOGG, A.

1859

DESCRIPTIONS OF NEW PLANTS FROM CERROS ISLAND: RHAMNUS INSULUS, SIMMONDSIA PABULOSA, DELPHINIUM FLAMMEUM.

CALIFORNIA ACADEMY OF SCIENCES, PROCEEDINGS 2:20-22.

THE HABIT AND HABITAT OF JOJOBA ARE DESCRIBED. UTILIZATION OF THE FOLIAGE AND SEEDS BY DEER AND GOATS IS EXTENSIVE. A DETAILED BOTANICAL DESCRIPTION OF JOJOBA IS PROVIDED. (THE NAME SIMMONDSIA PABULOSA HAS SINCE BEEN PUT INTO SYNONYM). THE DESCRIPTION OF SIMMONDSIA PABULOSA WAS REPRINTED AS THE CALIFORNIA GOAT NUT, IN HESPERIAN 5(3):392-393, ILLUS., 1860, WITH AN ADDITIONAL NOTE BY VEATCH. THE ILLUSTRATION IS LABELED GALPHIMIA PABULOSA.

OALS/SIMMONDSIA CHINENSIS/SYSTEMATICS/FOOD HABITS/BAJA CALIFORNIA/ GULF OF CALIFORNIA/ISLANDS

132

KELSEY, H.P./DAYTON, W.A.

1942

STANDARIZED PLANT NAMES. 2ND ED.

MCFARLAND CO., HARRISBURG, PA., FOR AMERICAN JOINT COMMITTEE ON HORTICULTURAL NOMENCLATURE. 677 P.

ON PAGE 588 UNDER SIMMONDSIA CHINENSIS: UNTIL COMPARATIVELY RECENTLY THIS COMMON AND IMPORTANT SOUTHWESTERN SHRUB WAS UNIVERSALLY KNOWN AS SIMMONDSIA CALIFORNICA. THE SCIENTIFIC NAME NOW APPROVED UNDER INTERNATIONAL RULES, S. CHINENSIS, IS PATENTLY PREPOSTEROUS, THE PLANT HAVING NOTHING TO DO WITH CHINA. THE EDITORIAL COMMITTEE FEELS THAT COMMON SENSE, AS WELL AS TECHNICAL RULES OF PRECEDENCE, SHOULD ENTER INTO BOTANICAL (AS WELL AS OTHER) LEGISLATION AND THAT, IF NECESSARY, A LIST OF CONSERVED SPECIES NAMES SHOULD BE MADE.

OALS/SIMMONDSIA CHINENSIS/SYSTEMATICS

133

KESTER, E.B.

1949

MINOR OIL-PRODUCING CROPS OF THE UNITED STATES.

AMERICAN OIL CHEMISTS SOCIETY, JOURNAL 26:65-83.

ACTUAL AND POTENTTAL VEGETABLE OIL SOURCES ARE DISCUSSED UNDER THE FOLLOWING CLASSIFICATION: PIT AND NUT OILS, FRUIT PULP OILS, SEED OILS, SEEDS OF FRUITS, SEEDS OF VEGETABLES AND OTHER DOMESTIC PLANTS, SEEDS OF WILD PLANTS. DATA ARE PRESENTED ON PERCENT OIL, COSTS, AREAS OF GROWTH, EXTRACTION PROCESSES, ECONOMIC CLIMATE, CURRENT AND POSSIBLE PRODUCTION, USE OF WASTES, ETC. JOJOBA IS NOTED AS A POTENTIALLY VERY USEFUL WILD SOURCE (P. 75-76). INCLUDES AN EXTENSIVE BIBLIOGRAPHY.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/CROP PRODUCTION/PLANT SUBSTANCES/SEEDS/SEED PRODUCTION/BIBLIOGRAPHIES

134

KESTER, E.B.

1951

MINOR OIL-PRODUCING CROPS OF THE UNITED STATES.

ECONOMIC BOTANY 5(1):38-59.

DISCUSSES THE OIL PRODUCING POTENTIAL OF VARIOUS CROPS SUCH AS THE PITS AND NUTS OF ALMOND, PERSIAN WALNUT, PECAN, FULBERT, TUNG, APRICOT, PRUNE, PEACH, CHERRY, AND PLUM; THE FRUIT PULP OF AVOCADO AND OLIVE; AND THE SEEDS OF CITRUS FRUITS, GRAPE, APPLE, PEAR, CRANBERRY, TOMATO, AND NUMEROUS OTHER DOMESTICALLY CULTIVATED PLANTS. SOME WILD PLANTS ARE ALSO TREATED, INCLUDING JOJOBA.

OALS/PLANT SUBSTANCES/PLANT USES/SEEDS/LIPIDS/LIQUID WAX/SIMMONDSIA CHINENSIS/SEED PRODUCTION/ORGANIC WASTES

135

KIRK, D.R.

1970

WILD EDIBLE PLANTS OF THE WESTERN UNITED STATES.

NATUREGRAPH PUBLISHERS, HEALDSBURG, CALIFORNIA. 326 P.

STATES THAT THE SEEDS CONTAIN A NUTRITIOUS OIL [SIC] AND THAT THEIR BITTER FLAVOR IS DUE TO TANNIN. DESCRIBES THE PREPARATION OF A COFFEE SUBSTITUTE FROM THE NUTS. STATES THAT THE OIL WAS USED IN THE MANUFACTURE OF HAIR OIL, AS A SUBSTITUTE FOR BEESWAX, IN ELECTRICAL INSULATION, VARNISHES, AND PHONOGRAPH RECORDS (P. 266-267).

OALS/SIMMONDSIA CHINENSIS/FOODS/PLANT USES/LIQUID WAX

136

KNIGHT, H.G.

1936

[JOJOBA] IN

U.S. DEPARTMENT OF AGRICULTURE, BUREAU OF CHEMISTRY AND SOILS, ANNUAL REPORT. 50 P.

PAGE 27: SEEDS OF THE PLANT SIMMONDSIA CALIFORNICA, WHICH WERE OFFERED TO THE EDIBLE-OIL SEED CRUSHERS DURING THE YEAR, WERE FOUND TO CONTAIN OVER 51 PERCENT OF LIGHT YELLOW OIL. HOWEVER, THE HIGH PROPORTION OF UNSAPONIFIABLE CONSTITUENTS, 48.3 PERCENT, INDICATED THAT THE OIL WOULD NOT BE SUITABLE FOR FOOD PURPOSES; ALSO THAT IT WOULD NOT BE OF ANY INTEREST TO MANUFACTURERS OF SOAP OR PRODUCTS MADE WITH DRYING OILS.

OALS/SIMMONDSIA CHINENSIS/LIPIDS/LIQUID WAX/PLANT USES/PLANT SUBSTANCES/MECHANICAL EXTRACTION

137

KNIGHT, H.G.

1937

OIL, FAT, AND WAX INVESTIGATION, LIQUID WAX FROM JOJOBA SEEDS. IN

U.S. DEPARTMENT OF AGRICULTURE, BUREAU OF CHEMISTRY AND SOILS, ANNUAL REPORT. 54 P.

COMPREHENSIVE STUDY DURING THE YEAR REVEALED THAT THE OIL OF JOJOBA SEEDS IS A LIQUID WAX, LIKE THAT OBTAINED FROM THE SPERM WHALE. IT CONSISTS ESSENTIALLY OF ESTERS OF UNSATURATED ALCOHOLS AND UNSATURATED FATTY ACIDS. ITS PHYSICAL AND CHEMICAL CHARACTERISTICS ARE LISTED. THIS BRIEF REPORT OUTLINES DEVELOPMENTS WITH JOJOBA FOR THE YEAR TREATED AND STATES THAT USES OF THIS UNIQUE PRODUCT REMAIN TO BE DISCOVERED.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/PLANT SUBSTANCES/ESTERS/ALCOHOLS/ACIDS

138

KNIPE, T.

195-

THE JAVELINA IN ARIZONA. A RESEARCH AND MANAGEMENT STUDY.

ARIZONA GAME AND FISH DEPARTMENT, PHOENIX, WILDLIFE BULLETIN 2. 96 P.

ACORNS, MANZANITA BERRIES, PINYON NUTS, MESQUITE BEANS, AND JOJOBA SEEDS ARE UTILIZED WHEN IN SEASON BY JAVELINA. JOJOBA BERRIES AND MESQUITE BEANS ARE TWO MAJOR MAST CROPS IN JAVELINA HABITAT. HOWEVER, THE JOJOBA SEED CROP IS EVEN LESS DEPENDABLE THAN THE ACORN CROP (P. 40-41).

OALS/SIMMONDSIA CHINENSIS/FOOD HABITS/PECARI TAJACU/SEEDS

139

KNOEPFLER, N.B./VIX, H.L.E.

1958

REVIEW OF CHEMISTRY AND RESEARCH POTENTIAL OF SIMMONDSIA CHINENSIS (JOJOBA) OIL.

JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY 6(2):118-121.

THE KNOWN CHEMISTRY AND RESEARCH POTENTIAL IS SUMMARIZED. CURRENT INTEREST STEMS FROM THE FACT THAT IMPORTATION FIGURES FOR 1951-1955 SHOW THE UNITED STATES TO BE DEPENDENT ON FOREIGN SOURCES OF PLANT WAX. PRELIMINARY INDUSTRIAL EVALUATIONS OF JOJOBA OIL AND THE HYDROGENATED WAX ARE DISCUSSED. RESULTS OF EVALUATIONS BY ELEVEN COMPANIES POINT OUT THE GOOD AND BAD PROPERTIES THE WAX POSSESSES FOR USE IN A WIDE VARIETY OF PRODUCTS.

OALS/SIMMONDSIA CHINENSIS/SEEDS/LIPIDS/ALCOHOLS/LIQUID WAX/ORGANIC COMPOUNDS/PLANT USES/PLANT SUBSTANCES

140

KNOEPFLER, N.B. ET AL

1959

A COMPARISON OF SIX SOLVENTS FOR THE EXTRACTION OF JOJOBA SEED.

AMERICAN OIL CHEMISTS SOCIETY, JOURNAL 36(12):644-648.

PRESENTS DATA SHOWING THE EFFECT OF SOLVENTS ON THE YIELD AND PROPERTIES OF THE LIQUID WAX FROM SIMMONDSIA, AND THE SUBSEQUENT EFFECT OF EACH SOLVENT UPON THE CHARACTERISTICS OF THE HYDROGENATED WAXES OBTAINED FROM THE LIQUID WAX. SOXHLET TYPE EXTRACTIONS WERE COMPARED TO COLD-HYDRAULIC PRESSING. SO FAR AS OIL YIELD IS CONCERNED, CARBON TETRACHLORIDE, BENZENE, HEPTANE, AND HEXANE ALL

EXTRACTED SUBSTANTIALLY THE SAME AMOUNTS. ISOPROPYL ALCOHOL EXTRACTED MORE MATERIAL, BUT UNDESIRABLE PRECIPITATES FORMED ON COOLING. THE WAXES FROM THE TETRACHLOROETHYLENE AND HEXANE EXTRACTIONS HAD THE LOWEST DENSITY VALUE AND THE WAX FROM ISOPROPYL ALCOHOL THE HIGHEST. ALL WAXES DEVELOPED A PRECIPITATE AFTER 7-10 DAYS. HYDROGENATION OF CLEAR FRACTIONS AND PRECIPITATE CONTAINING FRACTIONS OF THESE LIQUID WAXES SHOWED THAT THE PRECIPITATE HAD NO APPARENT EFFECT UPON THE MELTING POINT OR HARDNESS OF THE RESULTING WAX.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/ORGANIC COMPOUNDS/SOLVENT EXTRACTION/HYDROGENATION/MECHANICAL EXTRACTION

141

KROCHMAL, A. ET AL

1954

USEFUL NATIVE PLANTS IN THE AMERICAN SOUTHWESTERN DESERTS.

ECONOMIC BOTANY 8(1):3-28.

ATTEMPTS TO UTILIZE THE FOLLOWING PLANTS ARE DISCUSSED: YUCCA, CREOSOTE BUSH, CACTUS, AGAVES, MESQUITE, CANDELILLA, BEAR GRASS, CUCURBITS, DEVIL S CLAW, JOJOBA, AND CANAIGRE. A MAJOR PORTION OF THE PAPER CONSISTS OF ANNOTATED LISTS OF PLANTS IDENTIFIED FOR USE UNDER THE FOLLOWING CATAGORIES: DRUGS; FOODS, FLAVORINGS, SEASONINGS; FIBERS; GUMS AND RESINS; INSECTICIDES; OILS; ESSENTIAL OILS; PIGMENTS; LATEX; SAPONINS; TANNINS; WAXES.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/SOUTHWEST U.S./DESERT PLANTS/XEROPHYTES/PLANT USES/LARREA/YUCCA/OPUNTIA/AGAVE/PROSOPIS/ NOLINA/CUCURBITA/MEDICINAL PLANTS/FOODS/FIBER PLANTS/PLANT SUBSTANCES

142

KRONER, A.A.

1951

WHAT REPLACEMENTS FOR CARNAUBA WAX.

SOAP AND SANITARY CHEMICALS 27(3):110-113, 133.

BECAUSE OF RISING COSTS AND LIMITED SUPPLIES OF CARNAUBA WAX, RESEARCH CHEMISTS ARE SEARCHING FOR SUBSTITUTES. CHEMICAL AND PHYSICAL CONSTANTS FOR FIVE KINDS OF WAXES AVAILABLE AS SUBSTITUTES ARE GIVEN: ANIMAL, VEGETABLE, SYNTHETIC, PETROLEUM, AND COMPOSITION WAXES. THEIR VALUES AS REPLACEMENTS FOR CARNAUBA ARE DISCUSSED. JOJOBA LIQUID WAX IS NOT CONSIDERED.

OALS/LIPIDS/PLANT SUBSTANCES/PLANT USES/LIQUID WAX

143

KURTZ, E.B., JR.

1950

THE RELATION OF THE CHARACTERISTICS AND YIELD OF WAX TO PLANT AGE.

PLANT PHYSIOLOGY 25:269-278.

THIRTEEN SPECIES OF THE FOLLOWING GENERA WERE STUDIED: PHRAGMITES, ACACIA, OLNEYA, ASCLEPIAS, BELOPERONE, BACCHARIS, APLOPAPPUS, SORGHUM, AND PHOENIX. CHEMICAL CHARACTERIZATION OF THE WAX AND NON-WAX FRACTIONS WAS ACCOMPLISHED BY DETERMINING THE ACID, SAPONIFICATION, ESTER, AND WIJS IODINE NUMBERS. IN MOST CASES YIELD CHANGE WITH AGE WAS RELATED TO CUTICLE THICKNESS. THE WAX MELTING POINT USUALLY REMAINED UNCHANGED OR INCREASED SLIGHTLY WITH AGE. THE IODINE NUMBER OF THE WAX FRACTION USUALLY DECREASED WITH AGE. THE WAX ACID NUMBER FROM THE YOUNGEST MATERIAL WAS HIGHER THAN THAT FROM THE OLDER MATERIAL. THE AMOUNT OF WAX ESTERS AND ACIDS AND NON-WAX ESTERS INCREASED WITH AGE. IT WAS CONSIDERED THAT THIS MIGHT BE CORRELATED WITH THE DECREASE OR MAINTENANCE OF THE NON-WAX ACID CONCENTRATION AS THE PLANT MATURED. THE DIVERGENCE FROM THE GENERAL TRENDS OF THE RESULTS OF THE STAMINATE AND PISTILLATE PLANTS OF BACCHARIS SAROTHROIDES WAS BELIEVED TO BE ASSOCIATED WITH A SEXUAL FACTOR.

OALS/ARIZONA/ORGANIC COMPOUNDS/DESERT PLANTS/LEAVES/CUTICLE/AGE/PLANT GROWTH/PLANT CHEMISTRY/LIPIDS/ACACIA/OLNEYA/APLOPAPPUS/SORGHUM/ BACCHARIS/PALMS/PLANT SUBSTANCES

144

KURTZ, E.B., JR.

1958

A SURVEY OF SOME PLANT WAXES OF SOUTHERN ARIZONA.

AMERICAN OIL CHEMISTS SOCIETY, JOURNAL 35(9):465-467.

THE YIELD AND CHARACTERISTICS OF LEAF WAXES FROM 42 SPECIES OF PLANTS WERE DETERMINED. ALTHOUGH A FEW HAVE HIGH YIELDS OF WAX WHEN EXPRESSED ON THE BASIS OF AMOUNT OF WAX PER UNIT AREA OF PLANT SURFACE, THE MAJORITY OF SPECIES CONTAIN ONLY A SMALL AMOUNT OF WAX. SOME EFFECTS OF SEX ON PLANT WAXES IS NOTED IN THE DIOECIOUS SPECIES BACCHARIS SAROTHROIDES, ATRIPLEX CANEOCENS, AND SIMMONDSIA CHINENSIS. IT WAS CONCLUDED THAT THE OFTEN QUOTED STATEMENT, PLANTS INDIGENOUS TO ARID AND HOT REGIONS HAVE WAXY CUTICLES, IS UNTENABLE AND SHOULD BE MODIFIED TO READ ...WAX-LIKE CUTICLES. APPARENTLY THE THICK CUTICLES OF MANY DESERT PLANTS, SUCH AS AGAVE, OPUNTIA, AND EVEN ASCLEPIAS ALBICANS, ARE COMPOSED MAINLY OF SUBSTANCES THAT ARE NOT WAXES. (ABSTRACT-ECONOMIC BOTANY 13(1):29.)

OALS/LIPIDS/LEAVES/XEROPHYTES/DESERT PLANTS/ARIZONA/ORGANIC COMPOUNDS /ADAPTATION/SUCCULENTS/PLANT MORPHOLOGY/SIMMONDSIA CHINENSIS/AGAVE/ OPUNTIA/ASCLEPIAS/ATRIPLEX/BACCHARIS/SONORAN DESERT

145

LANGMAN, I.K.

1964

A SELECTED GUIDE TO THE LITERATURE ON THE FLOWERING PLANTS OF MEXICO.

UNIVERSITY OF PENNSYLVANIA PRESS, PHILADELPHIA, 1015 P.

AN EXTENSIVE BIBLIOGRAPHIC WORK; NUMEROUS REFERENCES TO JOJOBA, SOME IN OBSCURE MEXICAN PUBLICATIONS.

OALS/MEXICO/BIBLIOGRAPHIES/SIMMONDSIA CHINENSIS

146

LINK, H.F.

1821 - 1822

ENUMERATIO PLANTARIUM. HORTI REGII BOTANICI BEROLINENSIS ALTERA.

BEROLINI, APUD G. REIMER. 2 VOLS. IN 1.

A BRIEF BOTANICAL DESCRIPTION OF JOJOBA AS BUXUS CHINENSIS; THIS IS THE CRIGINAL DESCRIPTION UPON WHICH PRIORITY OF THE SPECIFIC NAME CHINENSIS IS BASED.

OALS/SIMMONDSIA CHINENSIS/SYSTEMATICS

147

LUMHOLTZ, C.

1971

NEW TRAILS IN MEXICO: AN ACCOUNT OF ONE YEAR S EXPLORATION IN NORTH-WESTERN SONORA, MEXICO, AND SOUTH-WESTERN ARIZONA, 1909-1910. REPRINT OF 1912 EDITION.

RIO GRANDE PRESS, INC., GLORIETA, NEW MEXICO.

ON PAGE 81, THE AUTHOR NOTES THAT THE NUTS OF THE JOJOBA ARE EATEN BY THE NATIVES AND ARE VERY OILY.

OALS/SIMMONDSIA CHINENSIS/FOODS/SEEDS/ETHNOBOTANY/ARIZONA/SONORA

148

LUNDELL, C.L.

1945

NEW CROPS AND NEW USES FOR OLD CROPS.

CHEMURGIC DIGEST 4:79-82.

BRIEFLY REVIEWS TEXAS POST-WORLD WAR II AGRICULTURAL PROBLEMS. SUGGESTS SEVERAL NEW CROPS HAVING GREAT POTENTIAL, INCLUDING JOJOBA.

OALS/SIMMONDSIA CHINENSIS/TEXAS

149

MAISARI, A.A.

1966

FACTORS AFFECTING THE ROOTING AND TRANSPLANTING OF JOJOBA, SIMMONDSIA CHINENSIS (LINK) SCHNEID.

UNIVERSITY OF ARIZONA (M.S. THESIS). 33 P.

CUTTINGS OF JOJOBA WERE TREATED WITH 5000, 4000, AND 3000 PPM IBA (INDOLEBUTYRIC ACID) AND ROOTED IN SAND, VERMICULITE, AND A MIXTURE OF SAND AND VERMICULITE, IN A GREENHOUSE. UNTREATED CUTTINGS WERE PLANTED AS CONTROLS. IBA TREATMENTS GAVE BETTER ROOTING PERCENTAGES THAN UNTREATED CUTTINGS, EXCEPT IN SAND. HIGH SURVIVAL WAS OBTAINED WITH PLANTS GROWING IN THE GREENHOUSE WHERE MINIMUM NIGHT TEMPERATURE WAS MAINTAINED AT 70 DEGREES F. IN THE LATHHOUSE WHERE TEMPERATURE DROPPED TO A MINIMUM 34 DEGREES F., POOR SURVIVAL WAS THE RESULT OF COLD INJURY. ROOT QUALITY (HEAVY, MEDIUM OR POOR ROOT SYSTEM) DID NOT INFLUENCE POTTED CUTTING SURVIVAL EXCEPT IN THE LATHHOUSE WHERE MEDIUM ROOTED CUTTINGS SURVIVED BEST. TRANSPLANTING SURVIVAL OF JOJOBA WAS TESTED UNDER FIELD CONDITIONS. IRRIGATION RATES AND ROOT QUALITY DID NOT RESULT IN SIGNIFICANT INCREASE IN SURVIVAL. (OALS)

OALS/ROOTS/SIMMONDSIA CHINENSIS/PLANT CHEMISTRY/SURVIVAL/SANDS/ CLIMATIC-VEGETAL RELATIONSHIPS/IRRIGATION EFFECTS/AGRONOMY/MINIMUM TEMPERATURE/GREENHOUSES/PLANTING MANAGEMENT

150

MARKWOOD, L.N.

1942

JOJOBA, AN OIL THAT S DIFFERENT.

DOMESTIC COMMERCE (U.S. DEPARTMENT OF COMMERCE) 30(11):20/CHEMURGIC DIGEST 1(22):174-175.

A BRIEF REVIEW OF JOJOBA, ITS OIL, AND POSSIBLE INDUSTRIAL USES.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/PLANT USES/PLANT SUBSTANCES

151

MARTINEZ, M.

1959 A

LAS PLANTAS MEDICINALES DE MEXICO (THE MEDICINAL PLANTS OF MEXICO). 4TH ED.

EDICIONES BOTAS, MEXICO. 656 P.

CITING CLAVIJERO, THE AUTHOR STATES THAT THE JOJOBA SEED HAS THE FOLLOWING MEDICINAL USES: STOPS RETENTION OF URINE, HELPS IN CHILD BIRTH, AND CURES WOUNDS. ALSO, IT IS AN EXCELLENT REMEDY FOR CANCER. THE INGESTION OF 1 OR 2 SEEDS EVERY THREE HOURS FOR SEVERAL DAYS IS REPORTED TO MODERATE HIGH-TEMPERATURE URINE CONDITIONS (P. 443-444).

OALS/SIMMONDSIA CHINENSIS/MEDICINAL PLANTS/MEXICO/PLANT USES/ ETHNOBOTANY

152

MARTINEZ, M.

1959 B

PLANTAS UTILIS DE MEXICO (THE USEFUL PLANTS OF MEXICO). 3RD ED.

EDICIONES BOTAS, MEXICO. 621 P.

THE JOJOBA PLANT IS DESCRIBED AND ITS NATURAL HISTORY OUTLINED (P. 350-353). IT IS NOTED THAT UPON GERMINATION A VERY LONG ROOT IS PRODUCED BEFORE THE FIRST LEAVES APPEAR. THE CHEMICAL COMPOSITION OF THE OIL IS RECOUNTED, AND USE OF THE RESIDUE AS LIVESTOCK AND POULTRY FEED IS SUGGESTED. DEER, GOATS AND SQUIRRELS EAT THE NUTS, AS DOES MAN. A PORRIDGE, CALLED CHAMPURRADO, IS SOMETIMES MADE FROM THEM. ALSO, IT IS USED FOR MEDICINE AS A CURE AGAINST URINE RETENTION, AND THE OIL AS A REMEDY AGAINST CANCER. POTENTIAL INDUSTRIAL USES ARE MENTIONED. THIS PLANT GROWS IN THE SOUTHERN DISTRICT OF BAJA CALIFORNIA AND IN THE ALTAR DISTRICT, AND NEAR GUAYMAS, SONORA. SOME CULTIVATION EXPERIMENTS WERE MADE IN THE SIERRA DE LA CANDELARIA, CHIHUAHUA WITH SEEMINGLY GOOD RESULTS.

OALS/MEXICO/SIMMONDSIA CHINENSIS/SONORA/BAJA CALIFORNIA/SEEDS/LIQUID WAX /NATURAL HISTORY/GERMINATION/CULTIVATION/FOODS/FOOD HABITS/ PALATABILITY/MEDICINAL PLANTS/PLANT USES/PLANT SUBSTANCES/JOJOBA MEAL

153

MARVEL, C.S. ET AL

1960.

POLYMERIZATION REACTIONS OF THE ACRYLATE AND METHACRYLATE ESTERS OF ALCOHOLS FROM JOJOBA OIL.

JOURNAL OF POLYMER SCIENCE 44:289-294.

THESE ESTERS POLYMERIZE AND COPOLYMERIZE IN THE PATTERN OF OTHER ACRYLATE AND METHACRYLATE ESTERS. SEVERAL HOMOPOLYMERS OF JOJOBA ALCOHOL METHACRYLATES WERE PREPARED. THESE POLYMERS ARE CLEAR, VISCOUS, STICKY, SOMEWHAT RUBBERY MATERIALS WHICH ARE THOUGHT TO HAVE SOME POTENTIAL USE AS ADHESIVES.

OALS/SIMMONDSIA CHINENSIS/ORGANIC COMPOUNDS/ALCOHOLS/PLANT SUBSTANCES /PLANT USES/LIQUID WAX/POLYMERIZATION/ESTERS

154

MATSUDA, K.

1962

THE BIOSYNTHESIS OF WAXES IN PLANTS.

UNIVERSITY OF ARIZONA, TUCSON (PH.D. DISSERTATION). 113 P.

TWO WAX PRODUCING PLANTS, CANDELILLA (EUPHORBIA ANTISYPHILITICA ZUCC.) AND JOJOBA (SIMMONDSIA CHINENSIS (LINK)SCHNEIDER) WERE USED IN STUDIES ON WAX BIOSYNTHESIS. THE COMPOSITION OF WAXES FROM CANDELILLA STEMS OF DIFFERENT AGES WERE DETERMINED AND IN-VITRO CULTURE STUDIES WERE MADE USING CANDELILLA STEM SEGMENTS AND JOJOBA EMBRYO SLICES. THE RESULTS INDICATED THAT THE RATE OF METABOLISM OF THE DIFFERENT FRACTIONS MAY VARY BUT THE MECHANISM OF PARAFFIN FORMATION WAS CONSTANT THROUGHOUT THE LIFE OF THE PLANT. IN-VITRO CULTURE STUDIES SHOWED RADIO CARBON FROM ACETATE-1-C SUPER 14 WAS INCORPORATED EASILY INTO ALL WAXES. THIS SUPPORTED AND EXTENDED PREVIOUS SUGGESTIONS THAT ACETATE IS PROBABLY THE NATURAL SUBSTRATE FOR WAX SYNTHESIS. THE INCORPORATION OF RADIO CARBON FROM ACETATE-1-C SUPER 14 INTO WAXES WAS ALTERED BY A NUMBER OF FACTORS. IN-VITRO CULTURE STUDIES ALSO INDICATED THAT ATP IS THE HIGH ENERGY SOURCE INVOLVED IN WAX SYNTHESIS IN BOTH JOJOBA AND CANDELILLA.

OALS/SIMMONDSIA CHINENSIS/PHOTOSYNTHESIS/LIPIDS/LIQUID WAX/PLANT PHYSIOLOGY/PLANT CHEMISTRY/RADIOISOTOPES/EUPHORBIACEAE/BIOSYNTHESIS

155

MAURI

1845

BROCCHIA DICHOTOMA MAURI. IN M. TENORE, CATALOGO DELLE PLANTE CHE SI COLTIVANO NEL R. ORTO BOTANICO DI NAPOLI, P. 80.

TIPOGRAFIA DELL AQUILA DI V. PUZZIELLO, NAPOLI.

A BRIEF DESCRIPTION, FROM ONE FEMALE PLANT, OF SIMMONDSIA CHINENSIS. THE NAME BROCCHIA DICHOTOMA WAS NEVER WIDELY USED.

OALS/SIMMONDSIA CHINENSIS/SYSTEMATICS

156

MAURITZON, J.

1935

KRITIK VON J. WIGERS ABHANDLUNG, EMBRYOLOGICAL STUDIES ON THE FAMILIES BUXACEAE, MELIACEAE, SIMARUBACEAE AND BURSERACEAE. (IN GERMAN)

BOTANISKA NOTISER 1935(6):490-502.

THE AUTHOR OFFERS A NUMBER OF CRITICISMS OF WIGER S (1935) STUDIES IN EMBRYOLOGY; WIGER (1936) HAS REPLIED TO THIS PAPER. MAURITZON CLAIMS THAT WIGER SAYS THE ENDOSPERM IN SIMMONDSIA CONTAINS NO STORED NOURISHMENT, WHICH IS EXACTLY THE FUNCTION OF THE ENDOSPERM. HE INTERPRETS THIS ERROR TO HAVE ARISEN FROM FAULTY PARAPHRASING OF PAX (1896), WHO DID STATE THAT THE ENDOSPERM WAS ABSENT IN MATURE SEEDS OF THIS VARIETY, BUT NOT THAT THE SAME CONTAINS NO STORED NOURISHMENT (P. 500).

OALS/SIMMONDSIA/PLANT MORPHOLOGY/SEEDS/BUXACEAE/SIMMONDSIA CHINENSIS

157

MCCULLOCH, C.Y./URNESS, P.J.

1973

DEER NUTRITION IN ARIZONA CHAPARRAL AND DESERT HABITATS. PART I: SEASONAL DIETS OF MULE AND WHITE-TAILED DEER, PART II: CHEMICAL ANALYSES AND IN VITRO DIGESTIBILITY OF SEASONAL DEER FORAGES, PART III: NUTRITIONAL VALUE OF SEASONAL DEER DIETS.

ARIZONA GAME AND FISH DEPARTMENT, RESEARCH DIVISION/U.S. FOREST SERVICE, ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION, SPECIAL REPORT 3. 68 P.

JOJOBA IS AN IMPORTANT DEER BROWSE PLANT IN THESE HABITATS AT THREE BAR WILDLIFE AREA, TONTO NATIONAL FOREST. IT RECEIVES DETAILED TREATMENT AS TO SEASONAL CHANGES IN IMPORTANCE IN DEER DIET. PERCENT OCCURRENCE ON VARIOUS SLOPE ASPECTS IS NOTED.

OALS/SIMMONDSIA CHINENSIS/ARIZONA/BROWSE /FORAGE PLANTS/CHAPARRAL/ FOOD HABITS/ODOCOILEUS HEMIONUS/ODOCOILEUS VIRGINIANUS/PALATABILITY/ NUTRIENTS/LEAVES/SEASONAL/ASPECT/SLOPES/DIGESTION/WILDLIFE

158

MCGINNIES, W.G.

1968

VEGETATION OF DESERT ENVIRONMENTS. IN W.G. MCGINNIES, B.J. GOLDMAN, P. PAYLORE, EDS., DESERTS OF THE WORLD, AN APPRAISAL OF RESEARCH INTO THEIR PHYSICAL AND BIOLOGICAL ENVIRONMENTS, P. 379-566.

UNIVERSITY OF ARIZONA PRESS, TUCSON. 788 P.

JOJOBA IS LISTED IN A LIST OF IMPORTANT SPECIES, IN THE FAMILY SIMMONDSIACEAE, AS TWO SPECIES, SIMMONDSIA CHINENSIS AND S. CALIFORNICA. IT IS NOTED THAT THE SEEDS PROVIDE NOURISHMENT FOR HERBIVOROUS ANIMALS AND HUMANS (P. 396, 474, 496).

OALS/SIMMONDSIA CHINENSIS/SYSTEMATICS/SEEDS/SIMMONDSIACEAE/FOODS/ BROWSE/FORAGE PLANTS

159

MCGINNIES, W.G./ARNOLD, J.F.

1939

RELATIVE WATER REQUIREMENT OF ARIZONA RANGE PLANTS.

ARIZONA AGRICULTURAL EXPERIMENT STATION, TECHNICAL BULLETIN 80:165-246.

THE WATER REQUIREMENT OF TWENTY-EIGHT SPECIES OF ARIZONA RANGE PLANTS AND FIVE CROP PLANTS WAS DETERMINED UNDER VARYING CLIMATIC CONDITIONS. THE NATIVE SPECIES INCLUDE 6 GROUPS OF PLANTS 1) PERENNIAL GRASSES OF THE DESERT GRASSLAND, 2) PERENNIAL GRASSES OF PLAINS GRASSLAND, 3) SOUTHERN TALL GRASSES, 4) WINTER ANNUALS, 5) SUMMER ANNUALS, 6) XEROPHYTIC SHRUBS. THE PERENNIAL GRASSES WERE FAIRLY UNIFORM IN THEIR WATER REQUIREMENT. THE SUMMER ANNUALS HAD LOWER WATER REQUIREMENT VALUES THAN THE WINTER ANNUALS. THE WINTER ANNUALS WERE AT LEAST AS EFFICIENT IN THE USE OF WATER AS THE PERENNIAL GRASSES DURING THE SAME SEASON. THE SUMMER ANNUALS, AS A GROUP, HAD LOWER WATER REQUIREMENTS THAN THE PERENNIAL GRASSES. THE TREES AND SHRUBS HAD MUCH HIGHER WATER REQUIREMENTS THAN ANY OTHER GROUP.

OALS/RANGE GRASSES/GRASSLAND BIOME/SANTA RITA EXPERIMENTAL RANGE/ ARIZONA/DESERT GRASSLAND/XEROPHYTES/TREES/SHRUBS/DESERT PLANTS/TALL GRASSES/ANNUALS /PERENNIALS/GRASSES/SUMMER/WINTER/SUMMER ANNUALS/ WINTER ANNUALS/WATER REQUIREMENTS/DROUGHT TOLERANCE/BOUTELOUA/ HETEROPOGON/STIPA /TRICHACHNE/ARISTIDA/APLOPAPPUS/EPHEDRA/SIMMONDSIA CHINENSIS/ACACIA/PROSOPIS/CERCIDIUM

160

MCKINNEY, R.S./JAMIESON, G.S.

1936

A NON-FATTY OIL FROM JOJOBA SEED.

OIL AND SOAP 13:289-292.

IT HAS BEEN SHOWN THAT JOJOBA OIL IS NOT A GLYCERIDE FAT BUT A LIQUID WAX, COMPOSED ALMOST ENTIRELY OF ESTERS OF HIGH MOLECULAR WEIGHT, MONO-ETHYLENIC ACIDS AND ALCOHOLS. THE UNSATURATED ACIDS CONSIST OF A MIXTURE OF EICOSANOIC AND DICOSANOIC ACIDS, ALONG WITH SMALL QUANTITIES OF PALMITOLEIC AND OLEIC ACIDS. THE UNSATURATED ALCOHOLS ARE A MIXTURE OF EICOSANOL AND DICOSANOL, ALONG WITH A LITTLE HEXACOSANOL AND A SMALL QUANTITY OF ALCOHOLS OF LOWER MOLECULAR WEIGHT. ITS COMPOSITION INDICATES THAT IT IS SOMEWHAT SIMILAR TO SPERM OIL. WHEN HEATED TO ABOUT 300 DEGREES CENTIGRADE FOR A SHORT TIME IT BECOMES COLORLESS.

OALS/SIMMONDSIA CHINENSIS/ORGANIC COMPOUNDS/LIPIDS/ALCOHOLS/LIQUID WAX/ESTERS/ACIDS

161

MCMINN, H.E.

1951

AN ILLUSTRATED MANUAL OF CALIFORNIA SHRUBS.

UNIVERSITY OF CALIFORNIA PRESS, BERKELEY. 663 P.

A BOTANICAL DESCRIPTION IS GIVEN OF THE PLANT JOJOBA (P. 262). ITS DISTRIBUTION IS NOTED AND A NUMBER OF COMMON NAMES ARE GIVEN: GOATNUT, JOJOBA, PIGNUT, LEMONLEAF, SHEEPNUT, QUININE PLANT, WILD-HAZEL, AND DEERNUT. THE HISTORY OF ITS SCIENTIFIC NAME IS REVIEWED. JOJOBA HAS BEEN A SOURCE OF FOOD TO INDIANS, AND A BEVERAGE USED AS A SUBSTITUTE FOR CHOCOLATE AND COFFEE IS PREPARED FROM THE SEEDS. THE OIL IS USED AS A HAIR TONIC.

OALS/SIMMONDSIA CHINENSIS/FOODS/PLANT USES/SYSTEMATICS/GULF OF CALIFORNIA/PLANT DISTRIBUTION/ETHNOBOTANY

162

MEIGS, P.

1939

THE KILIWA INDIANS OF LOWER CALIFORNIA.

IBERO-AMERICANA 15. 114 P.

LISTS JOJOBA AS A FOOD PLANT, CALLED J-SI (P. 9).

OALS/SIMMONDSIA CHINENSIS/PLANT USES/FOODS/ETHNOBOTANY/INDIANS OF NORTH AMERICA/BAJA CALIFORNIA/NATIVE AMERICANS

163

MELIKYAN, A.P.

1968

POLOZHENIE SEMEISTV BUXACEAE I SIMMONDSIACEAE V SISTEME (SYSTEMATIC POSITION OF THE FAMILIES BUXACEAE AND SIMMONDSIACEAE).

BOTANICHESKII ZHURNAL 53(8):1043-1047.

BASED ON THE AUTHOR S ANATOMICAL STUDIES OF 12 SPECIES OF BUXACEAE (BELONGING TO 4 GENERA), IT IS REGARDED AS JUSTIFIED TO DISTINGUISH SIMMONDSIA AS BEING IN A SEPARATE MONOTYPIC FAMILY, SIMMONDSIACEAE. THE AUTHOR THUS SUPPORTS THE EARLIER EXPRESSED CONTENTION OF VAN TIEGHEM (1897). ENGLISH SUMMARY.

OALS/SIMMONDSIA CHINENSIS/SIMMONDSIA/SYSTEMATICS/PLANT MORPHOLOGY/BUXACEAE/SIMMONDSIACEAE

164

METCALFE, C.R./CHALK, L.

1950

ANATOMY OF THE DICOTYLEDONS; LEAVES, STEMS AND WOOD IN RELATION TO TAXONOMY, WITH NOTES ON ECONOMIC USES. V.1-2.

CLARENDON PRESS, OXFORD. 1500 P.

THE FAMILY BUXACEAE IS TREATED, P. 1236-1241. INFORMATION ON THE LEAF AND STEM OF SIMMONDSIA IS BASED ON THAT OF SOLEREDER. THE AUTHOR NOTES THAT BUXUS, SIMMONDSIA AND STYLOCERAS DIFFER MARKEDLY IN THEIR WOOD ANATOMY-MORE SO THAN IS USUAL AMONG GENERA OF ONE FAMILY. SUCH DIFFERENCES, HOWEVER, MIGHT BE ATTRIBUTABLE TO DIFFERENT DEGREES OF SPECIALIZATION.

OALS/SIMMONDSIA CHINENSIS/SYSTEMATICS/LEAVES/STEMS/STOMATA/PLANT MORPHOLOGY/BUXACEAE/ADAPTATION

165

MIROV, N.T.

1950

SIMMONDSIA-DESERT SHRUB OFFERS NEW USES, FROM COVER CROP TO WAX.

CHEMURGIC DIGEST 9(7):7-9.

REVIEWS THE DISCOVERY OF JOJOBA AND THE NATURE OF THE LIQUID WAX FROM THE SEEDS. THE LARGE NUMBER OF SUGGESTED INDUSTRIAL USES OF THE WAX ARE DISCUSSED. IT IS SUGGESTED THAT MANAGEMENT OF WILD PLANTS FOR PRODUCTION BE TRIED ALONG WITH CULTIVATION TRIALS.

OALS/SIMMONDSIA CHINENSIS/LIPIDS/LIQUID WAX/CROP PRODUCTION/ CULTIVATION /PLANT USES/PLANT SUBSTANCES

166

MIROV, N.T.

1952

SIMMONDSIA OR JOJOBA, A PROBLEM IN ECONOMIC BOTANY.

ECONOMIC BOTANY 6(1):41-47.

THE HISTORY OF THE DISCOVERY OF SIMMONDSIA AND ATTEMPTS AT HORTICULTURAL USES ARE TRACED. INVESTIGATIONS INTO THE CHEMICAL AND PHYSICAL PROPERTIES OF THE LIQUID WAX OF THE SEEDS ARE DESCRIBED. POSSIBILITIES OF ECONOMIC EXPLOITATION ARE CONSIDERED AND THE AUTHOR CONCLUDES THAT THE DEVELOPMENT OF A WAX INDUSTRY SEEMS TO HINGE ON THE PROSPECTS OF GROWING THE BUSH UNDER CULTIVATION. RESULTS AT AN ELEVEN YEAR OLD PLANTATION IN RIVERSIDE, CALIFORNIA ARE PRESENTED. (ABSTRACT-PHARMACEUTISCH WEEKBLAD VOOR NEDERLAND 87:502.)

OALS/SIMMONDSIA CHINENSIS/CULTIVATION/SYSTEMATICS /LIPIDS/CROP PRODUCTION/PLANT BREEDING/LIQUID WAX/PLANT SUBSTANCES/FORAGE PLANTS/ BROWSE/SEEDS/ARIZONA/CALIFORNIA/MEXICO/SONORAN DESERT/PLANT USES

167

MIROV, N.T.

1955

THE PROCESS OF OIL FORMATION IN RIPENING SEEDS AND OF OIL DISINTEGRATION IN GERMINATING SEEDS OF SIMMONDSIA.

(UNPUBLISHED). 11 P.

THIS IS AN INCOMPLETE AND UNPUBLISHED MANUSCRIPT, BUT CONTAINS INTERESTING OBSERVATIONS. DURING THE SEED MATURATION THE WEIGHT OF THE OIL, LIQUID WAX, INCREASED, BUT THE DIFFERENCE IN PERCENTAGE OF OIL AT THE TIME OF THE SEED MATURITY AND AT THE TIME OF THEIR DROPPING FROM THE CAPSULE, TWO MONTHS LATER, WAS NEGLIGIBLE. DURING THE PROCESS OF RIPENING THE IODINE NUMBER OF THE OIL WAS ALMOST THE SAME. IN THIS RESPECT THE PROCESS OF FORMATION OF THE OIL (WAX) IN SIMMONDSIA DIFFERS FROM THAT OF ALL OTHER PLANTS (IN WHICH THE OIL IS NOT A WAX BUT A TRIGLYCERIDE). IN THE TRIGLYCERIDE PLANTS SATURATED ACIDS ARE FORMED FIRST AND THE UNSATURATED ACIDS APPEAR LATER. THIS SEEMS NOT TO BE THE CASE IN THE RIPENING SEEDS OF SIMMONDSIA. THE OIL CONTENT OF STORED SEEDS WAS COMPARED TO THAT OF THE COTYLEDONS OF 1 MONTH OLD AND 2 1/2 MONTH OLD SEEDLINGS. AFTER 1 MONTH CONSIDERABLE WAX WAS FOUND IN THE COTYLEDONS, AND AFTER 2 1/2 MONTHS SOME STILL REMAINED. APPARENTLY THE SEEDLINGS DO NOT UTILIZE THE WAX UNTIL RATHER LATE IN DEVELOPMENT.

OALS/SIMMONDSIA CHINENSIS/GERMINATION/SEEDS/SEEDLINGS/LIQUID WAX/ PLANT PHYSIOLOGY/ESTERS/PLANT GROWTH/PLANT NUTRITION/PLANT CHEMISTRY/ COTYLEDONS/ACIDS/FRUITING

168

MIROV, N.T.

1973

EXPERIMENTS WITH PLANTING JOJOBA. IN E.F. HAASE AND W.G. MCGINNIES, EDS., JOJOBA AND ITS USES: AN INTERNATIONAL CONFERENCE, JUNE 1972, P. 1-3.

UNIVERSITY OF ARIZONA, OFFICE OF ARID LANDS STUDIES, TUCSON. 81 P.

THE DISCOVERY OF LIQUID WAX IN JOJOBA SEEDS AND ITS ECONOMIC POTENTIAL IS REVIEWED ALONG WITH EARLY PROJECTS TO ESTABLISH THE PLANT UNDER CULTIVATION. THE AUTHOR TRACES HIS INTEREST IN AND ACTIVITIES WITH JOJOBA FROM THE LATE 1930 S. HE FOUND THAT SOAKING SEEDS OVERNIGHT ASSURED GERMINATION AND THAT CONTRARY TO RUMORS JOJOBA WAS NOT APOGAMIC. IN 1940 HE ESTABLISHED A ONE-HALF ACRE PLANTATION IN ARLINGTON, CALIFORNIA, WHERE 175 HILLS WERE PLANTED WITH THREE SEEDS THAT WERE CULLED LATER TO ADJUST THE SEX RATIO. SEEDS WERE PRODUCED AT 6 YEARS, AND AT 10 YEARS PLANTS WERE AT FULL PRODUCTION. ONCE MONTHLY IRRIGATION WAS PRACTICED, APRIL-SEPTEMBER. AT TEN YEARS BUSHES WERE SELECTED FOR SEED YIELD AND OIL YIELD, UP TO 56 PERCENT

OIL IN DRY SEEDS. THE PLANTATION WAS DESTROYED IN 1953. ANOTHER PLANTATION OF 640 ACRES IN FLORENCE JUNCTION, ARIZONA, WAS BRIEFLY STARTED, 1943, AND THEN ABANDONED IN FAVOR OF GROWING VEGETABLES FOR MILITARY NEEDS.

OALS/SIMMONDSIA CHINENSIS/SEEDS/LIQUID WAX/CULTIVATION/IRRIGATION PRACTICES/GERMINATION/POLLINATION/ARIZONA/CALIFORNIA/PLANTING MANAGEMENT/SEED PRODUCTION/FREEZING/MINIMUM TEMPERATURE

169

MIWA, T.K.

1971

JOJOBA OIL WAX ESTERS AND DERIVED FATTY ACIDS AND ALCOHOLS: GAS CHROMATOGRAPHIC ANALYSIS.

AMERICAN OIL CHEMISTS SOCIETY, JOURNAL 48:259-264.

THE COMPOSITIONS OF JOJOBA OIL FROM TWO ADJACENT REGIONS IN ARIZONA WERE ESSENTIALLY IDENTICAL EVEN THOUGH ONE SAMPLE WAS STORED FOR 5 YEARS. THE SAME PHENOTYPE SHRUBS THAT HAVE ADAPTED THEMSELVES TO THE HOT AND DRY ENVIRONMENT OF THE CALIFORNIA DESERT HAVE INCREASED MARKEDLY IN SEED SIZE, BUT HAVE CHANGED ONLY SLIGHTLY IN CHEMICAL COMPOSITION. CONVERSELY, THE DIFFERENT PHENOTYPE GROWING PROSTRATE ALONG THE OCEAN NEAR SAN DIEGO HAD SEEDS SIMILAR IN SIZE TO THE ARIZONA TYPE BUT HAD A DISTINCT SHIFT IN OIL COMPOSITION TOWARD LARGE MOLECULAR SIZE. THE WAX ESTERS ARE MADE UP OF A DISPROPORTIONATELY LARGE AMOUNT OF DOCOSENYL EICOSENOATE AND ARE NOT A RANDOM COMBINATION OF CONSTITUENT ACIDS AND ALCOHOLS. LUNARIA ANNUA SYNTHETIC WAX ESTER OIL WAS USED AS A MODEL.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/ALCOHOLS/ORGANIC COMPOUNDS/SEEDS /LIQUID WAX/CALIFORNIA /ARIZONA/PHYTOGEOGRAPHY/PLANT POPULATIONS/ ADAPTATION/ECOTYPES/PLANT SUBSTANCES/EVOLUTION/ACIDS/ESTERS/ VARIABILITY(GENETIC)/BIOSYNTHESIS

170

MIWA, T.K.

1973 A

CHEMICAL ASPECTS OF JOJOBA OIL A UNIQUE LIQUID WAX FROM DESERT SHRUB SIMMONDSIA CALIFORNICA.

COSMETIC AND PERFUMERY 88:39-41.

THE DISCOVERY OF JOJOBA S UNIQUE WAX IS REVIEWED. ANALYTICAL CONSTANTS FROM ANALYSIS OF TWO POPULATIONS ARE PRESENTED. THE COMPOSITION OF ACIDS AND ALCOHOLS IN JOJOBA OIL IS DESCRIBED. SULFURIZING AND EPOXIDIZING JOJOBA OIL PRODUCES USABLE CHEMICAL DERIVATIVES. GAS CHROMATOGRAPHIC ANALYSIS ON WAX ESTER COMPOSITION FROM ERUCIC-CONTAINING SEED OILS OF CRAMBE ABYSSINICA, LIMNANTHES DOUGLASII AND LUNARIA ANNUA ARE COMPARED WITH NATURAL JOJOBA OIL. CONSIDERATION IS GIVEN TO JOJOBA OIL AS A COSMETIC TO BE USED AS A THERAPEUTIC AGENT FOR EXCESSIVE EXCRETIONS FROM THE SEBACEOUS GLAND.

OALS/SIMMONDSIA CHINENSIS/LIPIDS/PLANT SUBSTANCES/ALCOHOLS/ORGANIC COMPOUNDS/LIQUID WAX/MEDICINAL PLANTS/PLANT USES/ACIDS/SULFURIZATION/ EPOXIDATION

171

MIWA, T.K.

1973 B

SAPONIFICATION AND GAS CHROMATOGRAPHIC ANALYSIS OF JOJOBA WAX ESTERS. IN E.F. HAASE AND W.G. MCGINNIES, EDS., JOJOBA AND ITS USES; AN INTERNATIONAL CONFERENCE, JUNE 1972, P. 61-72.

UNIVERSITY OF ARIZONA, OFFICE OF ARID LANDS STUDIES, TUCSON. 81 P.

TECHNIQUES ARE DESCRIBED FOR THE SAPONIFICATION OF THE OIL AND FOR THE GAS CHROMATOGRAPHIC ANALYSIS OF JOJOBA WAX ESTERS, INCLUDING INFORMATION ON THE PREVENTION OF EMULSIFICATION AND THE COMPLETE SEPARATION OF ACIDS FROM ALCOHOLS. IMPORTANT STEPS FOR THE GAS CHROMATOGRAPHY ANALYSIS ARE DESCRIBED IN DETAIL. OIL COMPOSITION OF ARIZONA DESERT AND CALIFORNIA DESERT PLANTS IS SIMILAR, BUT CALIFORNIA OCEANSIDE PLANTS HAVE OIL WITH A TENDENCY TOWARD HIGHER MOLECULAR WEIGHTS. INITIAL STUDIES INDICATE THAT JOJOBA OIL COULD BE USED IN TREATING ACNE VULGARIS, SUPPRESSING SEBACEOUS SECRETION. LACK OF A DEPENDABLE SOURCE OF THE OIL HAS STOPPED EFFORTS IN THIS AREA. ANOTHER USE SUGGESTED FOR JOJOBA OIL IS AS A RETARDANT TO EVAPORATION OF WATER FROM THE SURFACES OF LAKES AND RESERVOIRS.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/ORGANIC COMPOUNDS/PLANT USES/PLANT SUBSTANCES/ANALYTICAL TECHNIQUES/MEDICINAL PLANTS/ EVAPORATION CONTROL/ALCOHOLS/ESTERS

172

MIWA, T.K./WOLFF, I.A.

1962

FATTY ACIDS, FATTY ALCOHOLS, AND WAX ESTERS FROM LIMNANTHES DOUGLASII (MEADOW FOAM) SEED OIL.

AMERICAN OIL CHEMISTS SOCIETY, JOURNAL 39(7):320-322.

LIMNATHES DOUGLASII SEED OIL GLYCERIDES CONTAIN FATTY ACIDS WHICH PREDOMINANTLY (97 PERCENT) HAVE 20 OR MORE CARBON ATOMS. FATTY ACIDS WERE PREPARED BY SAPONIFICATION; FATTY ALCOHOLS, BY SODIUM REDUCTION OF THE GLYCERIDES; AND LIQUID WAX ESTERS, BY P-TOLUENESULFONIC ACID-CATALYZED REACTION OF THE FATTY ACIDS WITH THE FATTY ALCOHOLS. SOLID WAXES WERE PREPARED BY HYDROGENATION OF THE GLYCERIDE OIL AND THE WAX ESTERS. CHEMICAL AND PHYSICAL CONSTANTS WERE DETERMINED FOR THE SEED OIL AND ITS DERIVATIVES. THE LIQUID WAX ESTERS HAD PROPERTIES VERY SIMILAR TO THOSE OF JOJOBA (SIMMONDSIA CHINENSIS) SEED OIL. THE SOLID HYDROGENATED WAX ESTER WAS IDENTICAL IN PHYSICAL APPEARANCE AND MELTING POINT TO HYDROGENATED JOJOBA SEED OIL.

OALS/SIMMONDSIA CHINENSIS/LIPIDS/LIQUID WAX/ORGANIC COMPOUNDS/ ALCOHOLS/PLANT SUBSTANCES/SEEDS/ESTERS/ACIDS

173

MIWA, T.K./WOLFF, I.A.

1963

FATTY ACIDS, FATTY ALCOHOLS, WAX ESTERS AND METHYL ESTERS FROM CRAMBE ABYSSINICA AND LUNARIA ANNUA SEED OILS.

AMERICAN OIL CHEMISTS SOCIETY, JOURNAL 40:742-744.

CRAMBE AND LUNARIA SEED OILS ARE POTENTIAL SOURCES OF EUCIC ACID AND OTHER LONG-CHAIN FATTY DERIVATIVES, WHICH MAY BE UTILIZED IN THE CHEMICAL INDUSTRY. THEIR DERIVATIVES CLOSELY RESEMBLE CORRESPONDING DERIVATIVES OF LIMNANTHES SEED OIL IN PHYSICAL AND CHEMICAL PROPERTIES. THE WAX ESTER OF LIMNANTHES HAS BEEN PROPOSED AS A SUBSTITUTE FOR JOJOBA OIL; THE SEED OILS OF ALL FOUR GENERA HAVE BEEN PROPOSED AS POSSIBLE SUBSTITUTES OF SPERM WHALE OIL. THE CHEMICAL AND PHYSICAL CONSTANTS WERE DETERMINED FOR THE SEED OILS AND THEIR DERIVATIVES. COMPARISONS ARE MADE OF THE HYDROGENATED OILS AND HYDROGENATED WAX ESTERS WITH COMMERCIAL WAXES.

OILS/LIPIDS/ORGANIC COMPOUNDS/ACIDS/ESTERS/SPERM WHALE OIL/ HYDROGENATION/SEEDS/ALCOHOLS

174

MIWA, T.K./WOLFF, I.A.

1965

WAX ESTER SUBSTITUTE FOR JOJOBA OIL FROM THE SEED OF LIMNANTHES DOUGLASII.

UNITED STATES PATENT 3,226,406. DECEMBER 28, 1965.

A LIQUID WAX ESTER WAS PRODUCED BY SOLVENT EXTRACTION OF THE GLYCERIDE OIL PRESENT IN GROUND SEED OF LIMNANTHES DOUGLASSI, REMOVING THE SOLVENT AND SEPARATELY PREPARING THE MIXED CONSTITUENT FATTY ACIDS BY SAPONIFICATION AND THE MIXED CORRESPONDING FATTY ALCOHOLS FROM SEPARATE PORTIONS OF THE SAID GLYCERIDE OIL BY REDUCTION. THE FATTY ACIDS AND ALCOHOLS WERE REACTED IN THE PRESENCE OF XYLENE AND P-TOLUENE SULFONIC ACID MONOHYDRATE TO FORM THE DESIRED LIQUID WAX ESTER PRODUCT.

OILS/ORGANIC COMPOUNDS/PLANT USES/ALCOHOLS/SEEDS/LIPIDS/PATENTS/ LIQUID WAX/SIMMONDSIA CHINENSIS

175

MOLAISON, L.J./O CONNOR, R.T./SPADARO, J.J.

1959

LONG-CHAIN UNSATURATED ALCOHOLS FROM JOJOBA OIL BY SODIUM REDUCTION.

AMERICAN OIL CHEMISTS SOCIETY, JOURNAL 36(9):379-382.

JOJOBA OIL IS A LIQUID WAX COMPOSED ESSENTIALLY OF C SUB 20 AND C SUB 22 STRAIGHT-CHAIN MONOETHYLENIC ACIDS AND ALCOHOLS IN THE FORM OF ESTERS. SODIUM REDUCTION OF THE WAX FATTY ESTERS IN JOJOBA OIL YIELDED QUANTITATIVELY A MIXTURE OF UNSATURATED, LONG-CHAIN ALCOHOLS FROM THE ACID MOIETY OF THE JOJOBA OIL. YIELDS OF ABOUT 91 PERCENT WERE OBTAINED IN THE LABORATORY-SCALE EXPERIMENTS AND 82 TO 86 PERCENT FOR THE PILOT-PLANT EXPERIMENTS. ANALYTICAL DATA, INCLUDING DETAILED INFRARED SPECTRA INFORMATION, ARE GIVEN FOR THE RESULTING PRODUCT ALCOHOLS.

OALS/SIMMONDSIA CHINENSIS/ALCOHOLS/LIQUID WAX/LIPIDS/PLANT SUBSTANCES /ORGANIC COMPOUNDS/ESTERS

176

MORTON, J.F.

1963

PRINCIPAL WILD FOOD PLANTS OF THE UNITED STATES, EXCLUDING ALASKA AND HAWAII.

ECONOMIC BOTANY 17(4):319-330.

PRIMARILY A LISTING OF SPECIES WITH BRIEF ANNOTATION AS TO WHAT PART OF THE PLANT IS EATEN AND HOW IT MAY BE PREPARED. UNDER SIMMONDSIA CHINENSIS (P. 327): RIPE SEED KERNELS (FALL), RAW, OR BOILED TO EXTRACT EDIBLE OIL; KERNELS ROASTED, GROUND AND BOILED FOR COCOA-LIKE BEVERAGE.

OALS/SIMMONDSIA CHINENSIS/PLANT USES/FOODS

177

MULLER, J.

1869

BUXACEAE. IN A. DE CANDOLLE, PRODROMUS SYSTEMATIS NATURALIS REGNI VEGETABILIS. PARS 16, SECTIO 1, P. 17-23.

VICTORIS MASSON ET FILII, PARISIIS.

BOTANICAL DESCRIPTIONS OF THE SPECIES OF BUXUS, PACHYSANDRA AND SIMMONDSIA. THE DESCRIPTION OF THE GENUS SIMMONDSIA IS FOLLOWED BY DESCRIPTIONS OF ITS TWO SPECIES S. CALIFORNICA AND S. PABULOSA.

OALS/SIMMONDSIA CHINENSIS/SYSTEMATICS/SIMMONDSIA

178

MUNZ, P.A.

1935

A MANUAL OF SOUTHERN CALIFORNIA BOTANY.

J.W. STACEY, INC., SAN FRANCISCO. 643 P.

A BRIEF BOTANICAL DESCRIPTION OF THE PLANT SIMMONDSIA CHINENSIS, JOJOBA, FAMILY BUXACEAE, AND ITS DISTRIBUTION (P. 291).

OALS/SIMMONDSIA CHINENSIS/PLANT MORPHOLOGY

179

MUNZ, P.A./KECK, D.D.

1959

A CALIFORNIA FLORA.

UNVIERSITY OF CALIFORNIA PRESS, BERKELEY AND LOS ANGELES. 1681 P.

A BRIEF BOTANICAL DESCRIPTION OF THE JOJOBA PLANT AND ITS DISTRIBUTION IS GIVEN ON P. 985-986.

OALS/CALIFORNIA/SIMMONDSIA CHINENSIS

180

NATURAL VEGETATION COMMITTEE, ARIZONA CHAPTER, SOIL CONSERVATION SOCIETY OF AMERICA

1973

LANDSCAPING WITH NATIVE ARIZONA PLANTS.

UNIVERSITY OF ARIZONA PRESS, TUCSON. 194 P.

JOJOBA IS A RECOMMENDED SPECIES IN LOAMY UPLAND SOIL IN THREE OF THE FOURTEEN MAJOR VEGETATION TYPES NOTED FOR THE STATE: DESERT GRASSLAND VEGETATION TYPE, JOSHUA TREE VEGETATION TYPE, AND PALOVERDE-BURSAGE VEGETATION TYPE. NOTES THE FLOWERS ARE YELLOWISH, FROM DECEMBER TO JULY, SEED EDIBLE. GROWS ON DRY SLOPES AND ALONG WASHES 1,000-5,000 FEET. IT IS A SHAPELY DROUGHT-HARDY SHRUB EASILY STARTED FROM SEED AND THRIVES WITH LITTLE CARE (P. 25, 37, 41, 49, 108-409).

OALS/SIMMONDSIA CHINENSIS/NATURAL HISTORY/ORNAMENTAL PLANTS/ARIZONA

181

NEISWANGER, E.B.

1947

SOUTH TEXAS EXPERIMENTS WITH JOJOBA, SEEDS OF SHRUBS SUPPLY VALUABLE INDUSTRIAL WAX.

TEXAS CHEMURGIC NEWS 3(4):1.

PROCESSORS OF WAX PRODUCTS ARE PROMOTING THE GROWING OF WAX-BEARING PLANTS, SUCH AS JOJOBA, IN THE SOUTHWEST TO REPLACE IMPORTS FROM AFRICA AND SOUTH AMERICA. JOJOBA SEEDS HAVE BEEN DISTRIBUTED IN 31 SOUTH TEXAS COUNTIES. IT IS EXPECTED THAT MARGINAL LANDS COULD BE USED TO GROW JOJOBA EVEN IN THE LAREDO AND DEL RIO SECTIONS. PROCESSING OF SEED COULD BE DONE AT COTTONSEED OIL MILLS. POSSIBLE USES OF JOJOBA S LIQUID WAX ARE BRIEFLY OUTLINED. (ABSTRACT-ECONOMIC BOTANY 3(2):131.)

OALS/TEXAS/SIMMONDSIA CHINENSIS/CULTIVATION/MECHANICAL EXTRACTION

182

NUTTALL, T.

1844

ON SIMMONDSIA, A NEW GENUS OF PLANTS FROM CALIFORNIA.

LONDON JOURNAL OF BOTANY, W.J. HOOKER. 3:400-401.

IN THIS DESCRIPTION OF SIMMONDSIA CALIFORNICA FROM SAN DIEGO, CALIFORNIA, THE AUTHOR DESCRIBED THE MONOTYPIC GENUS SIMMONDSIA, IN MEMORY OF T.W. SIMMONDS, AN ARDENT BOTANIST AND NATURALIST, WHO ACCOMPANIED LORD SEAFORD TO BARBADOES ABOUT THE YEAR 1804, AND DIED SOON AFTER, WHILE ENGAGED IN EXPLORING THE ISLAND OF TRINIDAD. THE AUTHOR PLACED SIMMONDSIA CHINENSIS IN THE ORDER GARRYACEAE.

OALS/SIMMONDSIA/SIMMONDSIA CHINENSIS/SYSTEMATICS/CALIFORNIA

183

PAISLEY, D.M.

1961

PART I. SOME POLYMERIZATION REACTIONS OF THE ACRYLATE AND METHACRYLATE ESTERS OF ALCOHOLS FROM SIMMONDSIA CHINENSIS SEED OIL. PART II. POLYMERIZATION REACTIONS OF SOME ORGANOPHOSPHORUS COMPOUNDS.

UNIVERSITY OF ILLINOIS, URBANA (PH.D. THESIS). 144 P.

PART I (P. 1-32): THE ACRYLATE AND METHACRYLATE ESTERS OF THE MIXED ALCOHOLS, PRINCIPALLY EICOSENOL AND DOCOSENOL, HAVE BEEN SYNTHESIZED AND HOMOPOLYMERIZED AND COPOLYMERIZED IN THE PATTERN OF OTHER ACRYLATE AND METHACRYLATE ESTERS. FREE RADICAL INITIATION IN AN EMULSION SYSTEM PRODUCES SOLUBLE POLYMERS IN WHICH THE UNSATURATION OF THE ALCOHOL CHAIN HAS BEEN ALMOST COMPLETELY RETAINED, ALTHOUGH EXPOSURE TO AIR RENDERS THE POLYMERS CROSS-LINKED AND INSOLUBLE. THE POLYMERS ARE SOFT AND SHOW PROMISE FOR USE AS ADHESIVES.

OALS/SIMMONDSIA CHINENSIS/ALCOHOLS/ORGANIC COMPOUNDS/LIQUID WAX/PLANT USES/SEEDS/ESTERS/POLYMERIZATION

184

PALMER, E.

1878

PLANTS USED BY THE INDIANS OF THE UNITED STATES.

AMERICAN NATURALIST 12:593-606, 646-655.

PLANTS OF CALIFORNIA, ARIZONA, NEW MEXICO, AND UTAH MAKE UP THE MAJORITY OF THOSE DISCUSSED. SPECIES ARE TREATED INDIVIDUALLY AS TO THEIR VALUE TO THE NATIVE PEOPLES OF THE SOUTHWESTERN UNITED STATES AS FOOD, FIBER, MEDICINE OR DYE. JOJOBA IS TREATED ON P. 599.

OALS/SIMMONDSIA CHINENSIS/MEDICINAL PLANTS/FOODS/FIBER PLANTS/ SOUTHWEST U.S./ARIZONA/NEW MEXICO/CALIFORNIA/UTAH/PLANT USES/PLANT SUBSTANCES/INDIANS OF NORTH AMERICA/ETHNOBOTANY/NATIVE AMERICANS

185

PATTERSON, N. (NATCHILTA)

19--

MEMORANDUM BY NAT PATTERSON, APACHE MEDICINE MAN AND EMPLOYEE OF BOYCE THOMPSON SOUTHWESTERN ARBORETUM (RECORDED BY J.W. DAVIS).

BOYCE THOMPSON SOUTHWESTERN ARBORETUM, UNPUBLISHED RECORDS. 1 P.

IN PREPARING THE NUTS FOR THE MEDICINE, THE INDIANS BUILD A SMALL FIRE AND LET IT BURN DOWN TO EMBERS. THEN THEY RAKE THE ASHES AWAY LIGHTLY, AND PUT A FEW NUTS ON THE EMBERS AND COVER THEM WITH HOT ASHES. THE NUTS ARE LEFT IN THE ASHES UNTIL THE OILS START OOZING. THE DOCTOR THEN RAKES AWAY THE ASHES, TAKES ONE OF THE NUTS FROM THE EMBERS AND RUBS THE NUT ONTO A ROCK TO GRIND IT UP. AFTER HE HAS GROUND THE NUT UP INTO A SALVE-LIKE SUBSTANCE, HE SCRAPES THE SUBSTANCE UP ONTO HIS FINGER AND RUBS IT INTO THE WOUND. THIS SALVE IS SUPPOSED TO CURE CUTS, SCRATCHES AND SORES RAPIDLY.

OALS/SIMMONDSIA CHINENSIS/MEDICINAL PLANTS/BOYCE THOMPSON SOUTHWESTERN ARBORETUM/INDIANS OF NORTH AMERICA/NATIVE AMERICANS/ ETHNOBOTANY

186

PAX, F.

1896

BUXACEAE. IN A. ENGLER AND K. PRANTL, DIE NATURLICHEN PFLANZENFAMILIEN, III TIEL, ABT. 5, P. 130-135.

WILHELM ENGELMAN, LEIPZIG. 468 P.

REVIEWS EARLIER LITERATURE ON THE FAMILY INCLUDING SIMMONDSIA. DETAILED DESCRIPTIONS OF MORPHOLOGY, ESPECIALLY FLORAL PARTS, ARE PRESENTED FOR ALL OF THE GENERA OF BUXACEAE.

OALS/SIMMONDSIA CHINENSIS/PLANT MORPHOLOGY/SYSTEMATICS/FLOWERS/ BUXACEAE

187

PUREX CORPORATION, LTD.

1965

A DIFFERENT APPROACH TO THE TREATMENT OF ACNE VULGARIS.

PUREX CORPORATION, RESEARCH AND DEVELOPMENT BULLETIN 201:1-2. (UNPUBLISHED)

PHARMACOLOGICALLY JOJOBA WAX HAS ATTRACTED INTEREST BECAUSE FOLK USERS INSIST ON ITS EFFECTIVENESS IN THE TREATMENT OF DANDRUFF AND IN THE PROMOTION OF LUXURIANT GROWTH OF HAIR. THIS STUDY EXPLORES THE SUGGESTION THAT SULFURIZED JOJOBA OIL COULD BE USED AS A THERAPEUTIC AGENT FOR CONTROL OF EXCESSIVE EXCRETIONS FROM THE SEBACEOUS GLANDS. SEBUM SECRETION APPEARS TO BE A SELF-LIMITING PROCESS, AND JOJOBA OIL APPEARS TO ACT AS EFFECTIVELY AS LARGE CONCENTRATIONS OF SEBUM IN SIGNALING A REDUCTION IN SECRETION. THE WAX IS READILY TAKEN UP BY THE SKIN, TO WHICH IT IMPARTS A VELVETY SOFTNESS, AND SEEMINGLY HALTS THE ACCUMULATION OF EXCESSIVE SEBUM WHERE THIS IS WONT TO OCCUR.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/PLANT USES/MEDICINAL PLANTS/ SULFURIZATION

188

RAVEN, P.H.

1966

NATIVE SHRUBS OF SOUTHERN CALIFORNIA.

UNIVERSITY OF CALIFORNIA PRESS, BERKELEY, 132 P.

A BRIEF DESCRIPTION OF JOJOBA IS GIVEN ON PAGE 94.

OALS/SIMMONDSIA CHINENSIS/CALIFORNIA

189

RAVEN, P.H./KYHOS, D.W./HILL, A.J.

1965

CHROMOSOME NUMBERS OF SPERMATOPHYTES, MOSTLY CALIFORNIAN.

ALISC 6(1):105-113.

THE AUTHORS REPORT 2N=26 FOR MATERIAL FROM JOJOBA GROWING IN POTRERO GRADE, SAN DIEGO CO., CALIFORNIA. A REPORT OF APPROXIMATELY N=100 PROMPTED THE AUTHORS TO ADVISE THE SEARCH FOR INDIVIDUALS OR POPULATIONS HAVING N=52.

OALS/SIMMONDSIA CHINENSIS/CYTOLOGY/CHROMOSOMES/GENETICS/PLANT POPULATIONS/VARIABILITY(GENETIC)

190

RECORD, S.J./GARRATT, G.A.

1925

BOXWOODS.

YALE UNIVERSITY, SCHOOL OF FORESTRY, BULLETIN 14:3-81.

THE AUTHORS FOUND THE CLASSIFICATION OF THE FAMILY BUXACEAE BY VAN TIEGHEM PREFERABLE TO THAT OF PAX FOR THEIR PURPOSES. THIS LEAVES SIMMONDSIA OUT OF THE FAMILY. THEY NOTE THE WOOD OF SIMMONDSIA UNLIKE THE OTHER GENERA, IS OF ANOMALOUS STRUCTURE (INTERXYLARY BAST) AND ITS VESSELS ARE SPIRAL AND HAVE SIMPLE PERFORATIONS (P. 11-12).

OALS/SIMMONDSIA CHINENSIS/STEMS/WOOD PRODUCTS/PLANT MORPHOLOGY/ SYSTEMATICS/BUXACEAE/SIMMONDSIACEAE

191

RECORD, S.J./HESS, R.W.

1943

TIMBERS OF THE NEW WORLD.

YALE UNIVERSITY PRESS, NEW HAVEN.

SIMMONDSIA CHINENSIS IS USED FOR FUEL AND THE SEED FOR OIL. THE WOOD IS LEMON-YELLOW THROUGHOUT, WITHOUT DISTINCTIVE ODOR OR TASTE. IT IS HARD AND HEAVY, FINE-TEXTURED, OF IRREGULAR GRAIN, AND NOT RESISTANT TO DECAY. IT IS OF ANOMALOUS STRUCTURE, THE PHLOEM STRANDS BEING INCLUDED IN COARSE, CONCENTRIC, ANASTOMOSING BANDS OF CONJUNCTIVE TISSUE. COMMON NAMES LISTED (P. 111).

OALS/SIMMONDSIA CHINENSIS/PLANT USES/STEMS/PLANT MORPHOLOGY/WOOD PRODUCTS

192

ROEHR, C.M.

1910

A PRELIMINARY REPORT ON THE ANALYSIS OF THE SEEDS OF SIMMONDSIA CALIFORNICA.

PACIFIC PHARMACIST 3:335-338.

ANALYSIS OF THE SEEDS SHOW FIXED OIL 6.06 PERCENT, FAT 42.87 PERCENT AND PROTEIDS 12.97 PERCENT. THE FIXED OIL WAS A THICK, VISCID, YELLOW OR REDDISH-BROWN LIQUID, THE COLOR DEPENDING UPON THE TEMPERATURE USED IN ITS EXTRACTION. IN SOLUBILITY IT RESEMBLED OTHER EUPHORBIACEOUS OILS, BEING SOLUBLE IN ABSOLUTE ALCOHOL, IN GLACIAL ACETIC ACID AND IN OIL OF TURPENTINE. WHEN EXPOSED TO THE AIR, IT PARTOOK OF THE NATURE OF A SEMI-DRYING OIL. THE QUESTION OF ITS MEDICINAL VALUE IS STILL OPEN TO INVESTIGATION.

OALS/SIMMONDSIA CHINENSIS/LIPIDS/LIQUID WAX/MEDICINAL PLANTS/ORGANIC COMPOUNDS

193

ROSE, J.N.

1892

LIST OF PLANTS COLLECTED BY DR. EDWARD PALMER IN 1890 ON CARMEN ISLAND.

UNITED STATES NATIONAL HERBARIUM, CONTRIBUTIONS 1(5):129-134.

SIMMONDSIA CALIFORNICA NUTT. IN CANYONS, BUT NOT COMMON.

OALS/SIMMONDSIA CHINENSIS/BAJA CALIFORNIA/ISLANDS

194

ROSENZWEIG, M.L./WINAKUR, J.

1969

POPULATION ECOLOGY OF DESERT RODENT COMMUNITIES: HABITATS AND ENVIRONMENTAL COMPLEXITY.

ECOLOGY 50(4):558-572.

THE AUTHORS NOTED IN THEIR PLOT STUDIES THAT THE DISTRIBUTION OF PEROGNATHUS BAILEYI COINCIDED VERY CLOSELY WITH THE DISTRIBUTION OF SIMMONDSIA CHINENSIS. WHERE JOJOBA WAS ABSENT ANOTHER SPECIES OF PEROGNATHUS OCCURRED. THE AUTHORS SUGGEST THAT IF THESE ORGANISMS DISTRIBUTIONS REALLY ARE DIRECTLY CONNECTED, IT SHOULD BE INTERESTING TO DISCOVER WHY.

OALS/SIMMONDSIA CHINENSIS/RODENTS/ARIZONA/BOYCE THOMPSON SOUTHWESTERN ARBORETUM/PEROGNATHUS/DISTRIBUTION PATTERNS/BIOGEOGRAPHY/PLANT DISTRIBUTION

195

RUSSELL, F.

1908

THE PIMA INDIANS.

U.S. BUREAU OF AMERICAN ETHNOLOGY, ANNUAL REPORT, 26TH, 1904-1905. 391 P.

ON PAGE 78 MENTION IS MADE OF USE OF THE QUININE PLANT, JOJOBA, AS FOOD AND AS HAIR OIL.

OALS/SIMMONDSIA CHINENSIS/PLANT USES/FOODS/INDIANS OF NORTH AMERICA/ ETHNOBOTANY/NATIVE AMERICANS

196

SANCHEZ, G.C.

1944

LA JOJOBA; PLANTA CALIFORNIANA DE GRAN PORVENIR (THE JOJOBA, CALIFORNIA PLANT OF GREAT PROMISE).

HACIENDA 39:324-326.

PRESENTS A BRIEF DESCRIPTION OF JOJOBA HABITAT. THIS IS FOLLOWED BY DETAILED INSTRUCTION FOR SEEDING, TRANSPLANTING SEEDLINGS AND GENERAL CARE OF CULTIVATED PLANTS. ESTIMATES ARE PRESENTED ON SEED PRODUCTIVITY. DETAILS ARE GIVEN FOR THE PREPARATION OF SEVERAL FOOD DISHES FROM JOJOBA PASTE.

OALS/SIMMONDSIA CHINENSIS/SEEDLINGS/CULTIVATION/IRRIGATION PRACTICES/ /SEED PRODUCTION/FOODS/PLANTING MANAGEMENT/BAJA CALIFORNIA

197

SAUNDERS, C.F.

1930

A NEGLECTED NUT OF THE DESERT REGION.

DESERT 2:91.

THE NATURAL HISTORY OF THE PLANT AND ITS DISTRIBUTION ARE BRIEFLY DESCRIBED. UTILIZATION OF THE SEEDS INCLUDES EATING THEM RAW OR GRINDING THEM TO PREPARE A BEVERAGE. THE OIL IS USED TO PROMOTE GROWTH OF HAIR AND EYEBROWS, AS TABLE OIL, AND AS A REMEDY FOR CANCER.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/SEEDS/PLANT SUBSTANCES/LIPIDS/ NATURAL HISTORY/MEDICINAL PLANTS/PLANT USES

198

SAVAGE, E.S.

1951

A COMPARATIVE STUDY OF THE UTILIZATION OF JOJOBA AND COTTONSEED OIL IN THE RAT.

UNIVERSITY OF SOUTHERN CALIFORNIA, DEPT. OF BIOCHEMISTRY AND NUTRITION (M.S. THESIS). 54 P.

JOJOBA OIL HAS BEEN SHOWN TO HAVE THE LOWEST DIGESTIBILITY IN THE RAT OF ANY OF THE LIPID OILS SO FAR STUDIED. IT IS SUGGESTED THAT THIS PHENOMENON MAY RESULT FROM A DECREASED HYDROLYSIS IN THE GASTROINTESTINAL TRACT SINCE LARGE AMOUNTS OF UNHYDROLYZED WAX WERE FOUND IN THE FECES. FOLLOWING THE ADMINISTRATION OF JOJOBA OIL, A LOWERED UTILIZATION OF COTTONSEED OIL RESULTS OVER A CONSIDERABLE PERIOD OF TIME. THIS MAY POSSIBLY BE TRACED TO A DELAYED EXCRETION OF UNDIGESTED JOJOBA OIL OR TO A RE-EXCRETION OF THE WAX OR ALCOHOL VIA BILE OR INTESTINAL MUCOSA. THE FACT THAT THE NON-SAPONIFIABLE FRACTION OF THE FECES WAS 3 TO 4 TIMES THE NORMAL WOULD SEEM TO SUPPORT ONE OF THESE HYPOTHESES.

OALS/SIMMONDSIA CHINENSIS/LIPIDS/LIQUID WAX/ORGANIC COMPOUNDS/DIETS/ DIGESTION/SEEDS/RODENTS

199

SCHERY, R.W.

1952

PLANTS FOR MAN.

PRENTICE HALL, NEW YORK. 564 P.

CHAPTER 13 TREATS VEGETABLE OILS, FATS AND WAXES. ON P. 336 BRIEF MENTION IS MADE OF THE LIQUID WAX OF JOJOBA.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/PLANT SUBSTANCES/LIPIDS

200

SCHNEIDER, C.K.

1907

ILLUSTRIERTES HANDBUCH DER LAUBHOLZKUNDE. BD 2.

GUSTAV FISCHER, JENA.

THE AUTHOR RECOGNIZED THAT SIMMONDSIA CALIFORNICA NUTT. AND BUXUS CHINENSIS LINK WERE SYNONYMS. HE USED THE COMBINATION SIMMONDSIA CHINENSIS, RECOGNIZING THE PLANTS DISTINCTNESS FROM BUXUS AND CONFORMING TO THE PRIORITY RULE OF NOMENCLATURE (P. 141).

OALS/SIMMONDSIA/SIMMONDSIA CHINENSIS/SYSTEMATICS/BUXACEAE

201

SHEARON, W.H.

1951

VEGETABLE OILS.

CHEMICAL AND ENGINEERING NEWS 29(40):4065-4073.

THIS ARTICLE REVIEWS THE SITUATION OF COMESTIBLE AND INDUSTRIAL VEGETABLE OIL PRODUCTION IN THE WORLD FOLLOWING THE SECOND WORLD WAR. BOTH DOMESTIC (U.S.) AND FOREIGN PRODUCTION AND SOURCES ARE EXAMINED, FIGURES ARE GIVEN FOR YEARLY PRODUCTION, USES ARE OUTLINED, AND RECENT DEVELOPMENTS OF PRODUCTION AND MECHANIZATION OF CROP PRODUCTION AND PROCESSING ARE TREATED. PHYSICAL AND CHEMICAL CHARACTERISTICS AND CHEMICAL COMPOSITION OF PRINCIPLE OILS ARE PRESENTED IN TWO TABLES. THE AUTHOR CONCLUDED THAT THE VEGETABLE OIL SITUATION THE WORLD OVER WAS FAVORABLE. DOES NOT MENTION JOJOBA.

OALS/ORGANIC COMPOUNDS/SEEDS/LIPIDS/CROP PRODUCTION/SEED PRODUCTION/ PLANT BREEDING

202

SHREVE, F./WIGGINS, I.L.

1964

VEGETATION AND FLORA OF THE SONORAN DESERT. 2 VOLS.

STANFORD UNIVERSITY PRESS, STANFORD CALIFORNIA. 1740 P.

CONTAINS A BRIEF BOTANICAL DESCRIPTION OF THE JOJOBA PLANT, ITS FRUIT, AND HABITAT (P. 839-840).MAP P.184.

OALS/SIMMONDSIA CHINENSIS/SONORAN DESERT/PLANT DISTRIBUTION/MAPS

203

SINEATH, H.H./DAUGHERTY, P.M.

1952

INDUSTRIAL NEEDS FOR RAW MATERIALS OF PLANT ORIGIN.

RESEARCH ENGINEER 1951-1952:5-6, 21-24.

THIS SURVEY WAS DESIGNED TO PRESENT A MORE COMPREHENSIVE PICTURE OF THE ENTIRE RAW MATERIAL SITUATION AND TO SERVE AS A GUIDE IN THE INTRODUCTION OF PLANTS TO FILL THE NEEDS OF THE U.S. THE USE OF OIL FROM THE NATIVE PLANT JOJOBA AS A SUBSTITUTE FOR SPERM WHALE OIL IS A PRIME EXAMPLE OF THE POSSIBLITIES OF ACHIEVING INDEPENDENCE OF FOREIGN SUPPLIES. OTHER RAW MATERIALS DISCUSSED INCLUDE CARNAUBA, PERILLA, BAMBOO PULP, JUTE, KENAF, ERGOT, OIL OF CORIANDER, AND SESAME OIL.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/PLANT USES/FIBER PLANTS/PLANT SUBSTANCES/SPERM WHALE OIL/ECONOMIC DEVELOPMENT

204

SOLEREDER, H.

1908

SYSTEMATIC ANATOMY OF THE DICOTYLEDONS. V.1-2. TRANSLATED BY L.A. BOODLE AND F.E. FRITSCH, REVISED BY D.H. SCOTT.

CLARENDON PRESS, OXFORD.

UNDER SECTIONS ON THE FAMILY BUXACEAE (P. 761-763, 1053-1055) THE AUTHOR PRESENTS HIS OBSERVATIONS OF THE AXIS AND LEAF OF SIMMONDSIA CALIFORNICA, SARCOCOCCA PRUNIFORMIS, BUXUS SEMPERVIRENS AND PACHYSANDRA PROCUMBENS. AS CHARACTERS COMMON TO THE WHOLE GROUP, THE WOOD-PROSENCHYMA INVARIABLY BEARS BORDERED PITS, THE VESSELS ALWAYS HAVE BORDERED PITS ON THE WALLS IN CONTACT WITH PARENCHYMA, THE STOMATA ARE NEVER PROVIDED WITH PARALLEL SUBSIDIARY CELLS, AND EXTERNAL GLANDS ARE ABSENT. OXALATE OF LIME IS EXCRETED IN THE FORM OF CLUSTERED CRYSTALS OR AS CRYSTAL-SAND. THERE IS AN ANOMALOUS STRUCTURE OF THE AXIS IN SIMMONDSIA, ALSO FOUND IN THE ROOTS(APPEARANCE OF SUCCESSIVE RINGS OF GROWTH). THE LEAF IS BIFACIAL IN BUXUS, PACHYSANDRA, AND SARCOCOCCA, WHILE IN SIMMONDISA THE ENTIRE MESOPHYLL CONSISTS OF PALISADE-TISSUE. THE SPECIES EXHIBITING BIFACIAL STRUCTURE HAVE STOMATA ONLY ON THE LOWER SIDE OF THE LEAF; IN SIMMONDSIA THEY ARE EQUALLY DISTRIBUTED ON BOTH SURFACES.

OALS/SIMMONDSIA CHINENSIS/PLANT MORPHOLOGY/ROOTS/STEMS/LEAVES/STOMATA /SIMMONDSIA/CYTOLOGY/BUXACEAE

205

SOLOMON, A.M. ET AL

1973

FURTHER SCANNING ELECTRON PHOTOMICROGRAPHS OF SOUTHWESTERN POLLEN GRAINS.

ARIZONA ACADEMY OF SCIENCE, JOURNAL 8(3):135-157.

IN THIS CATALOGUE OF SOUTHWESTERN POLLEN GRAINS SIMMONDSIA CHINENSIS POLLEN IS DESCRIBED AS SPHERICAL, TRIPORATE, PORES CA. 10 MILLIMICRONS DIAMETER; EXINE TECTATE, OF IRREGULARLY SHAPED PLATES, FORMING A PSEUDOFRUSTILLATE PATTERN, EACH PLATE WITH ONE TO TEN MICROVERRUCAE. ILLUSTRATED WITH ELECTRON PHOTOMICROGRAPH.

OALS/SIMMONDSIA CHINENSIS/POLLEN/PLANT MORPHOLOGY/SOUTHWEST U.S.

206

SPADARO, J.J./EAVES, P.H./GASTROCK, E.A.

1960

DIRECT EXTRACTION OF JOJOBA SEED.

AMERICAN OIL CHEMISTS SOCIETY, JOURNAL 37(3):121-124.

DATA FOR THE APPLICATION OF THE VERSATILE FILTRATION-EXTRACTION PROCESS TO JOJOBA SEED ON A BENCH-SCALE HAVE BEEN PRESENTED. BASED ON EXPERIENCE WITH OTHER OIL-SEEDS, THERE SHOULD BE GOOD CORRELATION BETWEEN THE BENCH-SCALE AND ITS COMMERCIAL APPLICATION. MOISTURE CONTENTS OF THE MATERIAL DURING COOKING WERE OPTIMUM AT 10 AND 15 PERCENT. MASS VELOCITIES IN EXCESS OF 2,000 AND EXTRACTION EFFICIENCIES OF OVER 98 PERCENT WERE OBTAINED. THESE RESULTS ARE CONSIDERED SUITABLE FOR COMMERCIAL APPLICATION. HEXANE IS RECOMMENDED OVER HEPTANE AS THE EXTRACTION SOLVENT. THE USE OF UNCOOKED FLAKES IS NOT CONSIDERED FEASIBLE FOR LARGE-SCALE PRODUCTION.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/SEEDS/PLANT SUBSTANCES/ ORGANIC COMPOUNDS/SOLVENT EXTRACTION

207

SPADARO, J.J./LAMBOU, M.G.

1973

PREPARATION OF JOJOBA PRODUCTS AND THEIR POTENTIAL USES. IN E.F. HAASE AND W.G. MCGINNIES, EDS., JOJOBA AND ITS USES: AN INTERNATIONAL CONFERENCE, JUNE 1972, P. 47-60.

UNIVERSITY OF ARIZONA, OFFICE OF ARID LANDS STUDIES, TUCSON. 81 P.

THE PAPER REVIEWS THE RESEARCH CONTRIBUTIONS OF THE SOUTHERN MARKETING AND NUTRITION RESEARCH DIVISION OF USDA IN NEW ORLEANS. MECHANICAL EXTRACTION OF JOJOBA OIL IS DESCRIBED AND COMPARED WITH METHODS OF SOLVENT-EXTRACTION AND FILTRATION EXTRACTION. THE PROCESSES ARE DESCRIBED AND RESULTS ARE PRESENTED IN TABLES AND GRAPHS. USES OF THE LIQUID WAX AND MEAL ARE MENTIONED. THE CONVERSION OF JOJOBA WAX TO ALCOHOLS IS OUTLINED AND THE PROCESSES AND RESULTS OF HYDROGENATION, EPOXIDATION, AND POLYMERIZATION ARE PRESENTED. JOJOBA LIQUID WAX IS AN EXCELLENT SOURCE OF CARBON SUB 20 AND CARBON SUB 22 STRAIGHT-CHAIN ALCOHOLS AND ACIDS. THESE COMPOUNDS COULD SERVE AS POTENTIAL INTERMEDIATES IN THE PREPARATION OF DISINFECTANTS, SURFACTANTS, DETERGENTS, LUBRICANTS, DRIERS, EMULSIFIERS, RESINS, PLASTICIZERS, PROTECTIVE COATINGS, FIBERS, CORROSION INHIBITORS, CREAMS, OINTMENTS, EMULSIFIERS, ANTIFOAMERS AND OTHER PRODUCTS.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/ALCOHOLS/ORGANIC COMPOUNDS/PLANT USES/HYDROGENATION/EPOXIDATION/POLYMERIZATION/ MECHANICAL EXTRACTION/SOLVENT EXTRACTION/JOJOBA MEAL/ACIDS

208

STANDLEY, P.C.

1920 - 1926

TREES AND SHRUBS OF MEXICO, PARTS I-V.

UNITED STATES NATIONAL HERBARIUM, CONTRIBUTION 23. 1721 P.

ON PAGES 654-655 SIMMONDSIA CALIFORNICA IS DESCRIBED. THE SEEDS ARE EATEN RAW, PARCHED AND SOMETIMES USED IN A DRINK AS A SUBSTITUTE FOR COFFEE. OIL FROM THE SEEDS IS USED LOCALLY AS A HAIR TONIC. THE AUTHOR QUOTES CLAVIGERO (1789) ON MEDICINAL USES BY THE INDIANS. ON P. 1671 THE AUTHOR RECOGNIZES THE NAME SIMMONDSIA CHINENSIS AS HAVING PRECEDENT.

OALS/SIMMONDSIA CHINENSIS/MEDICINAL PLANTS/FOODS/PLANT USES/ SYSTEMATICS

209

STEBBINS, G.L./MAJOR, J.

1965

ENDEMISM AND SPECIATION IN THE CALIFORNIA FLORA.

ECOLOGICAL MONOGRAPHS 35(1):1-35.

AN EXTENSIVE REVIEW OF INFORMATION AND THEORIES PERTAINING TO THE SUBJECT. CALIFORNIA WAS DIVIDED INTO 10 FLORISTIC SUBDIVISIONS, WHICH WERE BASED UPON GEOGRAPHIC COMPACTNESS. FOR EACH SUBDIVISION, THE SPECIES WERE LISTED WHICH BELONG TO MONOTYPIC OR DITYPIC GENERA, OR WHICH HAVE ONLY ONE OR TWO SPECIES IN CALIFORNIA, THE REST BEING IN REMOTE AREAS. THESE SPECIES, NOT NECESSARILY ENDEMICS ARE TERMED RELICT SPECIES, AND THEIR NUMBER IN THE FLORA CAN BE TAKEN AS AN INDICATION OF THE EXTENT TO WHICH ANCIENT ELEMENTS ARE PRESERVED IN IT. FOR STUDYING ENDEMIC SPECIES WHICH MIGHT BE EXPECTED TO BE RELATIVELY RECENT, 70 RELATIVELY LARGE GENERA OF REPRESENTATIVE FAMILIES WERE SELECTED, AND THEIR WIDESPREAD AS WELL AS ENDEMIC SPECIES WERE LISTED FOR EACH OF THE 10 FLORISTIC SUBDIVISIONS. ONE WAY OF DISTINGUISHING BETWEEN RELATIVELY ANCIENT AND MORE RECENT SPECIES IN THE LARGER GENERA IS ON THE BASIS OF CHROMOSOME NUMBER. CONSEQUENTLY LISTS WERE COMPILED OF GENERA HAVING DIPLOID AND POLYPLOID ENDEMIC SPECIES, EITHER PATROENDEMICS OR APOENDEMICS. THE GREATEST FREQUENCY OF PATROENDEMICS IS IN THE CENTRAL COAST SUBDIVISION, AND NEAR THE ACTUAL COAST. THE REGIONS OF HIGH FREQUENCY OF APOENDEMICS ARE ASSOCIATED WITH BORDER LINES BETWEEN RELATIVELY MESIC AND MORE XERIC BIOTA. WHILE ENDEMIC SPECIES ARE MOST FREQUENT IN MOUNTAINOUS REGIONS, RELATIVELY LOW MOUNTAINS HAVE AS MANY OR MORE ENDEMICS THAN THE HIGHER MOUNTAIN RANGES. AN OVERALL HYPOTHESIS IS PRESENTED TO EXPLAIN THE HIGH DEGREE OF ENDEMISM IN CALIFORNIA. IT IS NOTED THAT SIMMONDSIA CHINENSIS HAS CA. 100 CHROMOSOMES. IT OCCURS IN 2 OF THE 10 SUB-DIVISIONS, SOUTHERN CALIFORNIA AND COLORADO DESERT. JOJOBA IS RECOGNIZED AS A PALEOENDEMIC SPECIES, I.E. SYSTEMATICALLY ISOLATED, SHOWING LITTLE VARIABILITY, OFTEN ECOLOGICAL SPECIALISTS, AND PERHAPS MOVING TOWARDS EXTINCTION. ITS HIGH CHROMOSOME NUMBER ALONG WITH ITS BEING MONOTYPIC INDICATE THAT IT IS ALSO A PALEOPOLYPLOID.

OALS/RELICT VEGETATION/VEGETATION CHANGE/PLANT DISTRIBUTION/CLIMATIC-VEGETAL RELATIONSHIPS/BIOGEOGRAPHY/CHROMOSOMES/SPECIATION/SIMMONDSIA CHINENSIS/CALIFORNIA/PHYTOGEOGRAPHY/PLANT ECOLOGY/EVOLUTION/ PALEOGEOGRAPHY/PLEISTOCENE EPOCH

210

STEINLE, J.V.

1952

WAX CHEMURGY IN THE UNITED STATES.

CHEMURGIC DIGEST 11(6):4-5.

WITH AN INADEQUATE SUPPLY AND HIGH PRICE OF CARNAUBA, IT IS WORTH LOOKING FOR AMERICAN SOURCES OF MODERATELY PRICED VEGETABLE WAXES. IN GENERAL, THE MOST DESIRABLE VEGETABLE WAXES POSSESS THE FOLLOWING PROPERTIES: TOUGHNESS, WATER REPELLENCY, HARDNESS, ABSENCE OF TACK, LIGHTNESS OF COLOR, HIGH MELTING POINT, FREEDOM FROM RESINS, A MINIMUM OF HYDROCARBONS AND KETONES IN THEIR COMPOSITION, AND THE ABILITY TO PRODUCE A HIGH GLOSS WITH BUFFING. PROCESSES AND EXPERIMENTAL DEVELOPMENTS IN EXTRACTION OF WAXES ARE DISCUSSED FOR THE FOLLOWING NATIVE OR INTRODUCED PLANTS: SUGAR CANE, CANDELILLA, CAAUASSU, 13 INDIGENOUS PLANTS OF SOUTHERN ARIZONA, SORGHUM GRAIN, BARK OF DOUGLAS FIR TREE, SEEDS OF JOJOBA. IT IS RECOMMENDED THAT EFFORTS AT DEVELOPING THESE POTENTIAL SOURCES OF VEGETATION WAXES BE CONTINUED SO THAT THE U.S. DOES NOT HAVE TO RELY SO HEAVILY ON IMPORTED WAXES.

OALS/SIMMONDSIA CHINENSIS/ORGANIC COMPOUNDS/LIQUID WAX/PSEUDOTSUGA MENZIESII/XEROPHYTES/SORGHUM/PLANT USES/LIPIDS/PLANT SUBSTANCES

211

SWANK, W.G.

1958

THE MULE DEER IN ARIZONA CHAPARRAL AND AN ANALYSIS OF OTHER IMPORTANT DEER HERDS. A RESEARCH AND MANAGEMENT STUDY.

ARIZONA GAME AND FISH DEPARTMENT, PHOENIX, WILDLIFE BULLETIN 3. 103 P.

THE PROTEIN CONTENT OF SEVERAL FORAGE PLANTS WAS DETERMINED. COFFEE-BUSH (SIMMONDSIA CHINENSIS), A SPECIES ABUNDANT ON THE DESERT AND AT LOWER ELEVATIONS IN THE CHAPARRAL, HAD A HIGH PROTEIN CONTENT. THE PEAK WAS 21.1 PERCENT, THE LOW 8.3 PERCENT, THE AVERAGE PROTEIN CONTENT 13.5 PERCENT. ON THE DESERT THIS SPECIES IS CONSIDERED TO BE ONE OF THE MOST IMPORTANT BROWSE PLANTS.

OALS/SIMMONDSIA CHINENSIS/FOOD HABITS/ARIZONA/CHAPARRAL/FORAGE PLANTS /PROTEINS/ODOCOILEUS HEMIONUS/BROWSE

212

TAKHTAJAN [TAKHTADZHYAN], A.L.

1959

DIE EVOLUTION DER ANGIOSPERMEN. TRANSLATED FROM RUSSIAN BY W. HOPPNER.

GUSTAV FISCHER, JENA.

SIMMONDSIA IS PLACED IN THE FAMILY SIMMONDSIACEAE IN THE ORDER CENTROSPERMAE. THE EVIDENCE FOR ITS RELATIONSHIP TO THE BUXACEAE, AIZOACEAE AND CENTROSPERMAE IS DISCUSSED. CONCLUDES THAT THE SYSTEMATIC CLASSIFICATION OF THE SIMMONDSIACEAE NEEDS WORK IN THE FUTURE.

OALS/SIMMONDSIA/SIMMONDSIACEAE/SIMMONDSIA CHINENSIS/BUXACEAE/ SYSTEMATICS

213

TAKHTAJAN [TAKHTADZHYAN], A.L.

1966

SISTEMA I FILOGENIYA TSVETKOVYKH RASTENII (A SYSTEM AND PHYLOGENY OF THE FLOWERING PLANTS).

IZDATEL STVO [=IZSD-VO] NAUKA, MOSKVA-LENINGRAD.

COMPARES THE LEAF, STEM, FLORAL AND SEED STRUCTURES OF MEMBERS OF THE FAMILY BUXACEAE WITH SIMMONDSIA. THE AUTHOR CONCURS WITH VAN TIEGHEM, 1898, THAT SIMMONDSIA IS BETTER PLACED IN A SEPARATE FAMILY SIMMONDSIACEAE. VAN TIEGHEM HAD PLACED THIS MONOTYPIC FAMILY WITH THE AIZOACEAE-TETRAGONIEAE, AND THE AUTHOR PLACED IT WITH THE CARYOPHYLLALES. THE AUTHOR NOW PLACES SIMMONDSIACEAE NEXT TO BUXACEAE.

OALS/SIMMONDSIA/SIMMONDSIA CHINENSIS/SYSTEMATICS/PLANT MORPHOLOGY/ BUXACEAE/SIMMONDSIACEAE

214

TAKHTAJAN [TAKHTADZHYAN], A.L.

1969

FLOWERING PLANTS, ORIGIN AND DISPERSAL. TRANSLATION FROM THE RUSSIAN BY C. JEFFREY.

SMITHSONIAN INSTITUTION PRESS, WASHINGTON, D.C. 310 P.

PLACES SIMMONDSIA IN THE MONOTYPIC FAMILY SIMMONDSIACEAE IN THE ORDER EUPHORBIALES (P. 221).

OALS/SIMMONDSIA/SIMMONDSIA CHINENSIS/SYSTEMATICS/SIMMONDSIACEAE/ BUXACEAE

215

TAUSSKY, I.

1944

COMPOSITION OF MATTER AND PREPARATION AND PROCESS OF PRODUCING THE SAME.

UNITED STATES PATENT 2,350,082: MAY 30, 1944.

THIS INVENTION, RELATING TO FAT-CONTAINING FOOD COMPOSITIONS, MORE PARTICULARLY TO CAKE BATTER AND SHORTENING COMPOSITIONS AND TO PROCESSES OF PRODUCING THE SAME, CONSISTS MAINLY IN INCORPORATING VARIOUS SUBSTANCES PRODUCED BY TREATING LIQUID JOJOBA NUT OIL INTO VARIOUS COMPOSITIONS. SUCH A SHORTENING MATERIAL IS NEEDED AS THE REGULAR SHORTENING, USUALLY MADE OF HYDROGENATED COTTON SEED, SOY BEAN, OR LIKE OILS, IS SUBSTANTIALLY LACKING IN EMULSIFYING POWER. THIS EMULSIFYING POWER CAN BE ADDED BY USING THE UNSAPONIFIABLE DISTILLATE OF UNHARDENED, ELAIDINATED OR HYDROGENATED JOJOBA NUT OIL, I.E. UNHARDENED, ELAIDINATED OR HYDROGENATED JOJOBA NUT ALCOHOL, AS SHORTENING MATERIAL. SHORTENING COMPOSITIONS OF THIS TYPE AND THEIR PREPARATION ARE DESCRIBED; 16 CLAIMS ARE MADE.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/ALCOHOLS/FOODS/SEEDS/PLANT USES/ /PATENTS/LIPIDS

216

TAUSSKY, I.

1946

PROCESSES OF REFINING, PURIFYING, AND HYDROGENATING FATS, FATTY ACIDS, AND WAXES.

UNITED STATES PATENT 2,413,009. DECEMBER 24, 1946.

DEALS WITH THE PROCESS OF REFINING A SUBSTANCE SELECTED FROM THE GROUP CONSISTING OF FATS, FATTY ACIDS AND WAXES, INCLUDING JOJOBA WAX. THE SUBSTANCE IS COMBINED WITH A SMALL PERCENTAGE OF A FINELY-DIVIDED SPENT HYDROGENATION CATALYST AND SUBJECTED TO HYDROGEN PRESSURE OF BETWEEN 50 AND 750 POUNDS PER SQUARE INCH AT A TEMPERATURE SLIGHTLY ABOVE 212 DEGREES F.

OALS/SIMMONDSIA CHINENSIS/PATENTS/ACIDS/LIPIDS/LIQUID WAX/ORGANIC COMPOUNDS

217

THOMPSON, A.E.

1973

NEEDS FOR HORTICULTURAL RESEARCH ON PROPAGATION, CULTURE AND BREEDING OF JOJOBA. IN E.F. HAASE AND W.G. MCGINNIES, EDS., JOJOBA AND ITS USES: AN INTERNATIONAL CONFERENCE, JUNE 1972, P. 33-36.

UNIVERSITY OF ARIZONA, OFFICE OF ARID LANDS STUDIES, TUCSON. 81 P.

THIS PAPER IS AN OUTLINE OF STEPS NEEDED IN THE HORTICULTURAL DEVELOPMENT OF JOJOBA AS A CULTIVATE, WHICH COULD BE ACCOMPLISHED BY THE ARIZONA AGRICULTURAL EXPERIMENT STATION. THREE MAJOR AREAS ARE CONSIDERED: 1) PLANT BREEDING AND GENETICS; EVALUATION OF VARIABILITY, SELECTION PLANT TYPES, SITE SELECTION, EVALUATION OF POTENTIAL OF MINIMIZING THE LENGTH OF THE BREEDING CYCLE, EVALUATION OF DISEASE AND INSECT RESISTANCE, 2) ASEXUAL AND SEXUAL PROPAGATION AND PLANT ESTABLISHMENT; STEM CUTTINGS, SEEDS, TYPE OF CONTAINER FOR TRANSPLANTS, CONDITIONING PLANTS FOR TRANSPLANTING, PLANTING AND ESTABLISHING PLANTS IN THE FIELD, AND 3) METHODS OF CULTURE; SOIL AND WATER REQUIREMENTS, METHODS OF IRRIGATION, PLANTING ARRANGEMENTS AND DISTANCES, PRUNING PROCEDURES, MECHANICAL HARVESTING, PEST CONTROL. ONCE THE EVALUATION OF JOJOBA IN THESE AREAS HAS PROVIDED MORE INFORMATION, PROBABLY 5-8 YEARS, IT COULD BECOME AN IMPORTANT NEW CROP AND IMPORTANT CONTRIBUTION TO INDIAN RESERVATION ECONOMICS.

OALS/SIMMONDSIA CHINENSIS/ARIZONA/GENETICS/REPRODUCTION/ VARIABILITY(GENETIC)/PLANTING MANAGEMENT/IRRIGATION PRACTICES/PLANT BREEDING/SEEDLINGS/CULTIVATION/DISEASES/PESTS(INSECTS)/INDIANS OF NORTH AMERICA/NATIVE AMERICANS/ECONOMIC DEVELOPMENT

218

THOMPSON, P.F.

1972

COMPARISONS OF SPERM OIL BASED E.P. ADDITIVES WITH THEIR REPLACEMENT PRODUCTS.

NLGI (NATIONAL LUBRICATING GREASE INSTITUTE) SPOKESMAN 36(6):208-213.

THE SOURCES, USES, AND CHEMISTRY OF SPERM WHALE OIL ARE DISCUSSED. NATIONAL CONCERN ABOUT THE SHRINKING POPULATION OF SPERM WHALES WHICH CAUSED THEIR LISTING UNDER THE ENDANGERED SPECIES ACT, FORCES SPERM WHALE OIL USERS TO LOOK FOR REPLACEMENT PRODUCTS. THIS REPORT PRESENTS INFORMATION ON VARIOUS EVALUATIONS OF THESE PRODUCTS. THOSE CONTAINING SULFUR, SULFUR AND CHLORINE, AND CHLORINE HAVE BEEN DEVELOPED THAT HAVE PROPERTIES AND PRICE-PERFORMANCE RELATIONSHIPS EQUIVALENT TO SPERM OIL BASED EXTREME PRESSURE ADDITIVES. THE RAW MATERIALS FOR THE REPLACEMENT PRODUCTS CAN BE CLASSIFIED AS A COMBINATION OF DOMESTICALLY AVAILABLE NATURAL AND SYNTHETIC RAW MATERIALS, SELECTED FROM HIGH QUALITY LARD OILS, METHYL ESTERS AND SYNTHETICALLY DERIVED HIGHER MOLECULAR WEIGHT ESTERS AND OTHER FUNCTIONALLY SUBSTITUTED CHEMICAL COMPOUNDS. INDUSTRIAL USE OF MOST OF THE REPLACEMENTS IS UNDERWAY AND THE RESULTS SUPPORT AND CORRELATE WELL WITH THE LABORATORY EVALUATIONS.

OALS/SPERM WHALE OIL/LIPIDS/ORGANIC COMPOUNDS/LIQUID WAX/ESTERS/ SULFURIZATION

219

THORNBER, J.J.

1910

THE GRAZING RANGES OF ARIZONA.

ARIZONA AGRICULTURAL EXPERIMENT STATION, BULLETIN 65:245-360.

ON P. 269 BRIEF MENTION IS MADE OF THE IMPORTANCE OF JOJOBA AS A BROWSE PLANT IN THE VICINITY OF TUCSON. THE AUTHOR CLAIMS THAT THE NUTS ARE COLLECTED AND STORED BY SQUIRRELS, THUS SPREADING THE PLANT.

OALS/ARIZONA/FORAGE PLANTS/RODENTS/SIMMONDSIA CHINENSIS/BROWSE

220

TOBIAS, J.W./MAZZUCO, A.F./LATORRE, R.J.

1947 - 1949

ACCION IN VITRO DE LA CERA LIQUIDA EXTRAIDA DE LAS SEMILLAS DE SIMMONDSIA CALIFORNICA NUTT. SOBRE EL MYCOBACTERIUM TUBERCULOSIS (IN VITRO ACTION OF THE LIQUID WAX EXTRACTED FROM SIMMONDSIA CALIFORNICA NUTT. SEEDS ON MYCOBACTERIUM TUBERCULOSIS).

INSTITUTO MODELO DE CLINICA MEDICA, BUENOS AIRES, ANALES 27:803-818.

THE LIQUID WAX OBTAINED FROM THE SEEDS OF JOJOBA HAS AN INTENSE INHIBITORY ACTION ON TUBERCLE BACILLI. THE VIRULENT MYCOBACTERIUM TUBERCULOSIS PUT INTO CONTACT WITH THIS WAX DOES NOT GROW IN THE USUAL CULTURE MEDIA. IT IS NOT POSSIBLE TO DEMONSTRATE ITS PRESENCE IN THE SMEARS, EXAMINED WITH THE ELECTRON MICROSCOPE, CONSISTING OF MATERIAL DERIVED FROM THE CULTURE MEDIA OF THE EMULSION OF THE BACILLI IN THE LIQUID WAX.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/PLANT USES/MEDICINAL PLANTS/ BACTERIA/CULTURES(BIOLOGY)/MICROORGANISMS

221

TOMOFF, C.S./JOHNSON, J.D.

1973

JOJOBA SEED PRODUCTION POTENTIAL: ARIZONA, 1972. IN E.F. HAASE AND W.G. MCGINNIES, EDS., JOJOBA AND ITS USES; AN INTERNATIONAL CONFERENCE, JUNE 1972, P. 27-28.

UNIVERSITY OF ARIZONA, OFFICE OF ARID LANDS STUDIES, TUCSON. 81 P.

REPORTS ON ATTEMPTS UNDERWAY TO MAP THE GEOGRAPHICAL DISTRIBUTIONS OF JOJOBA POPULATIONS, EXPRESSING THEM IN TERMS OF THEIR POPULATION DENSITIES, SEX RATIOS, PRESENT FRUITING CONDITIONS, AND THEN ESTIMATING THE SEED PRODUCTION POTENTIAL FOR EACH POPULATION ON A WEIGHT PER ACRE BASIS. PROBLEMS WITH SAMPLING ARE DISCUSSED. DROUGHT HAS CAUSED MANY PLANTS TO ABORT THEIR FRUIT. DENSE FRUITING STANDS ARE SITUATED PREDOMINATELY ON NORTHEAST, NORTH, AND NORTHWEST FACING SLOPES, ALONG STEEP SLOPES IMMEDIATELY ADJACENT TO WASHES OR RUNOFFS, OR ON RELATIVELY FLAT TERRAIN WHICH IS FED WITH CONSIDERABLE RUNOFF. IT IS HOPED THAT 50,000 POUNDS OF SEED CAN BE HARVESTED FROM SOUTH CENTRAL ARIZONA.

OALS/SIMMONDSIA CHINENSIS/PRODUCTIVITY/SEEDS/FRUITING/DROUGHTS/ MICROENVIRONMENT/ASPECT/SLOPE EXPOSURE/PLANT POPULATIONS/MAPPING/ PHENOLOGY/PLANT DISTRIBUTION/SEED PRODUCTION

222

TORREY, J.

1859

BOTANY OF THE BORDER. IN W.H. EMORY, REPORT ON THE UNITED STATES AND MEXICAN BOUNDARY SURVEY, VOL. 2, PT. 1.

U.S. CONGRESS, 34TH, 1ST SESSION, HOUSE EX. DOC. 135. WASHINGTON, 270 P., 61 PLATES.

THE FRUIT OF SIMMONDSIA CALIFORNICA IS DESCRIBED, AS IT WAS NOT AVAILABLE TO THE ORIGINAL DESCRIBER OF THE SPECIES (P. 202).

OALS/SIMMONDSIA CHINENSIS/SEEDS

223

U.S. FOREST SERVICE

1948

WOODY-PLANT SEED MANUAL.

U.S. DEPARTMENT OF AGRICULTURE, MISCELLANEOUS PUBLICATION 654.

DISTRIBUTION, USES AND SEEDING HABITS OF THE JOJOBA PLANT ARE MENTIONED (P. 339, 393). COLLECTION OF SEEDS BEFORE THE WINTER RAINS IS RECOMMENDED. SEEDS MAY BE STORED IN AN ORDINARY STORAGE ROOM FOR 1 OR 2 YEARS; FOR LONGER PERIODS, AIRTIGHT CONTAINERS AND LOW TEMPERATURES ARE ADVISABLE. GERMINATION IS HYPOGEOUS. EXPERIMENTS HAVE INDICATED THAT JOJOBA MIGHT BE A GOOD SPECIES FOR DIRECT SEEDING IN THE FIELD, WERE IT NOT THAT SMALL RODENTS DIG UP THE SEEDS AFTER PLANTING. GERMINATION BEGINS IN 5 TO 7 DAYS AFTER THE SEED IS SOWN, SEEDLINGS APPEAR IN 15 TO 20 DAYS AFTER SOWING. ILLUSTRATES SEEDLINGS AT 3, 7, AND 14 DAYS.

OALS/SIMMONDSIA CHINENSIS/SEEDS/SEEDLINGS/GERMINATION/PLANTING MANAGEMENT/VIABILITY/SEEDING/RODENTS/PLANTING MANAGEMENT

224

VAN DERSAL, W.R.

1938

NATIVE WOODY PLANTS OF THE UNITED STATES, THEIR EROSION CONTROL AND WILDLIFE VALUES.

U.S. DEPARTMENT OF AGRICULTURE, MISCELLANEOUS PUBLICATION 303. 362 P.

NOTES THAT JOJOBA IS BROWSED BY LIVESTOCK AND IS MUCH EATEN BY SQUIRRELS, MULE DEER, AND WHITE-WINGED DOVES (P. 261).

OALS/SIMMONDSIA CHINENSIS/PHENOLOGY/SEEDS/FOOD HABITS/WILDLIFE/ RODENTS/ODOCOILEUS HEMIONUS/ZENAIDA ASIATICA/EROSION CONTROL/BIRDS

225

VAN TIEGHEM, P.

1897

SUR LES BUXACEES. I: SUR LE GENRE SIMMONDSIE, CONSIDERE COMME TYPE D UNE FAMILLE DISTINCTE, LES SIMMONDSIACEES (ON THE BUXACEAE. I: ON THE GENUS SIMMONDSIA CONSIDERED AS THE TYPE OF A DISTINCT FAMILY, SIMMONDSIACEAE).

ANNALES DES SCIENCES NATURALES, BOTANIQUE ET BIOLOGIE VEGETALE 5:290-301.

THE STEM, LEAF, ROOT, FLOWERS, FRUIT, SEEDLING AND GERMINATION OF SIMMONDSIA WERE EXAMINED IN DETAIL. SIMMONDSIA WAS FOUND TO BE OUTSTANDING IN THE FOLLOWING: STEM AND ROOT STRUCTURE, DIOECIOUS HABIT, FIVE PART CALYX, CYCLIC CONFORMATION OF THE TWO TYPES OF FLOWERS, ABSENCE OF A COROLLA, POLYSTAMENS, CONFORMATION OF THE PISTIL, UNITY OF THE OVULE IN EACH CARPEL, APICAL INSERTION OF THE STIGMA AND THEIR OLD AGE, THE ABSENCE OF ALBUMEN IN THE COTYLEDONS, THE ACCUMBENT OF THE COTYLEDONS AND IN THE GERMINATION WITH HYPOGEOUS COTYLEDONS. THE AUTHOR CONCLUDES THAT SIMMONDSIA DIFFERS SO GREATLY FROM OTHER MEMBERS OF THE FAMILY BUXACEAE THAT IT SHOULD CONSTITUTE THE TYPE OF A DISTINCT MONOTYPIC FAMILY, THE SIMMONDSIACEAE. THE RELATIONSHIPS OF THE FAMILY ARE BRIEFLY CONSIDERED.

OALS/SIMMONDSIA CHINENSIS/SYSTEMATICS/STEMS/LEAVES/ROOTS/FLOWERS/ SEEDS/PLANT MORPHOLOGY/GERMINATION/SEEDLINGS/BUXACEAE/SIMMONDSIACEAE

226

VAN TIEGHEM, P.

1898

SUR LE GENRE SIMMONDSIE, CONSIDERE COMME TYPE D UNE FAMILLE DISTINCTE, LES SIMMONDSIACEES (ON THE GENUS SIMMONDSIA, CONSIDERED AS THE TYPE OF A DISTINCT FAMILY, THE SIMMONDSIACEAE).

JOURNAL DE BOTANIQUE 12:103-112.

IDENTICAL TO 1897 PAPER BY THE SAME AUTHOR, EXCEPT THAT IT LACKS A ONE PAGE SECTION ON GERMINATION AND SEEDLINGS.

OALS/SIMMONDSIA CHINENSIS/SYSTEMATICS/STEMS/LEAVES/ROOTS/FLOWERS/ SEEDS/PLANT MORPHOLOGY/SIMMONDSIACEAE/BUXACEAE

227

VASEY, G./ROSE, J.N.

1890 A

LIST OF PLANTS COLLECTED BY DR. EDWARD PALMER IN 1889 IN THE REGION OF LOWER CALIFORNIA, WITH NOTES AND DESCRIPTIONS OF NEW SPECIES. 2: PLANTS COLLECTED AT CEDROS ISLAND.

U.S. NATIONAL HERBARIUM, CONTRIBUTIONS 1(1):1-28.

UNDER FAMILY EUPHORBIACEAE, SIMMONDSIA CALIFORNIA NUTT., DR. PALMER SAYS THIS COMMON SHRUB IS IN FULL BLOOM (JANUARY 30) AT GUAYNAS; IN 1887 IT WAS IN BLOOM IN OCTOBER (P. 20).

OALS/SIMMONDSIA CHINENSIS/BAJA CALIFORNIA/MEXICO/ISLANDS/SONORA/ PHENOLOGY/FLOWERING

228

VASEY, G./ROSE, J.N.

1890 B

LIST OF PLANTS COLLECTED BY DR. EDWARD PALMER IN LOWER CALIFORNIA AND WESTERN MEXICO IN 1890.

U.S. NATIONAL HERBARIUM, CONTRIBUTION 1(3):63-96.

PLANT NUMBER 729, SIMMONDSIA CALIFORNICA NUTT.. THIS IS S. FABULOSA [SIC] OF KELLOGG, REFERRED HERE BY S. WATSON, BUT WITHOUT SEEING SPECIMENS. IT IS ONLY KNOWN FROM DR. VEATCH'S COLLECTION AND WAS NOT REDISCOVERED BY MR. GREENE. DR. PALMER SPEAKS OF IT AS A LARGE SHRUB AT MOUTH OF CANYONS (P. 79).

OALS/SIMMONDSIA CHINENSIS/SONORA/BAJA CALIFORNIA/MEXICO/SYSTEMATICS

229

VAUGHAN, J.G.

1970

THE STRUCTURE AND UTILIZATION OF OIL SEEDS.

CHAPMAN AND HALL, LONDON. 279 P.

PAGES 20-22 CONTAIN A BRIEF DISCUSSION OF JOJOBA. POSSIBLE USES OF THE OIL ARE OUTLINED AND THE MORPHOLOGY OF THE SEED IS DESCRIBED. IN TRANSVERSE SECTIONS OF THE SEEDS TWO CREAM-COLOURED COTYLEDONS ARE VERY OBVIOUS, AND IN THE MAJORITY OF EXAMPLES THE OUTLINE OF THE SEED IS SEEN IN THE FORM OF THREE PIECES. THERE IS NO ENDOSPERM PRESENT. THE MICROSCOPIC STRUCTURE OF THE TESTA IS DESCRIBED. THE COTYLEDONS CONSIST OF PARENCHYMA CELLS WITH OIL DROPS AND VERY SMALL ALEURONE GRAINS.

OALS/SIMMONDSIA CHINENSIS/SEEDS/PLANT MORPHOLOGY/CYTOLOGY/PLANT USES

230

VIETMEYER, N.D.

1971

SIMMONDSIA WAX: A POTENTIALLY VALUABLE RESOURCE FOR ARID ZONES AND FOR WHALE CONSERVATION. A REVIEW OF STATEMENTS FROM THE LITERATURE.

(UNPUBLISHED). 19 P.

THE AUTHOR SUGGESTS THAT THE DEVELOPMENT OF A SIMMONDSIA SEED INDUSTRY HAS THE POTENTIAL OF MEETING THE NEEDS OF INDUSTRY, OF WHALE CONSERVATION, AND OF INDIAN WELFARE. THE NATURAL HISTORY OF THE PLANT, JOJOBA, IS OUTLINED AND ATTEMPTS AT CULTIVATION IN ISRAEL ARE NOTED. THE CHARACTERISTICS AND PROPERTIES OF THE UNIQUE LIQUID WAX OBTAINED FROM THE SEEDS ARE NOTED AND COMPARED WITH THOSE OF SPERM WHALE OIL. THE POTENTIAL OF USING JOJOBA OIL TO REPLACE SPERM WHALE OIL IS DISCUSSED. ALSO, THE HYDROGENATED OIL COULD REPLACE OR EXTEND THE MUCH HIGHER PRICED CARNAUBA WAX. INCLUDES BIBLIOGRAPHY, STATISTICS ON SPERM WHALE OIL, JOJOBA OIL AND CARNAUBA WAX, DISTRIBUTION MAP, AND LIST OF PEOPLE WORKING ON JOJOBA.

OALS/SIMMONDSIA CHINENSIS/ECONOMIC DEVELOPMENT/SPERM WHALE OIL/LIQUID WAX/INDIANS OF NORTH AMERICA/PLANT DISTRIBUTION/ISRAEL/NATIVE AMERICANS

231

VIETMEYER, N.D.

1973

SUMMARIZING REMARKS. IN E.F. HAASE AND W.G. MCGINNIES, EDS., JOJOBA AND ITS USES; AN INTERNATIONAL CONFERENCE, JUNE 1972, P. 75-77.

UNIVERSITY OF ARIZONA, OFFICE OF ARID LANDS STUDIES, TUCSON. 81 P.

THE AUTHOR REVIEWS THE HIGHLIGHTS OF NEW FINDINGS PRESENTED AT THE CONFERENCE, FOLLOWED BY THREE PROBLEMS OF ORGANIZATION: 1) THE NEED FOR A CAREFULLY PREPARED MONOGRAPH, 2) THE NEED TO APPLY THE LATEST TECHNOLOGY FROM ALL PERTINENT FIELDS, AND 3) THE NEED TO ESTABLISH A TASK GROUP FOR NATIONAL AND INTERNATIONAL COOPERATION IN THE RESEARCH AND DEVELOPMENT OF JOJOBA. THIS PANEL S TASKS ARE OUTLINED. RESEARCH TOPICS WORTHY OF EFFORT ARE LISTED. (REPRINTED 1972, BOXWOOD BULLETIN 12(2):27-29).

OALS/SIMMONDSIA CHINENSIS/REVIEWS/ARIZONA/ECONOMIC DEVELOPMENT

232

WARTH, A.H.

1956

THE CHEMISTRY AND TECHNOLOGY OF WAXES. 2ND ED.

REINHOLD PUBLISHING CORP., NEW YORK.

A GENERAL DISCRIPTION OF THE JOJOBA PLANT, DISCOVERY OF ITS UNIQUE LIQUID WAX, AND POSSIBLE USES IS GIVEN. FOLLOWING THIS IS A DETAILED DESCRIPTION OF THE COMPOSITION OF JOJOBA OIL, LARGELY BASED ON THE FINDINGS OF MCKINNEY AND JAMIESON. THE USES OF JOJOBA WAX BY NATIVE PEOPLE AND POSSIBLE MODERN USES BEFORE AND AFTER ALTERATION, SULFURIZATION AND HYDROGENATION, ARE REVIEWED. THE AUTHOR NOTES THAT JOJOBA OIL IS NOT READILY AVAILABLE DUE TO THE UNCERTAINTY OF WILD CROPS (P. 302-307).

OILS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/PLANT USES/ORGANIC COMPOUNDS/SULFURIZATION/HYDROGENATION/NATIVE AMERICANS/ETHNOBOTANY

233

WATSON, S.

1880

BOTANY OF CALIFORNIA, VOL. II. (UNIFORM WITH THE PUBLICATIONS OF THE GEOLOGICAL SURVEY OF CALIFORNIA).

LITTLE, BROWN, AND COMPANY. BOSTON. 559 P.

A BOTANICAL DESCRIPTION IS GIVEN OF THE GENUS SIMMONDSIA AND ITS ONLY SPECIES S. CALIFORNICA ON P. 67.

OILS/SIMMONDSIA CHINENSIS/CALIFORNIA

234

WATSON, S.

1889

UPON A COLLECTION OF PLANTS MADE BY DR. E. PALMER IN 1887 ABOUT GUAYMAS, MEXICO, AT MULEJE AND LOS ANGELES BAY IN LOWER CALIFORNIA, AND ON THE ISLAND OF SAN PEDRO MARTIR IN THE GULF OF CALIFORNIA.

AMERICAN ACADEMY OF ARTS AND SCIENCES. PROCEEDINGS 24(6):63-87.

SIMPLY MENTIONS THAT SIMMONDSIA CALIFORNICA NUTT. IS COMMON ABOUT GUAYMAS (P. 76).

OILS/SIMMONDSIA CHINENSIS/MEXICO/SONORA/BAJA CALIFORNIA/GULF OF CALIFORNIA/ISLANDS

235

WEEK, E.F./SEVIGNE, F.J.

1949 A

VITAMIN A UTILIZATION STUDIES. II THE UTILIZATION OF VITAMIN A ALCOHOL, VITAMIN A ACETATE AND VITAMIN A NATURAL ESTERS BY THE CHICK.

JOURNAL OF NUTRITION 39:233-250.

VITAMIN A LIVER STORAGE TESTS WERE USED AS THE CRITERION FOR DETERMINING THE RELATIVE USE OF THE ALCOHOL, ACETATE AND NATURAL ESTER FORMS OF VITAMIN A BY THE CHICK UNDER VARIOUS EXPERIMENTAL CONDITIONS. WIDE VARIATIONS IN THE STORAGE OF VITAMIN A WERE FOUND, DEPENDING BOTH ON THE FORM OF VITAMIN A FED AND ON THE CHARACTER AND QUANTITY OF DILUENT. THE FOLLOWING CARRIERS WERE SHOWN TO CONTAIN FACTORS INHIBITING VITAMIN A ESTER HYDROLYSIS: JOJOBA SEED OIL, ETHYL LAURATE, BASKING SHARK LIVER OIL, AND MINERAL OIL. A REDUCTION IN THE VOLUME OF JOJOBA SEED OIL SIGNIFICANTLY INCREASED THE USE OF VITAMIN A ACETATE AND VITAMIN A NATURAL ESTER. AS THE SAME CHANGE IN VOLUME OF JOJOBA SEED OIL HAS NO SIGNIFICANT EFFECT ON THE USE OF VITAMIN A ALCOHOL, IT IS CONCLUDED THAT THE IMPROVED USE OF THE ESTER FORMS IN THE LESSER DILUTIONS IS DUE TO THE REDUCED AMOUNTS OF HYDROLYSIS-INHIBITING FACTORS CARRIED IN THIS QUANTITY OF DILUENT.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/DIETS/DIGESTION/NUTRIENTS/ ALCOHOLS/ORGANIC COMPOUNDS/ESTERS/BIRDS/MEDICINAL PLANTS

236

WECK, E.F./SEVIGNE, F.J.

1949 B

VITAMIN A UTILIZATION STUDIES II: THE UTILIZATION OF VITAMIN A ALCOHOL, VITAMIN A ACETATE AND VITAMIN A NATURAL ESTERS BY THE RAT.

JOURNAL OF NUTRITION 39:251-257.

IT WAS SHOWN THAT THE RELATIVE BIOLOGICAL EFFICACY OF THE THREE FORMS OF THE VITAMIN, ALTHOUGH ADMINISTERED AT EQUIVALENT UNIT LEVELS, WAS GREATLY AFFECTED BY THE NATURE AND QUANTITY OF THE DILUENT PRESENT IN THE VITAMIN SUPPLEMENT. JOJOBA OIL DILUENT HAS A SIGNIFICANT ADVERSE EFFECT, IN COMPARISON TO CORN OIL, ON THE HYDROLYSIS OF VITAMIN A ESTERS BY THE RAT.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/DIETS/DIGESTION/NUTRIENTS/ ALCOHOLS /ORGANIC COMPOUNDS/RODENTS/ESTERS/MEDICINAL PLANTS

237

WELLS, F.B.

1948

PROCESSES OF MAKING SULFURIZED JOJOBA OIL.

UNITED STATES PATENT 2,450,403 SEPTEMBER 28, 1948 (TO ELLIS-FOSTER COMPANY).

NOTES ADVANTAGES OF JOJOBA OIL OVER SPERM WHALE OIL: 1) PLEASANT ODOR, 2) CRUDE OIL VERY PURE, NEEDS LITTLE OR NO REFINEMENT, 3) NATIVE VEGETABLE PRODUCT MAKES SUPPLY MORE SECURE, 4) TAKES UP LARGE AMOUNTS OF SULFUR, 5) OIL DOES NOT DARKEN ON SULFURIZATION, 6) REMAINS LIQUID WHEN HIGHLY SULFURIZED. PROCEDURES AND RESULTS ARE PRESENTED FOR THE SULFURIZATION OF JOJOBA BEAN OIL, HYDROLYZED JOJOBA BEAN OIL, JOJOBA SAPONIFIABLES, AND JOJOBA UNSAPONIFIABLES. RESULTS OF MIXING THE SULFURIZED JOJOBA OIL WITH VARIOUS LUBRICANTS SHOW THAT THE SULFUR CONTENT REMAINS HIGHER THAN FOR SIMILAR PREPARATIONS UTILIZING SPERM WHALE OIL.

OALS/SIMMONDSIA CHINENSIS/LIPIDS/LIQUID WAX/PLANT SUBSTANCES/PLANT USES/ORGANIC COMPOUNDS/PATENTS/SPERM WHALE OIL/SULFURIZATION

238

WELLS, F.B.

1954

JOJOBA OIL, A LIQUID WAX, AND SOME OF ITS APPLICATIONS.

JOURNAL OF CHEMICAL EDUCATION 31(5):253-254.

THE CHARACTERISTICS OF THE OIL ARE LISTED. THE FREE ALCOHOLS AND PARTICULARLY THE FREE ACIDS FROM JOJOBA OIL WOULD FIND SOME APPLICATION IN THE FREE STATE, BUT THE WIDEST FIELD OF APPLICATION IS UNDOUBTEDLY IN SOME COMBINED FORM. POTENTIAL APPLICATIONS ARE LISTED. PROCEDURES FOR OBTAINING, AND APPLICATIONS OF, THE SULFATED OIL ARE PRESENTED.

OILS/SIMMONDSIA CHINENSIS/LIQUID WAX/LIPIDS/ALCOHOLS/PLANT USES/PLANT SUBSTANCES/ACIDS/SULFURIZATION

239

WELLS, F.B.

1955

A NOTE ON JOJOBA BEAN MEAL, A POTENTIAL FEED.

CEREAL CHEMISTRY 32(2):157-159.

PROTEIN, CARBOHYDRATE, ASH AND MINERAL CONTENT WERE DETERMINED FOR JOJOBA BEAN MEAL, FROM WHICH THE OIL (LIQUID WAX) HAD BEEN EXTRACTED. THE MEAL WAS FED TO RATS WITH GOOD RESULTS. IT WAS ALSO UTILIZED TO REPLACE SOYBEAN FLOUR IN A POLLEN SUBSTITUTE FOR BEES. HUMAN CONSUMPTION OF BEANS AND MEAL HAD NO ADVERSE EFFECT, BUT THE TASTE IS BITTER.

OILS/SIMMONDSIA CHINENSIS/SEEDS/ORGANIC COMPOUNDS/BEES/FOODS/ NUTRIENTS/POLLEN/PLANT USES/PLANT SUBSTANCES/JOJOBA MEAL/PALATABILITY

240

WELLS, M.A./TOMOFF, C.S.

1973

AN ANALYSIS OF THE OIL CONTENT, AND THE FATTY ACID, FATTY ALCOHOL AND WAX ESTER COMPOSITION DURING DEVELOPMENT OF JOJOBA (SIMMONDSIA CALIFORNICA) SEEDS.

UNIVERSITY OF ARIZONA, OFFICE OF ARID LANDS STUDIES. 12 P. (UNPUBLISHED)

ALTHOUGH THERE IS A CLEAR INCREASE IN THE OIL CONTENT PER SEED DURING MATURATION, THE QUALITATIVE COMPOSITION OF THE OIL AS WELL AS THE QUANTITATIVE COMPOSITION OF FATTY ACIDS AND ALCOHOLS, AND WAX ESTERS

DOES NOT CHANGE SIGNIFICANTLY. AS FIRST REPORTED BY MIWA, THERE IS A VERY HIGH PROPORTION OF THE 42 CARBON ATOM WAX ESTER, WHICH CLEARLY MEANS THAT THERE CANNOT BE RANDOM ESTERIFICATION OF FATTY ACIDS AND ALCOHOLS DURING WAX ESTER SYNTHESIS. CONTRARY TO THE PREDICTION OF MIWA, NO EVIDENCE WAS OBTAINED FOR THE PREFERENTIAL SYNTHESIS OF THE 42 CARBON ATOM WAX ESTER DURING SEED MATURATION. THUS, THE NON-RANDOM NATURE OF THE WAX ESTERS MUST REFLECT THE SPECIFICITY OF THE ENZYME SYSTEM RESPONSIBLE FOR WAX ESTER SYNTHESIS. THIS OBSERVATION, TAKEN IN CONJUNCTION WITH THE DATA SHOWING NO ALTERATION IN WAX ESTER COMPOSITION DURING PROLONGED STORAGE, HAS IMPORTANT PRACTICAL CONSEQUENCES. WHATEVER DESIRABLE PROPERTIES THE PECULIAR WAX ESTER COMPOSITION OF JOJOBA OIL MAY HAVE, THESE PROPERTIES CAN BE FOUND IN THE OIL REGARDLESS OF THE STAGE OF MATURATION OF THE SEED, OR THE LENGTH OF TIME THE SEEDS ARE STORED. THUS, THE EXACT TIMING OF SEED PICKING IS NOT AN IMPORTANT FACTOR IN THE QUALITY OF THE OIL OBTAINED FROM THE SEEDS. OF COURSE, THE QUANTITY OF OIL WILL BY HIGHER THE MORE MATURE THE SEEDS. ONCE THE SEEDS ARE DRY, PROLONGED STORAGE DOES NOT AFFECT THE WAX ESTER COMPOSITION AND THEREFORE PRESUMABLY THE QUALITY OF THE OIL. IT IS EXTREMELY IMPORTANT TO AVOID ALLOWING THE SEEDS TO SIT, EVEN FOR SHORT PERIODS OF TIME, UNDER CONDITIONS FAVORABLE TO GERMINATION OR GROWTH OF MOLD. PROCEDURES ON ANALYSIS ARE DESCRIBED AND RESULTS ARE PRESENTED IN TABLES AND FIGURES.

OALS/SIMMONDSIA CHINENSIS/SEEDS/LIQUID WAX/LIPIDS/ALCOHOLS/ORGANIC COMPOUNDS/PHENOLOGY/SEED PRODUCTION/CROP PRODUCTION/PLANT GROWTH/AGE/ PLANT PHYSIOLOGY/BIOSYNTHESIS

241

WHITNER, T.C., JR.

1940

FACTICE-CONTAINING PRINTING INK.

UNITED STATES PATENT 2,191,603, FEBRUARY 27. 1940. (TO ELLIS LABORATORIES, INC).

PRINTING INKS CONSIST FOR THE MOST PART OF A LIQUID VEHICLE, A PIGMENT, AND A BINDING AGENT. MANY RESINS HAVE BEEN USED AS BINDING AGENTS. IN PLACE OF THEM AN OIL-SOLUBLE FACTICE, PARTICULARLY THE FACTICE MADE FROM JOJOBA OIL, CAN BE EMPLOYED AS A BINDING AGENT FOR PRINTING INKS. THE RESULTING FILMS ARE DRY, NON-SMUDGING, AND FLEXIBLE. JOJOBA OIL FACTICE IS PARTICULARLY APPLICABLE TO THE PREPARATION OF QUICK-DRYING INKS BECAUSE OF ITS SOLUBILITY IN A WIDE VARIETY OF LIQUIDS. DESCRIPTIONS ARE GIVEN FOR THE PREPARATION OF A NUMBER OF INKS AND THEIR SUITABILITY IS NOTED.

OALS/SIMMONDSIA CHINENSIS/LIPIDS/LIQUID WAX/ORGANIC COMPOUNDS/PLANT USES/PATENTS

242

WHITTAKER, R.H./NIERING, W.A.

1964

VEGETATION OF THE SANTA CATALINA MOUNTAINS, ARIZONA. II ECOLOGICAL CLASSIFICATION AND DISTRIBUTION OF SPECIES.

ARIZONA ACADEMY OF SCIENCES, JOURNAL 3:9-34.

THE MAJOR PORTION OF THIS PAPER IS A TABLE OF SPECIES WITH DATA ON THE FOLLOWING: ELEVATIONAL DISTRIBUTION, MICROENVIRONMENTAL DISTRIBUTION, GROWTH FORM, LIFE FORM, AND BIOGEOGRAPHIC ASSOCIATIONS. JOJOBA IS TREATED ON PAGE 31.

OALS/SIMMONDSIA CHINENSIS/ARIZONA/PLANT ECOLOGY/SANTA CATALINA MOUNTAINS/BIOGEOGRAPHY/MICROENVIRONMENT/PLANT DISTRIBUTION/LIFE FORMS(PLANTS)/PLANT GROWTH/ELEVATION

243

WICKSON, E.J.

1903

REPORTS ON VARIOUS SEEDS AND PLANTS INCLUDED IN THE UNIVERSITY DISTRIBUTION.

CALIFORNIA AGRICULTURAL EXPERIMENT STATION, REPORT 1901-1903, P. 142-160.

THIS PAPER REPORTS THE COMMENTARIES RECEIVED BY THE STATION FROM RECIPIENTS OF EXOTIC OR NEW VARIETIES OF SEEDS. DEGREE OF SUCCESS OR FAILURE AT GROWTH IN VARIOUS PARTS OF CALIFORNIA AND CROP YIELDS ARE TREATED. CONSIDERATION IS GIVEN TREES AND SHRUBS, GREEN MANURE AND FORAGE PLANTS, AFRICAN STOCK MELON, GRASSES RAPE, CEREALS, FRUITS AND VEGETABLES. THE SHRUB JOJOBA SEEMS TO NEED PROTECTION FROM HEAT DURING THE SEEDLING STAGE (P. 145-146).

OALS/INTRODUCED SPECIES/CULTIVATION/AGRONOMY/CROP PRODUCTION/ SIMMONDSIA CHINENSIS/EUCALYPTUS/ACACIA/PLANTING MANAGEMENT/CULTIVATION /MAXIMUM TEMPERATURE/THERMAL STRESS

244

WICKSON, E.J.

1912

THE CALIFORNIA FRUITS AND HOW TO GROW THEM. 6TH. ED. (NUMEROUS OTHER EDITIONS).

PACIFIC RURAL PRESS, SAN FRANCISCO, CALIFORNIA. 602 P.

THE AUTHOR BRIEFLY DESCRIBES THE NATIVE USES OF THE JAJOBA [SIC] OR GOAT-NUT (P. 45).

OALS/CALIFORNIA/SIMMONDSIA CHINENSIS/PLANT USES/FOODS/ETHNOBOTANY

245

WIELAND, P.A.T./FROLICH, E.F./WALLACE, A.

1971

VEGETATIVE PROPAGATION OF WOODY SHRUB SPECIES FROM THE NORTHERN MOJAVE AND SOUTHERN GREAT BASIN DESERTS.

MADRONO 21(3):149-152.

ATTEMPTS WERE MADE TO VEGETATIVELY PROPAGATE MATERIALS FROM 17 WOODY PERENNIALS FROM THE NEVADA TEST SITE (NORTHERN MOJAVE-SOUTHERN GREAT BASIN DESERTS). STEM CUTTINGS COLLECTED IN 1966, 1967, AND 1968 WERE SUBJECTED TO A BASIC TEST PATTERN. FROM 5 TO 15 CUTTINGS OF EACH WERE SUBJECTED TO 15 DIFFERENT TREATMENTS COMPRISING A 3 BY 5 FACTORIAL DESIGN. THREE GROWTH REGULATOR TREATMENTS WERE: A) CONTROL, B) DIPPING CUT TIPS INTO HORMODIN 2 (0.3 PERCENT IBA (INDOL BUTURIC ACID) IN TALC), AND C) DIPPING IN HORMODIN 3 (0.8 PERCENT IBA IN TALC PREPARATIONS). THE CUTTINGS WERE THEN PLACED INTO 5 DIFFERENT ENVIRONMENTAL CONDITIONS FOR ROOTING. TEMPERATURES IN THESE UNITS REFLECTED AMBIENT CONDITIONS AND VARIED FROM SEASON TO SEASON, USUALLY 20 TO 30 DEGREES C IN THE DAYTIME AND 10 TO 20 DEGREES C AT NIGHT. LATER STUDIES INVOLVED PLACING THE CUTTINGS DIRECTLY INTO YOLO LOAM SOIL BEFORE ROOTING, CONSIDERED A GOOD TECHNIQUE FOR MANY SPECIES. (OALS)

OALS/VAUQUELINIA CALIFORNICA /SHRUBS/WOODY PLANTS/ REGENERATION(VEGETATION)/MOJAVE DESERT/GREAT BASIN/FOUQUIERIA SPLENDENS/CHILOPSIS LINEARIS /SIMMONDSIA CHINENSIS/ENCELIA FARINOSA/ FRANSERIA/HYMENOCLEA SALSOLA/PEUCEPHYLLUM SCHOTTII /PLUCHEA SERICEA/ GARRYA WRIGHTII/PERENNIALS/PLANT GROWTH REGULATORS/CHEMICAL CONTROLS/ ENVIRONMENTAL EFFECTS/NEVADA TEST SITE/PLANTING MANAGEMENT/VEGETATION ESTABLISHMENT

246

WIGER, J.

1935

EMBRYOLOGICAL STUDIES ON THE FAMILIES BUXACEAE, MELIACEAE, SIMARUBACEAE AND BURSERACEAE.

LUND UNIVERSITY, HAKAN OHLSSON. 133 P. (PH.D. THESIS.)

FOUR GENERA OF THE FAMILY BUXACEAE WERE EXAMINED: BUXUS, SARCOCOCCA, PACHYSANDRA AND SIMMONDSIA. ALL ARE MONOECIOUS EXCEPT SIMMONDSIA. IN SIMMONDSIA THE GYNAECEUM PRESENTS SOME DIVERGING FEATURES OF PLACENTATION. THE CARPELS, AS IN THE OTHER GENERA, ARE THREE, WITH ONLY A SINGLE OVULE IN EACH PARTITION. IN SIMMONDSIA THERE ARE NO INTERSTYLAR NECTARY PROTUBERANCES. THE ARCHESPORIUM INTEGUMENTS ARE MANY LAYERED. THE TETRAD DIVISION, EMBRYO SAC, AND FERTILIZATION ARE DESCRIBED. SARCOCOCCA AND SIMMONDSIA DIFFER FROM THE OTHER GENERA AS TO THE ENDOSPERM, IN THAT THEY FORM A NUCLEAR ONE. THE SEEDS OF ALL FOUR GENERA ARE DESCRIBED: IN SIMMONDSIA USUALLY ONLY ONE SEED PER FRUIT RIPENS. POLLEN PRODUCTION IS NOTED, IN SIMMONDSIA NUMEROUS STAMENS OFTEN FAIL TO PRODUCE EFFICIENT POLLEN, AS THEIR SUBSTANCE DEGENERATES. THE AUTHOR NOTES SEVERAL DIFFERENCES, THAT COULD BE USED TO SEPARATE SIMMONDSIA FROM THE BUXACEAE: THE EARLY PLACENTATION IS SOMEWHAT DIFFERENT, BASAL INSTEAD OF APICAL IN THAT THE OBTURATOR IS LACKING, AND THAT THE INNER INTEGUMENT IS MANY LAYERED. BUT HE IS NOT CERTAIN THAT A MORE NATURAL POSITION WOULD RESULT FROM LINKING SIMMONDSIA TO THE CENTROSPERMS.

OALS/SIMMONDSIA CHINENSIS/FLOWERS/PLANT GROWTH/PLANT MORPHOLOGY/
REPRODUCTION/FLOWERING/SEEDS/CYTOLOGY/FRUITING/PHENOLOGY/SYSTEMATICS/
SIMMONDSIA/POLLEN/BUXACEAE/SIMMONDSIACEAE

247

WIGER, J.

1936

REPLY TO REMARKS ON MY PAPER ON BUXACEAE, MELIACEAE ETC.

BOTANISKA NOTISER 1936(6):565-589.

THE AUTHOR DEFENDS CRITICISMS BY J. MAURITZON (1935). SEVERAL POINTS ARE AT ISSUE FOR MEMBERS OF THE FAMILY BUXACEAE. WIGER REITERATES HIS POSITION THAT THERE IS NO FOOD RESERVE IN THE ENDOSPERM OF SIMMONDSIA.

OALS/SIMMONDSIA /PLANT MORPHOLOGY/CYTOLOGY/SEEDS/SIMMONDSIA CHINENSIS
/BUXACEAE

248

WISNIAK, J./STEIN, S.

197-

HYDROGEN SOLUBILITY IN JOJOBA OIL.

(UNPUBLISHED).

THE SOLUBILITY OF HYDROGEN IN JOJOBA OIL HAS BEEN DETERMINED AT TEMPERATURES BETWEEN 50 AND 250 DEGREES C. AND PRESSURES BETWEEN 100 AND 800 POUNDS PER SQUARE INCH GAUGE. THE SYSTEM BEHAVES ACCORDING TO HENRY'S LAW. SOLUBILITY DECREASED WITH INCREASED TEMPERATURES, WITH A HEAT OF SOLUTION OF 1240 CALORIES/GRAM MOLECULE ENTROPY OF SOLUTION OF 2.9 CALORIES/DEGREE KELVIN GRAM MOLECULE. THE PARTIAL VOLUME OF HYDROGEN VARIES BETWEEN 24.6 AND 62.9 MILLILITERS/GRAM MOLECULE IN THE TEMPERATURE RANGE CONSIDERED.

OALS/SIMMONDSIA CHINENSIS/LIQUID WAX/HYDROGENATION/TEMPERATURE/
LIPIDS

249

WUNDERLICH, R.

1967

SOME REMARKS ON THE TAXONOMIC SIGNIFICANCE OF THE SEED COAT.

PHYTOMORPHOLOGY 17(1-4):301-311.

DEVELOPMENT OF INTEGUMENTS INTO SEED COAT IS SHOWN TO BE SIMILAR NOT ONLY WITHIN A FAMILY, BUT ALSO BETWEEN ALL THOSE FAMILIES WHOSE AFFINITY MAY BE ACCEPTED AS CERTAIN ON THE BASIS OF OTHER TAXONOMICALLY SIGNIFICANT FEATURES. FURTHER, IT IS SHOWN THAT THE TAXONOMIC POSITION OF JUST THOSE FAMILIES (OR GENERA) WHOSE INTEGUMENT DEVELOPMENT FUNDAMENTALLY DIFFERS FROM THAT OF THE TYPICAL MEMBERS OF THE ORDER (OR FAMILY) IS UNCERTAIN AND MUCH DISPUTED. THIS IS THE CASE WITH BUXACEAE (WHICH CERTAINLY DO NOT BELONG TO EUPHORBIALES), AND SIMMONDSIA (WHICH PROBABLY DOES NOT BELONG TO BUXACEAE). SIMMONDSIA DIFFERS FROM BUXACEAE IN THE STRUCTURE OF INTEGUMENTS (AN EXTRAORDINARILY MULTI-LAYERED OUTER INTEGUMENT WITH VASCULAR BUNDLES, AND ABOUT 5 LAYERED INNER INTEGUMENT) AND IN THE OCCURRENCE OF NUCLEAR ENDOSPERM. IT REMAINS UNDECIDED WHETHER THERE ARE ANY CLOSE RELATIONSHIPS TO CENTROSPERMAE.

OALS/SIMMONDSIA CHINENSIS/SYSTEMATICS/PLANT GROWTH/PLANT MORPHOLOGY/SEEDS/GERMINATION/CYTOLOGY/SIMMONDSIA/BUXACEAE/SIMMONDSIACEAE

250

YANG, T.W./ABE, Y.

1973 A

SUMMARY OF QUALITATIVE PHENOLOGY DATA, SAGUARO NATIONAL MONUMENT EAST AND WEST, ARIZONA, U.S.A. JUNE TO NOVEMBER 1972.

INTERNATIONAL BIOLOGICAL PROGRAM, ORIGIN AND STRUCTURE OF ECOSYSTEMS, TECHNICAL REPORT 73-1. 23 P. (UNPUBLISHED)

CONTAINS WEEKLY OR BIMONTHLY RECORDS OF PERCENT STEM ELONGATION, LEAF INITIATION, FLOWER INITIATION, FLOWERING, FRUIT MATURING, AND FRUIT MATURE FOR SIMMONDSIA CHINENSIS. DATA ONLY, NO TEXT.

OALS/SIMMONDSIA CHINENSIS/PHENOLOGY/FLOWERING/FRUITING/SEASONAL/PLANT GROWTH/GROWING SEASON/NATIONAL PARKS

251

YANG, T.W./ABE, Y.

1973 B

SUMMARY OF QUALITATIVE PHENOLOGY DATA, SAGUARO NATIONAL MONUMENT EAST AND WEST, ARIZONA, U.S.A. NOVEMBER 18, 1972-JULY 13, 1973.

INTERNATIONAL BIOLOGICAL PROGRAM, ORIGIN AND STRUCTURE OF ECOSYSTEMS, TECHNICAL REPORT 73-18. 23 P. (UNPUBLISHED)

CONTAINS WEEKLY OR BIMONTHLY RECORDS OF PERCENT STEM ELONGATION, LEAF INITIATION, FLOWER INITIATION, FLOWERING, FRUIT MATURING, AND FRUIT MATURE FOR SIMMONDSIA CHINENSIS. DATA ONLY, NO TEXT.

OALS/SIMMONDSIA CHINENSIS/PHENOLOGY/FLOWERING/FRUITING/SEASONAL/PLANT GROWTH/GROWING SEASON/NATIONAL PARKS

252

YERMANOS, D.M.

1973

JOJOBA, A BRIEF SURVEY OF THE AGRONOMIC POTENTIAL.

CALIFORNIA AGRICULTURE 27(9):10-13.

AN UP-TO-DATE EVALUATION OF COSTS AND FEASIBILITY OF ECONOMICALLY HARVESTING WILD POPULATIONS AND ESTABLISHING PLANTATIONS OF CULTIVATED JOJOBA. THE COST OF HARVESTING AND CLEANING WILD SEED IS APPROXIMATELY ONE DOLLAR/POUND. A SIMPLE HAND PICKING TOOL HAS BEEN USED EXPERIMENTALLY AND IS PICTURED IN SEVERAL PHOTOGRAPHS. PRUNING OF WILD PLANTS TO AID IN HARVESTING HAS BEEN STARTED WITH 3,000 PLANTS. RECOMMENDATIONS FOR THE ESTABLISHMENT OF PLANTATIONS INCLUDE DISTANCES BETWEEN PLANTS, SEX RATIOS, IRRIGATION, AND PRUNING. COSTS OF ESTABLISHING PLANTATIONS, MAINTENANCE, AND COST OF HARVESTING ARE ESTIMATED. ESTIMATES OF SEED PRODUCTIVITY ARE 750 POUNDS/ACRE AT 9 YEARS AND 3,750 POUNDS/ACRE AT 12 YEARS. THE AUTHOR ESTIMATES THAT IT WOULD TAKE 25,000 ACRES OF JOJOBA TO PRODUCE ENOUGH WAX, 50,000,000 POUNDS TO REPLACE THE PRESENT NEEDS OF SPERM WHALE OIL. IF JOJOBA WERE AVAILABLE AT 10 CENTS/POUND ITS WAX COULD BE PRODUCED FOR 27 CENTS/POUND, THE PRICE OF SPERM WHALE OIL. IT WOULD BE IMPOSSIBLE TO OBTAIN SEED AT THIS PRICE FROM WILD POPULATIONS, BUT CONCEIVABLY COULD BE FROM CULTIVATED PLANTS. THE AUTHOR STATES THAT 1) JOJOBA WAX HAS A GOOD MARKETING POTENTIAL, 2) LARGE-SCALE, PROFITABLE PRODUCTION OF CULTIVATED JOJOBA IS POSSIBLE, AND 3) JOJOBA NUT PRODUCTION COULD BE BASED ON THE WILD STANDS FOR A FEW YEARS, PREFERABLY WITH A GOVERNMENT SUBSIDY. JOJOBA PLANTATIONS SHOULD BE ESTABLISHED IN THE MEANTIME SO THAT JOJOBA PRODUCTION COULD EVENTUALLY BE BASED ON THESE PLANTATIONS. UNLESS ACTION IS SOON TAKEN THE USERS OF SPERM WHALE OIL MAY ELIMINATE ITS NEED BY DEVELOPING SYNTHETIC SUBSTITUTES.

OILS/SIMMONDSIA CHINENSIS/ECONOMIC DEVELOPMENT/SEEDS/SEED PRODUCTION/ /CULTIVATION/REPRODUCTION/PLANTING MANAGEMENT/IRRIGATION PRACTICES/ LIQUID WAX/SPERM WHALE OIL/COST-BENIFIT ANALYSIS

253

YERMANOS, D.M./FRANCOIS, L.E./TAMMADONI, T.

1967

EFFECTS OF SOIL SALINITY ON THE DEVELOPMENT OF JOJOBA.

ECONOMIC BOTANY 21(1):69-81.

PRESENTS EXPERIMENTAL DATA REGARDING THE FIRST TWO YEARS OF GROWTH. FOUR SALINITY TREATMENTS WERE UTILIZED (CONTROL, LOW, MEDIUM, AND HIGH SALT). HIGH SALT LEAVES WERE THICKER AND LONGER THAN CONTROL LEAVES. STEMS ON CONTROL PLANTS WERE CONSISTENTLY THICKER THAN THOSE OF SALT-TREATED PLANTS. SOIL SALINITY INCREASED THE MOISTURE CONTENT OF LEAVES AND STEMS. MINERAL ANALYSIS OF LEAF SAMPLES INDICATED A PROGRESSIVE INCREASE IN CALCIUM, CHLORINE, AND SODIUM AND A DECREASE IN MAGNESIUM WITH INCREASING SALINITY. FLOWER COUNTS SHOWED A SHARP REDUCTION IN TOTAL FLOWER NUMBER ON PLANTS IN THE HIGH SALT TREATMENT. SOIL SALINITY CAUSED ANATOMICAL CHANGES AT A MICROSCOPIC LEVEL IN THE LEAVES AND STEMS. JOJOBA IS ABLE TO WITHSTAND HIGH LEVELS OF SOIL SALINITY DURING THE FIRST TWO YEARS OF DEVELOPMENT WITHOUT ANY SYMPTOMS OF MAJOR INJURY.

OALS/SIMMONDSIA CHINENSIS/PLANT GROWTH/PLANT MORPHOLOGY/FLOWERING/ PLANT PHYSIOLOGY/SOIL-WATER-PLANT RELATIONSHIPS/WATER REQUIREMENTS/ LEAVES/STEMS/PLANT CHEMISTRY/SALINITY/SALINE SOILS/SALT TOLERANCE

254

YERMANOS, D.M./HOLMES, R.

1973

JOJOBA-AT VISTA, ANALYSIS OF COIT PLANTATION, THE OLDEST DEMONSTRATION PLOT.

CALIFORNIA AGRICULTURE 27(5):12-14.

THE COIT PLANTATION LAND WILL SOON BE CONVERTED TO NON-AGRICULTURAL USES. THIS PAPER REPORTS ON THE PRODUCTIVITY OF TWO PLOTS CONTAINING INDIVIDUALS OF THE VISTA VARIETY, PLANTS FROM BAJA CALIFORNIA, AND PLANTS FROM ARIZONA. SEED YIELDS OF SHRUBS UP TO 13 YEARS OF AGE ARE PRESENTED. NOTES ARE RECORDED ON THE GENERAL PHENOLOGY. BASING YIELD PREDICTION ON THE BEST YIELDS OF THE VISTA PLANTATION, A YIELD OF 3, 300 KILOGRAMS/HECTARE (2910 POUNDS/ACRE) FOR A 6-YEAR-OLD PLANTATION AND 4446 KILOGRAMS/HECTARE (3,930 POUNDS/ACRE) FOR A 12-YEAR-OLD PLANTATION COULD BE REALIZED.

OALS/SIMMONDSIA CHINENSIS/CALIFORNIA/CULTIVATION/PHENOLOGY/CROP PRODUCTION /IRRIGATION PRACTICES/PRODUCTIVITY/SEED PRODUCTION/PLANT GROWTH/COST-BENIFIT ANALYSIS

255

YERMANOS, D.M. ET AL

1968

JOJOBA, A NEW CALIFORNIA CROP. SEED YIELD, COLD TOLERANCE, AND EVALUATION FOR ALUMINUM INDUSTRY.

CALIFORNIA AGRICULTURE 22(10):2-3.

RECORDS WERE MAINTAINED ON SEED CROP YIELD FOR THREE GROUPS OF PLANTS: 1) FROM BAJA CALIFORNIA, 2) FROM ARIZONA, 3) A CLONE NAMED VISTA, DEVELOPED IN CALIFORNIA, FROM SEED FROM SUPERIOR, ARIZONA. EXPERIMENTS WITH IRRIGATION OF SOME PLANTS RESULTED IN INCREASED YIELD OF SEEDS. ANTHESIS WAS MORE UNIFORM IN THE CLONAL MATERIAL. NIGHT TEMPERATURES OF 17 AND 22 DEGREES WERE LETHAL IN EXPERIMENTS, WHILE 25 DEGREES ONLY CAUSED MINOR DAMAGE TO PLANTS. TEST OF JOJOBA OIL SUGGEST THAT IT IS NOT SUITABLE FOR USE AS A ROLLING OIL DURING THE COLD ROLLING OF ALUMINUM SHEETS. THE WAX STAINED THE SHEETS AND DROPPED IN VISCOSITY WHEN ITS TEMPERATURE WAS INCREASED FROM 100 DEGREES TO 150 DEGREES FAHRENHEIT.

OALS/SIMMONDSIA CHINENSIS/SEEDS/CROP PRODUCTION/LIPIDS/LIQUID WAX/ PLANT SUBSTANCES/IRRIGATION PRACTICES/SEED PRODUCTION/MINIMUM TEMPERATURE/FREEZING/PLANTING MANAGEMENT/PLANT USES

256

ZACATECAS A., A.

1943

JOJOBA.

ESCUELA PARTICULAR DE AGRICULTURA, CD. JUAREZ, CHIHUAHUA (THESIS). 23 P.

REVIEWS THE STATUS AND POSSIBILITIES OF JOJOBA UTILIZATION IN MEXICO DURING THE EARLY 1940 S. USES OF THE SEEDS BY VARIOUS NATIVE TRIBES OF NORTHWESTERN MEXICO ARE MENTIONED. ITS BOTANICAL POSITION IS CONSIDERED, THE AUTHOR PREFERRING TO PLACE IT IN THE FAMILY BIXACEAE, OVER EUPHORBIACEAE. THE ROOTS, STEMS, LEAVES, FLOWERS, AND FRUITS ARE DESCRIBED. CLIMATIC AND SOIL CONDITIONS NECESSARY FOR JOJOBA S GROWTH ARE BRIEFLY NOTED. THE COMPOSITION OF THE SEEDS IS PRESENTED AND IT IS NOTED THAT IT IS UTILIZED BY SUCH WILD ANIMALS AS DEER, RABBITS, AND SQUIRRELS. ALSO, IT IS PREPARED A NUMBER OF WAYS FOR HUMAN CONSUMPTION. RECOMMENDATIONS ARE MADE FOR ESTABLISHING PLANTATIONS ON UNCULTIVATED LAND. PRODUCTIVITY OF FRUIT ON WILD PLANTS WAS NOTED AS HIGH AS 8 TO 10 KILOGRAMS/BUSH, AVERAGE 5 TO 6. METHODS OF TREATING THE SEEDS AND MECHANICAL EXTRACTION OF THE OIL ARE PRESENTED. AMONG THE USES FORSEEN BY THE AUTHOR FOR THE OIL IS THE MAKING OF SOAPS, AN OUTLINE OF THE PROCESS OF WHICH IS DESCRIBED.

OILS/SIMMONDSIA CHINENSIS/MEXICO/PLANT USES/SEED PRODUCTION/FOOD HABITS/FOODS/SYSTEMATICS/NATURAL HISTORY/WILDLIFE/CULTIVATION/ ETHNOBOTANY/INDIANS OF NORTH AMERICA/NATIVE AMERICANS/BROWSE/FORAGE PLANTS/PRODUCTIVITY/MECHANICAL EXTRACTION

INDICES

AUTHOR INDEX*

* Item numbers refer to the Bibliography's numbered references, not to page numbers

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