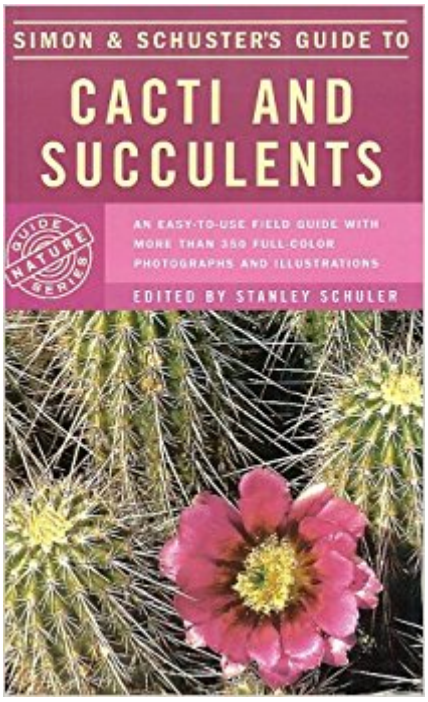
Simon & Schuster's Guide To Cacti And Succulents: An Easy-to-Use Field Guide With More Than 350 Full-Color Photographs And Illustrations



Synopsis

Fascinating, informative, and user-friendly, "Simon & Schuster’s Guide to Cacti and Succulents" is a stunning reference to an intriguing category of plants. A thorough introduction describes the history of "Cactaceae" (the largest of the many plant families known as succulents because they store water in their leaves, stems, and roots) and provides general guidelines for their cultivation. Then, each of the more than 300 detailed entries describes an individual species, including its place of origin and ideal conditions for its growth. Full-color photographs enable easy identification of the plants in the field. Whether for the casual gardener or the serious horticulturist, this beautiful and comprehensive guide will be an invaluable resource.

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INTRODUCTION THE CACTACEAE It has often been said that there can be no half measures in regard to cacti: people either love them or hate them. This assertion would appear to be borne out by the fact that on the one hand, many people find them unattractive, or indeed repulsive, because of their prickles, while on the other hand, there are innumerable associations of cactus lovers throughout the world -- for example, in New South Wales, Vienna, Zurich, Prague, Tokyo, Moscow and, naturally, Mexico City and El Centro, California. The fascination that people feel for cacti is as multifaceted as the plants themselves and as mysterious as their origins, and it is a fascination that deepens as one’s knowledge of the plants increases. Comprising over 2,000 species, Cactaceae is

the largest of the many plant families -- such as the euphorbias, crassulas, agaves, mesembryanthemums, milkweeds and lilies -- that are known as succulents because they store water in their leaves, stems and roots. (In other words, to clarify a point that puzzles many people, all cacti are succulents, but not all succulents are cacti.) The origins of the Cactaceae are thought to be very ancient in terms of the development of plant forms, although few succulent plants survive in fossilized form to tell us their history. The system of classification adopted by botanists for Cactaceae is based not only on the affinities between different genera but also on their presumed chronological development. It divides the cacti into four categories, as follows: 1. Plants that still produce leaves in spite of the special characteristics of the cactus family 2. Plants that produce leaves, but in most cases lose them very soon 3. Plants with rudimentary leaves similar to scales, or with no leaves at all 4. Plants with stems resembling leaves (cladodes), epiphytes or semi-epiphytes This is a rational sequence based on the premise that succulent plants of families other than the Cactaceae lose their leaves because they have to adapt to dry climates, but it does not mean that cacti developed in precisely this way. Indeed they may well have been able to adapt contemporaneously to diverse climates. How and why the genus Rhipsalis, which belongs to a family native to the Americas, came to grow wild in equatorial Africa, Madagascar, the Mascarene Islands and Ceylon is a mystery, although it is likely that the plant was introduced into these areas by birds which carried its sticky seeds to the Old World. All members of the Cactaceae are xerophytes in the broadest sense of the word: they are adapted for growth under dry conditions. In particular, they are designed to reduce moisture loss to a minimum, and they are capable of storing water in their tissues. In addition, all members of the family -- no matter what their shape -- have a characteristic that distinguishes them from all other plant families: they produce areoles. These round to oval structures ranging from 1/16 in. (1 1/2 mm.) to more than 1/2 in. (13 mm.) across are found in widely varying positions on the cacti. They are composed of two perpendicular buds. From the upper bud come either the flowers and subsequent fruits or the new branches, which consist of segments -- often called "joints," like the upper and lower joints of a chicken leg -- that are knotted tightly together at the base. From the lower bud come the spines. These may resemble a cluster of small, wicked daggers (sometimes with barbed ends); or the dagger-like spines may be surrounded by tiny bristles or prickles and/or curly wool or hair. One of the peculiarities of the cacti is that the spines -- like the thorns on roses -- are not connected to the tissues below them; consequently no real harm is done to a plant when a spine is torn off. By contrast, when a spine is removed from a succulent such as Euphorbia, the tissue beneath it is damaged. Cacti have numerous other distinctive features, but none of them is common to the entire family. They are simply features that

enable us to distinguish one cactus genus from another. For example, roots may be quite superficial but very extensive, or they may be taproots, in some cases swollen and shaped like carrots, serving as a reserve for water and nutrients. Large taproots are particularly characteristic of small cacti growing in extremely dry areas. In some species the taproot resembles a dahlia's "foot," being subdivided so that some parts may continue to function even if others dry up or are damaged. The stems of cacti with persistent leaves are woody, since the leaves are the mechanism through which the plants transpire (give off moisture). By contrast, in cacti without leaves, transpiration as well as photosynthesis is a function of the stems, and these are especially adapted to the job in several ways. For one thing, they are generally compact cylinders, semicylinders or globes; therefore the surface area from which moisture can be transpired is reduced. In the second place, the stem is covered with a thick, waxy skin through which moisture cannot pass. Even the stomata are designed to slow moisture loss. Finally, transpiration is limited by the spines, bristles and small hairs, which, if fairly dense, insulate the epidermis and thus protect it from excessive cold or overexposure to ultraviolet rays. This protection mechanism is especially marked on the upper part of the stem or at its apex, where the tissues are more delicate and the flowers usually grow. This area is spectacular in the columnar cacti with heads of extremely dense bristles and hairs known as the cephalium. A particularly showy example is the Melocactus. It develops a special structure that appears to be superimposed upon the apex of the stem and is thickly covered with colored hairs and bristles from among which the flower buds appear. The characteristic roundness of stems and joints, no matter what their length, ensures that no one part is at the mercy of the sun's rays for more than a short time in the course of a day, and that only a minimal part is permanently exposed to the north. In a great many species the base of the stem appears to lignify with the passage of time, but it does not become wood. The spongy tissues harden, but the water vessels continue to pass through them. The vessels are protected by an outer layer properly described as suberose, since it is far more like cork than true bark. Sometimes stem tissues grow together to form an irregular shape; and joints may produce twin forms along the whole or most of their length, occasionally becoming distorted, opening out like fans, or bending over as they grow. This phenomenon, known as fasciation, results from various physical or bacteriological causes. It is not hereditary; affected plants or their offspring may indeed regress. It occurs in other succulents and gives rise to so-called "monstrosities" that are highly prized by cactus collectors. Monstrous shapes are generally grafted onto other plants, since -- except for unusually strong plants such as Cereus -- they are supported only precariously by their roots and may revert to normal. Leaves are persistent only in the first category of cacti, consisting solely of the genus Pereskia, which is considered a

transitional form between normal plants and xerophytes. The stem bears normal, often very prickly, areoles. The lower part produces leaves, petiolated to a greater or lesser degree, and new shoots spring from their axils. The second category, composing the tribe Opuntieae, includes one genus with leaves that are more or less persistent. The leaves of the other genera are usually small, fall very soon, and perform no functions, the latter having been taken over by the stem. In all the genera of this tribe the areoles have groups of minute barbed bristles (glochids) that can be very troublesome and painful because they become detached at the slightest touch and penetrate the skin. Glochids are not found in any other members of the Cactaceae. The cacti of the other two categories have rudimentary leaves reduced to often minute scales. Alternatively, leaves are absent altogether, in which case there are enlarged leaf bases that are fused together in various arrangements to form what are known as ribs or tubercles. The areoles grow on the ribs, often at the apex, though in some genera -- Mammillaria in particular -- both flowers and joints spring from an axillary areole at the base (or axil) of the tubercle, while the areole at the apex has no vegetative function. In other genera, the two areoles are still connected: although they appear to be separate, the one is in fact an extension of the other, connected by a very fine groove. When this is the case, new joints may also appear at the apex of the tubercle. Cactus flowers are generally solitary, and there is no clear distinction between calyx and corolla in the perianth: there is a gradual transition from sepaloid to petaloid segments that are spiral-shaped and are often fused at the base or united to form a tube of varying shape and length. The segments (petals) may be oval, lanceolate, obtuse, acuminate, dentate or even laciniate; they may be white, yellow, red or violet, while the external sepals may be greenish or brownish. These flowers are mostly regular, and the perianth is inserted above the ovary, which is generally round or oval (in some species it becomes elongated at maturity) and often bears areoles, scales, spines or hairs. The stamens, which are always numerous, have long filaments. The pistil may be even longer, and the stigma is often stellate and sometimes colored. Some genera (e.g., Opuntia) have sensitive stamens: when touched by an insect or by a finger, they close over the top of the pistil, straightening up again a minute or two later. This experiment can generally be made only in bright sunlight when the flower is open, since the flowers of most day-flowering genera remain closed whenever sun is not shining directly upon them -- they close even when the sky clouds over, reopening when the clouds have passed by. The fruit of almost all cacti consists of a berry containing several or a great many seeds. In Opuntia, fruits are fairly large, but they are small and often tiny in other genera. The fruit of some genera becomes elongated and remains umbilicate, with a slight depression at its apex at the point where the perianth joined the ovary. In other cases this point was so small that all that remains of it is a

small hole to which the residue of the dried corolla clings for a long time. Fruits are indehiscent in many cases. When they are more or less dehiscent, the seeds fall prey to ants, which to a certain extent help to disseminate them. NATURAL HABITATS AND DISTRIBUTION OF THE CACTUS The greatest problem presented by the cultivation of any type of plant is the need for raising it under conditions similar to those of its native habitat. In point of fact, most plants have an almost incredible capacity for adaptation, but this flexibility inevitably brings about a change for the worse in their structure and appearance. This is true in the case of all succulents, including cacti. An increase or decrease in light, the wrong amount of moisture, or a dormant period that is too short or too long will, at best, result in feeble growth, lack of color, loss of the defense systems peculiar to every species, and an absence of flowers. At worst, the root system will be damaged, the tissues will rot, and the plant will eventually die. A large number of disappointments and the death of many plants are due more to ignorance about geography or climate than to a lack of horticultural knowledge. For this reason, the descriptions of cacti given in this book include brief notes on their natural habitats. However, since it is impossible to describe the peculiarities of each plant's habitat in minute detail, and since cacti are very adaptable, we give a brief overview of their environmental distribution below. It is hoped that this will be a useful adjunct to the details given in each entry. With one exception of no practical importance, all members of the Cactaceae family are native to the continents of North and South America. In this vast area there is a huge variety of habitats, from the tropical to the polar. Even the physical geography of the mountain chains differs markedly. Winds and ocean currents bring violent hurricanes to the essentially dry, mild climate of North America. Freezing air rolls off the high peaks of the Andes into the tropical forests of South America. One of the chief adaptational achievements of the cactus is its tolerance to periods of drought. This tolerance is only relative, however, since it invariably depends upon the amount of water held in the substratum and, above all, on how long it takes for this to become stagnant. Strange as it may seem, neither the floods that occasionally devastate Texas and Colorado nor the hurricanes that strike Florida cause as much damage to cacti as one might imagine. This is mainly because cacti tend to grow on well-drained high ground, and also because such violent storms occur infrequently. Conversely, the dryness of the air in Arizona would in quite a short time prove fatal to Epiphyllum cacti, which grow in warm, damp, wooded areas. On a purely practical, rather than botanical, basis, let us subdivide the members of the Cactaceae into four broad groups, according to habitat. The variants that occur in each group are ignored. 1. Plants from a desert or near-desert habitat 2. Plants from a mountainous habitat 3. Plants from steppes and grasslands 4. Plants from tropical or subtropical forests These categories are not always applicable. For example, the many species and

varieties of the genus Opuntia are so widely distributed as to make it appear ubiquitous. The flat-branched Opuntia polyacantha grows in the Canadian provinces of Alberta and British Columbia at a latitude of more than 50Ã Â N, while Opuntia australis, which has more or less oval or globular joints, and many other similar species grow in Patagonia (in order to survive there, all are of low and prostrate habit). Other species of Opuntia are to be found along the coasts of Florida and the Carolinas, in the Antilles, in the Galapagos Islands, in all the desert regions and in the Andes. Thus this genus, which is the largest of the Cactaceae, is able, through a variety of forms, to live in three out of four of the above habitats. Desert or near-desert regions in which periods of complete aridity often alternate with torrential rain are found largely in the southwestern United States (although they extend southward into Mexico). This huge expanse of country reaches from Montana and Utah in the north to the Mexican border and from California in the west to beyond the Rocky Mountains, across the whole of the Texas plateau. Climatic conditions vary widely. The area of true desert is relatively small: it lies mainly to the west of the mountains, stretching eastward beyond the Great Salt Lake, along the Colorado River and the Rio Grande. Desert cacti are found in great abundance in Arizona. Less than 60 miles (100 kilometers) from the Mexican border is a desert center for the study and preservation of desert plants, set up under the auspices of the Carnegie Foundation. The name of a small town to the south of Tucson, Sahuarita, is significant in that sahuaro, or saguaro, is the local Indian name for Carnegiea gigantea. In this area, bounded by the Gila Desert to the east and the San Francisco and Colorado plateaus to the north, there exists a unique forest of Carnegiea -- giant cacti that may reach a height of 50 ft. (15 m.) or more. Their relatively superficial roots may spread over an area more than 65 ft. (20 m.) wide. All the cacti of this and similar regions like intense sunlight and absolutely dry soil during their dormant periods, though they need abundant water during their vegetative period. Although they grow on plateaus and high ground, none of the cacti in the United States can truly be described as plants with a mountainous habitat, since they always occur in a sheltered position. The slopes of the Rocky Mountains are well forested, mainly by conifers, and the Coast Range is the home of the fabulous Sequoia. Since the variation between daytime and nighttime temperatures in desert regions is very great, a certain amount of humidity results from the cooling down of the soil. This is particularly true in the case of plateaus, and it is this phenomenon that allows the survival and determines the characteristics of the cacti and other succulents of the huge central plateau of Mexico. This rises to a height of 6,500 ft. (2,000 m.) and is swept by dry winds from the northeast. In summer it is extremely hot and sun-scorched, while in winter snow occasionally falls. The eastern and western ranges of the Sierra Madre which border it have peaks rising to 11,500 ft. (3,500 m.) but do not form a continuous chain: there is an opening

onto the coastal plain around the Gulf of Mexico through which winds sweep into the hinterland. The far-flung volcanic lakes, the network of often torrential rivers, and the seasonal rains are not sufficient to mitigate the extreme conditions to which these plants, growing on calcareous and stony soil, are subjected. The difference in temperature between the extremely hot days and the cold nights has either strengthened the protective issues of all the succulents or produced new defense mechanisms. Thus we find that Sedum and Echeveria have a brightly colored surface wax which thickens and becomes blue-green or reddish, and that certain cacti have developed extremely hard and bright-colored spines while their epidermis turns bronze-colored. On the Mexican plateau and particularly in the states of Hidalgo and San Luis PotosÃƒÂ- , an impressive number of cacti, including the strangest and least-known genera, are to be found. These are rarely cultivated in some countries because the climate in which they have developed has apparently made them extremely slow-growing and has also discouraged production of the shoots necessary for propagation. What's more, it is impossible to take cuttings from many of them because they are small and globular. They tend to have taproots swollen out of all proportion to their aboveground bodies. Because of these propagation problems and because the plants are extremely difficult to find in the first place, they are the gems of any cactus collection. Among the most interesting are the flat and horny Ariocarpus, which buries itself so completely that it is hard to distinguish from the surrounding soil; the distinctive Leuchtenbergia, which has adapted to the environment by dividing its surface into long tubercles, similar to the leaves of the agave, so that all the moisture forming during the night collects in the center; Obregonia, which also has leaflike tubercles, though they are less conspicuous; and Pelecyphora aztechium, whose bizarre raised tubercles may be so shaped to ensure that all moisture runs gradually into the soil. South of the Tropic of Cancer, where there is either periodic or constant rainfall, lies the equatorial forest. This type of vegetation dominates the whole of Central America, skirting the northern end of the Andean cordillera to both the east and west, extending into Guyana and covering the enormous area of the Basin. Here, as on all the islands of the West Indies, epiphytic and semi-epiphytic cacti are to be found. They include the splendid Epiphyllum with perfumed flowers, and the bizarre members of the Rhipsalidinae, which hang from the branches of tall trees where they are attached to tiny amounts of humus. They absorb moisture from their surroundings through fine, hairlike roots and often form a fringe around the large leaves of epiphytic ferns or the stiff leaves of the Bromeliaceae. Although the epiphytic cacti are semidormant during periods of scant rainfall, the atmosphere is always warm and humid enough to prevent their drying up. Their flowers may not be as showy as those of the orchids living beside them, but aerial shrubberies formed by their tiny fleshy stems are intricate and delightful. In addition

to these specialized forms, classic globular or cylindrical cacti grow in the flat coastal regions of the West Indies. Although these do not appear to differ from desert cacti, they actually enjoy radically different conditions of growth: a minimum and fairly constant temperature of 65-68Ã Â F. (18-20Ã Â C.); perfectly drained soil that is light and slightly salty -- suitable for a root system that is relatively poor and delicate (since there is nothing for it to contend with) -- and an atmosphere that, even in times of scarce rainfall, remains humid. Some genera grow in both North and South America, although the species differ. For example, the Opuntia cacti of South America tend to be cylindrical or globular rather than flat, as they generally are in North America. In South America particularly we find cacti associated with mountainous areas, steppes and grasslands. On the slopes of the Andes, for instance, grow the large Cereus cacti, such as Espostoa and Oreocereus, that are covered with wool or bristles as a protection against the cold. Also growing here are the Trichocereus species with fairly short stems that split into branches at the base in order to resist the wind. In the mountains of Bolivia and northern Argentina, cacti grow at an altitude of 11,900 ft. (3,630 m.) down to the almost steppelike plains and prairies. A great many cacti well known in their cultivated form -- Rebutia, Lobivia, Parodia, Cleistocactus and Haageocereus -- originate in this area. Some species of Lobivia have been found at altitudes of more than 9,850 ft. (3,000 m.). Here they flourish in strong sunlight and are unaccustomed to any kind of shade. By contrast, genera such as Echinopsis, which also grow on the prairies of central Argentina, prefer a certain amount of shade in summer and therefore seek shelter under a layer of dry grass. The mountains of southern Brazil, Paraguay and Uruguay are the home of the widely cultivated Cereus, the flowering Chamaecereus, and Gymnocalycium. The very common Schlumbergera is one of the epiphytes that grow sheltered from the north wind in the coastal forests of the Rio de Janeiro hinterland. The habitat of Gymnocalycium is transitional between mountain and forest; the plants generally prefer a certain amount of shade and much richer soil than desert cacti. One of the great problems in trying to cultivate Andean -- and particularly Peruvian -- cacti involves the duplication of the exact environmental conditions under which the plants grow naturally. To achieve success, you must first determine exactly where the plants come from. Then you must remember that while the peaks of the Andes are exposed to intense direct sunlight, the lower slopes are often shaded by clouds that shut out the direct rays of the sun but produce a strong diffused light, and the valley floors receive even less sunlight. Finally, you must find a window in which these light conditions can be closely approximated. In the United States and Europe, the summer sun often is too strong or, more important, shines for too many hours a day; consequently, plants that are not well protected by wool or hair may be severely burned when exposed to it. THE DISCOVERY AND HISTORY OF CACTI

It has sometimes been claimed that Christopher Columbus brought the first cactus to Europe, but the earliest European record of it actually dates from 1635. This was the year that the first volume of Historia de las Indias Occidentales by Gonzalo HernÃƒÂ¡ndez de Oviedo y ValdÃƒÂ©s appeared with illustrations of what we would now call a Cereus and an Opuntia. The Opuntia, so closely associated with Mexico, figures in much older history. According to one legend, the Aztecs founded their capital, TenochtitlÃƒÂ¡n, in 1325, on the basis of a priest's dream that a cactus growing out of a rock became a tree so luxuriant that an eagle settled upon it. This legend was recounted in detail by Fra Diego Duran in his Historia de las Indias de la Nueva EspaÃƒÂ a (1581), but the fulfilling of the prophecy had been depicted as early as 1541 in the Codex Mendoza, compiled by the Aztecs on the orders of the Spaniards. The first colored illustrations of cacti are also of a Cereus and an Opuntia. They appear in what is known as the Codex Badianus, written by a learned Indian, Martin de la Cruz, in 1552. The best accounts of native cultures, particularly those in Mexico, were written by the missionaries. Since their task was to convert the natives, they also had to learn their language (Nahuatl), get to know their religion and customs and understand something of their earlier civilizations. The best-known missionary was a Franciscan friar named Bernardino de SahagÃƒÂºn, who went to Mexico in 1529. His great work Historia Universal de Nueva EspaÃƒÂ a brought together all available information about the country and its inhabitants. He collected his material in an unusual manner. He would put questions to a number of natives who knew no Spanish. They would write their replies in the ideographic signs they used. Fra Bernardino would then submit the replies to some of his fellow scholars at the College of Santa Cruz, who interpreted the signs and translated them into Nahuatl. The results of these interviews were then used to form the friar's history, which was also written in the language of the country. Fra Bernardino learned that the natives used a certain plant to induce a hallucinatory state during religious ceremonies. Since he probably knew that among all ancient or primitive peoples the chief source of hallucinogens was the mushroom, he named this hallucinogenic plant teonanacatl, or divine mushroom, partly because that is what the Aztec hieroglyph resembled. Today we know that the plant was the cactus Lophophora williamsii, better known by the local names of peyote, mescal, mescal and peyotl. It is possible that other cacti were used in a similar way; Ariocarpus, Pelecyphora and Obregonia, for example, are all small enough to resemble a mushroom, and all contain at least one hallucinogenic alkaloid. It is interesting that although the use of peyote has been widespread since the early eighteenth century, it is officially prohibited in the United States, even to American Indian tribes. However, a legal exception has had to be made in the case of the Native American Church, a Christian sect including about 40,000 Navajos as members, because its

constitution declares that believers have the right to use peyote as a sacrament during religious services. Although information about the discovery of cacti is less reliable and precise than that regarding other plants, a number of specimens must have arrived in Europe during the second half of the sixteenth century. These provided the basis for the descriptions contained in the herbals that were then proliferating. Oviedo, besides writing his History, collected a great many plants in his garden on the island of Haiti; and since he made regular visits to Spain, he probably brought with him specimens of the plants. We do know that during this period Opuntia ficus-indica arrived from the New World, as did Melocactus communis and some others. The Melocactus was described and illustrated by Matthias de l'Obel in 1576 under the name Echinomelocactus. There are also occasional references to the efforts made to keep these cacti alive in an uncongenial climate. In 1597 one of the most famous of all herbals was published in London: The Herball or Generall Historie of Plants, by John Gerald. This contained illustrations of two Cereus ("The Torch or Thorne Euphorbium" and "The Thorne Reede of Peru"); a Melocactus ("The Hedgehogge Thistle"); and an Opuntia ("The Indian Fig Tree"). In the seventeenth century, in botanical gardens all over Europe, the study of plants became greatly intensified, and plants and seeds were imported in considerable numbers. During the period, several cacti arrived and survived comparatively well because heated buildings known as orangeries were being used to grow citrus fruit. Some of these cacti were classified, although they were later renamed by post-Linnaean botanists. In 1623, Gaspard Bauhin mentioned Opuntia ficus-indica and a Cereus peruvianus spinosus fructu rubro in his Pinax Theatri Botanici; and in 1688 John Ray, in his Historia Plantarum, II, mentioned an Echinomelocactus lanuginosum tubercolis spinosis that was obviously a Mammillaria. In 1696, Plunket described and illustrated an Epiphyllum as Phyllanthos americana sinuosis foils longis, and in the same year, Abraham Munting of Groningen published a herbal, entitled Naauwkeurige Beschryving der Aardgewassen ("A Precise Description of the World's Plants"), in which there is an illustration of a stylized, but flowering and fruit-bearing, Opuntia major augustifolia. In 1718, Richard Bradley, the first professor of botany at Cambridge University, published his History of Succulent Plants, and two years later he followed with an article on the cultivation of succulents. In the first edition of Philip Miller's Gardener's Dictionary, published in 1731, twelve Cereus and eleven Opuntia each are listed. The following year, Johann Jakob Dillen, better known as Dillenius, wrote the two-volume Hortus Elthamensis. In it he illustrated an Epiphyllum, Pereskia, Opuntia and Nopalea cochenillifera that were being grown in James Sherard's garden at Eltham, England. In 1753, Linnaeus published his Species Plantarum -- the work that laid the foundations of botanical nomenclature. In this he grouped together all the members of the family then known by the name cactus -- a term derived

from the Greek kaktos, which Theophrastus and Theocritus had used to describe an unidentified prickly plant that was probably a thistle. Linnaeus coined the word from the ending of Echinomelocactos, and used the other names which had already become established to indicate the species. Soon after this, however, in a later edition of his Gardener's Dictionary, Miller pronounced this grouping inadequate and established four genera, placing alongside Cactus the three old names of Opuntia, Cereus and Pereskia. The etymology of the familiar name Opuntia is somewhat complicated. It derives from Opus, the capital of Locris, in ancient Greece. Around the city there apparently grew a great many fig trees bearing very sweet fruits from which the latex (opos) used as rennet was extracted. Thus opuntios, the adjective meaning "of Opus," came to be associated with a plant producing figlike fruit. It is generally accepted that Miller took the name from Joseph Pitton de Tournefort, who identified four types of Opuntia, but there were other precedents: as early as 1656 (the year of Tournefort's birth) a Ficus indicus minor, Opuntia was mentioned in a catalog of the plants growing in John Tradescant's garden in Chelsea. The name Cereus came into use in somewhat similar fashion. Miller gave the credit for it to Paul Hermann, the director of the Botanical Gardens at Leyden during the second half of the seventeenth century. However, the name had been used earlier by Jacob Theodore Tabernaemontanus in his herbal entitled Kraecherbuch. The second part of this, published posthumously in 1625, contains an illustration of a Cereus peruvianus. Miller took the third "new name," Pereskia, from that used by the French naturalist Charles Plumier to designate a single species. Plumier spent a long time in the Caribbean and was the author of Nova Plantarum Americanorum Genera. Linnaeus also adopted the name Pereskia, but in accordance with his single-genus scheme, it became Cactus pereskia. (Actually Pereskia is an incorrect name, because the plant was named after Nicholas Claude Fabry de Peiresc, another French naturalist; but all attempts to change the spelling have been overruled by the International Code of Botanical Nomenclature.) Miller's four genera were accepted during the second half of the eighteenth century and must have been considered adequate to cover the twenty-two species that were cultivated in Kew in 1789 and listed by William Aiton in the first edition of his Hortus Kewensis. Antoine Laurent de Jussieu's Genera Plantarum Secundum Ordines Naturalis Disposita (1789) represents the first attempt to classify plants in natural orders. It was also the first time a family of Cacti was recognized, although the family did not assume its present-day proportions until 1799 with the publication of Tableau du RÃƒÂ¨gne VÃƒÂ©gÃƒÂ©tal, by Etienne P. Ventenat. In this the family was called Cactoides. The great Geneva botanist Augustin Pyrame de Candolle was only twenty-one when the first part of his Plantarum Historia Succulentarum, illustrated by Pierre-Joseph Redoute, was published in 1799. He continued to work on the book until

1829, but before it came to fruition, Andrian H. Haworth revolutionized the cactus family again. In his Synopsis Plantarum Succulentarum of 1812, he kept Miller's three additional genera but completely abolished Linnaeus' Cactus, and established other genera -- of greatest importance, Mammillaria. Yet the abolition of the term "cactus," except as the basis for the family name and as a component of various generic names, was not really a defeat for Linnaeus, because it is now accepted as the common name for all plants belonging to the family Cactaceae. In the nineteenth century, there was a great increase in the number of expeditions and botanical discoveries made, and in the study of herbaria and living specimens in collections. The journeys undertaken by Friedrich Alexander von Humboldt and described in the mighty thirty-volume work Voyage aux regions equinoxiales du Nouveau Continent, faitoute, was published in 1799. He continued to work on the book until 1829, but before it came to fruition, Andrian H. Haworth revolutionized the cactus family again. In his Synopsis Plantarum Succulentarum of 1812, he kept Miller's three additional genera but completely abolished Linnaeus' Cactus, and established other genera -- of greatest importance, Mammillaria. Yet the abolition of the term "cactus," except as the basis for the family name and as a component of various generic names, was not really a defeat for Linnaeus, because it is now accepted as the common name for all plants belonging to the family Cactaceae. In the nineteenth century, there was a great increase in the number of expeditions and botanical discoveries made, and in the study of herbaria and living specimens in collections. The journeys undertaken by Friedrich Alexander von Humboldt and described in the mighty thirty-volume work Voyage aux regions equinoxiales du Nouveau Continent, fait en 1799-1804 were of fundamental importance. Other botanists who made invaluable contributions included the Prince of Salm-Dyck, Link, Otto, Martius, Lemaire, Riccobono, Engelmann and Karl Schumann. Many of them attempted to introduce new systems of plant classification and family orders, but the overall effect of this tumult of research was the proliferation of genera and species rather than a clarification of the subject as a whole. The sorting out of this confusion of names -- many of which were invalid, or were merely discarded as synonyms -- was begun in 1904 by two dedicated Americans: Nathaniel Lord Britton, director of the New York Botanical Gardens, and Joseph Nelson Rose, assistant curator of the United States National Museum Herbarium of the Smithsonian Institution. With the powerful backing of the Carnegie Institution, founded by the great steel magnate Andrew Carnegie, Britton and Rose traveled the length and breadth of the American continents, went to Europe to see the European collections of cacti, consulted herbals and archives, and obtained the collaboration of famous botanists, collectors and private individuals. Between 1919 and 1923 their four-volume Cactaceae was finally published. In this they divided the family into tribes, subtribes, and occasionally series; they established many

new genera and eliminated others. This division is still followed by many today, although new discoveries have been added and some modifications have been made. Numerous botanists, most of them German, have specialized in the study of succulent plants in general and cacti in particular since before World War II. The most famous was Curt Backeberg (1894-1966), who revolutionized the classification system that had been followed until then. His new system retains the three main groups but promotes them to the rank of subfamilies, and divides them into tribes, subtribes, groups and subgroups. Plants are placed in these categories not only on the basis of botanical affinity, but also on the basis of a geographic-environmental concept. One result of this concept has been the creation of numerous very restricted genera, several of which are monotypic. Many of Backeberg's genera were never accepted; others persist merely as synonyms. The most interesting aspect of his system is that he heads his list of Cereus-group cacti with the epiphyte genera, starting with the Rhipsalis, followed by the Hylocereinae and the Cacteae (the latter are divided into Austrocereeae from South America, and Boreocereeae from North America), and ending with the Mammillaria. Other authors have also considered the epiphyte genera to be descendants of the Hylocereinae with structural modifications brought about by their habitat. In view of the mystery surrounding their origins, this hypothesis cannot be disproved. Many members of the family Cactaceae, like the members of other plant families, have been given common names as well as formal botanical names. Virtually all of these, however, are residents of the United States. Only a tiny handful of South and Central American cacti have common names. In the United States the general practice has been to give the same common surname to one cactus genus. For example, the Opuntia cacti that have acquired common names (many have not) are generally known as prickly pears, or prickly pear cacti. This group includes the beaver tail prickly pear, the fragile prickly pear, the porcupine prickly pear, the yellow spine prickly pear, and many others. The surnames of other large groups include the barrel cacti (genus Ferocactus), beehive cacti (genus Coryphantha), hedgehog cacti (genus Echinocereus), and pincushion cacti (genus Mammillaria). Members of genus Cylindropuntia are generally known as chollas -- bush pencil cholla, jumping cholla, teddy bear cholla, etc. In the individual plant entries that follow, common names are given for those species that have them.

CACTI IN USE No species of the Cactaceae family can possibly be said to be economically important in the usual sense of the term, but many of them are put to use in some way in the areas in which they grow. For example, in areas where there are no trees and there is therefore no wood, dried Cereus stems are used as less efficient substitutes for wooden building planks and logs, while in grassless regions the flat branches of Opuntia, stripped of their glochids, are used as forage. Moreover, very young branches of Opuntia, whose prickles can easily be scraped off, are eaten

fried in Mexico and boiled in Texas. They are known as nopalitos, nopal being a common name applied to several different species. To ward off scurvy, seventeenth- and eighteenth-century sailors ate boiled branches; they remained fresh for a long time, because of their succulence, and provided a substitute for perishable green vegetables. Most people are acquainted with the prickly pear. Opuntia ficus-indica grows in many warm countries and has become naturalized in several Mediterranean countries, where its fruit is grown for export. This is not the only cactus to produce edible fruit, although prickly pears are undoubtedly the sweetest and most delicious. Other species that are widely cultivated for their fruit are Opuntia tuna, Opuntia streptacantha and Opuntia cardona. The Mexicans commonly eat the fruit of various native cereus cacti -- Hylocereus undatus, for example -- or the bluish berries of Myrtillocactus geometrizans, which are sold in Mexican markets under the name garambullos. The fruit of the big saguaro, Carnegiea gigantea, is also considered excellent -- quite good enough, at any rate, to compensate for the difficulty of picking it at a height of 30 ft. (10 m.) or more. Some species of Echinocereus are known by the common name "strawberry cactus," since their fruit is not only fleshy but also edible. Although the fruit is prickly, the spines become soft when it ripens, and are easily removed. In view of its formidable array of spines, it is extraordinary that Echinocactus should be put to any use; yet beneath its prickly epidermis there lies a watery pulp, vaguely reminiscent of watermelon, from which a preserve known as dulces de viznaga is made. Viznaga is commonly used to describe several species, not just Echinocactus visnaga, whose specific name is derived from popular usage. Probably the most extensive use to which cacti are put is that of providing protective enclosures. Several species of Cereus are used for this purpose because they put up a particularly impenetrable thicket of branches. Also popular in hedges are the Pachycereus and Stenocereus species that grow with such an upright and regular habit that they are called organ-pipe or organ cactus. Opuntia, too, is often used as hedging. Indeed, a long flowerbox filled with prickly cacti and placed on top of a wall might well prove a more efficacious -- and certainly a more aesthetic -- deterrent to trespassers than the iron spikes or barbed wire commonly used. GENERAL RULES OF CULTIVATION From the standpoint of the gardener who wants to grow them, cacti are best divided into two main groups -- those from desert and mountain habitats, and those from tropical and subtropical forests. Several general rules regarding cultivation are applicable to these two categories, but significant individual variations must be taken into account. Temperature and Climate One of the most commonly held but erroneous popular beliefs is that cacti are houseplants. The truth is that few succulent plants are suitable for cultivation indoors, because of the difficulty of duplicating the special growing conditions they demand. Today most houses have central heating,

and they are therefore too warm for a cactus, which needs a complete rest and good airing in winter. Excessive heat during the daytime is accompanied by another drawback: although the indoor temperature drops at night, it does not do so to the same extent as in the cactus's natural environment. Even more important, the indoor air is always dry, and no nocturnal humidity is produced to compensate for a plant's lack of moisture. Cacti should be watered, therefore, even if only now and again. It should be noted that if the supply of light and air is inadequate, watering will promote an unnatural growth cycle that results in the production of delicate and weakly spined tissues. In temperate climates the most favorable conditions for cactus cultivation are to be found in a greenhouse. This should be cold, the temperature ranging from a minimum of 36-50Ã Â F. (2-10Ã Â C.) to a maximum of 47-54Ã Â F. (8-12Ã Â C.), depending on the various species. However, if a few factors are taken into consideration, cultivation indoors can also be feasible. Modern houses with large window area are best suited to the growth of all kinds of plants, cacti included. Apartments with covered balconies are ideal because the balconies can be glassed in to form conservatories. Since it is on window panes that moisture condenses during the night, if a cactus is placed on a windowsill indoors, it will enjoy the sunshine flooding through the glass on bright days and a relatively cool atmosphere at night. In addition, it should be able to obtain sufficient moisture to keep its tissues turgid, making winter watering unnecessary. Radiators are often placed beneath windowsills, but this need not affect the plants if a shelf with an air space below it is placed above the radiator. The plants should be set on this in trays containing a layer of gravel that is quite dry. The gravel can be slightly moistened from time to time if any wrinkling from excessive heat is noticed. This arrangement is particularly suitable for young plants, which are usually rather delicate and need a slightly warmer atmosphere than old plants. For cultivating cacti outdoors in a garden or on a terrace it is advisable to put up a shelter. The most suitable type depends on the local climate. In warm areas a simple roof of glass or rigid plastic often suffices to protect plants from frost, rain or -- worst of all -- hail. Where the temperature regularly falls to below freezing for long periods, a greenhouse should be erected for adult plants that cannot conveniently be brought indoors. A collapsible greenhouse is perfectly adequate. Do-it-yourself enthusiasts may wish to build their own, and in areas not subject to strong winds or torrential rain, a wooden framework covered with heavy-duty polyethylene will do. This should be constructed so that the southern end can be raised to ventilate the greenhouse in good weather. On really cold nights, matting anchored by hooks in the roof should be thrown over the house to prevent daytime heat from escaping. Most of the greenhouses on the market are easily assembled. In colder climates, those with glass panes can be heated by electricity, but heating is not advisable in plastic-covered

greenhouses since the plastic may be stretched or damaged if direct heat is unequally dispersed. In the case of glass greenhouses, the need for well-planned periods of ventilation is greater because the plants are vulnerable to attack by parasites, and the constant humidity may give rise to green algae on the panes. In summer, cacti should be outside -- in sunshine, shade, or semishade, according to the species. It is difficult to say exactly how long they should be left out, since local seasonal variations in the weather must be taken into account. There is usually a period when the temperature ranges between 54Ã Â and 65Ã Â F. (12Ã Â and 18Ã Â C.), and the possibility of a sudden drop is unlikely. At these temperatures most cacti begin to show the first signs of growth, but this sometimes slows down or ceases during the summer as a result of two climatic differences. In their countries of origin, the extreme daytime heat is tempered by nighttime cold, and the number of daylight hours in the tropics is much smaller than in temperate zones, hence many cultivated cacti suffer from too many hours of sunshine. If cacti are subjected to thirteen to fifteen hours of sunshine per day at summer temperatures of over 86Ã Â F. (30Ã Â C.) in the shade and minimum nighttime temperatures of over 68Ã Â F. (20Ã Â C.), they enter a semidormant state in which they still require regular watering. In hot weather such as this, therefore, it is advisable to remove even those species that normally like a sunny position from the midday sun. In Britain and the cooler parts of Europe, however, few cacti can be grown successfully outdoors in the summer. Although they may not die, a long, dull wet spell will damage them. To guard against this, most growers keep the great majority of their plants in the greenhouse, putting only the overflow outside. Light and Air Almost all species of the Cactaceae require as much air as possible, and most of them require exposure to the sun. During the winter months, however, no matter how well they have been looked after, their tissues become weakened and their defenses destroyed; so unless they are transferred outdoors in stages, their epidermis may suffer burns, which, though they eventually heal, will leave the plant permanently blemished. By the same token, plants that are kept behind glass should be shaded by a thin curtain from very hot, bright sunshine, since the sun’s rays are magnified by the glass. These precautions apply especially to young plants, which are much more sensitive to sunlight than adult plants. (The truth of this statement may seem questionable when you consider how easily cactus seeds germinate and grow in strong sunshine, but it must be remembered that in their natural environment fledgling plants are normally shaded by other plants, rocks, etc.) However, epiphytic or semi-epiphytic cacti that originally grew in the forest need to spend more of their lives in shade or semishade. Some Epiphyllum hybrids can tolerate a little sunshine because they have been crossed with Helicereus. But they are exceptions. Generally, a position of semishade in very bright surroundings results in a greater abundance of more beautiful

flowers. Soil It is absolutely essential that all members of the cactus family be grown in soil that is porous and perfectly drained. If it is not and the soil becomes waterlogged, the roots will rot and the plant will die. Many people believe that cacti can be kept completely dry or almost so, and that this is a solution to the problem; but dry, hard soil prevents oxygen from reaching the roots, and asphyxiation results. This is why even succulent plants wither. It is true that in their natural habitat many species live on hard, rocky terrain; but one must bear in mind how far their roots reach out, growing around obstacles and down into the earth until they find a place where they can spread. Such spreading is not possible in a flowerpot. Sand must be added to the soil in which all cacti are grown to ensure that it is highly porous. In addition, the soil must always be free of any sort of decomposing organic matter, although fully decomposed matter is essential. Desert or mountain cacti require soil that is very rich in mineral salts; epiphytes and semi-epiphytes grown mainly for their flowers -- Epiphyllum, Hylocereus and Selenicereus, for instance -- need a soil with more humus, such as completely decomposed leaf mold and a little well-rotted horse manure or similar fertilizer. Rhipsalis and similar genera grown in pots require mainly leaf mold and peat. Delicate or very young plants benefit from the addition of some crushed charcoal as well as sand. This will neutralize any fermentation of residual matter. (Both ordinary charcoal chips and the so-called activated charcoal sold for aquarium filters should be washed in a colander or through gauze before use.) At the end of this discussion we list four types of basic soil for pot-grown cacti. With experience, you can vary them to suit particular needs. Every keen grower tends to have his own secret formula. Various materials can be added to the growing medium. Tiny pellets of expanded clay or polystyrene can be used instead of grit. Builder’s sharp sand used for making mortar has the advantage of containing pebbles of various sizes. If the sand is shaken a little at a time, the largest gravel can be removed and what is left will be a mixture of two of the requisite materials. All-purpose potting soil should be avoided, as it is peaty, holds moisture, and easily forms lumps. It may be used in place of leaf mold if leaf mold is hard to find; but the proportion used should be smaller. Fertilizer other than horse manure, which is not always available, can be used, although because of their lack of leaves cacti do not need much nitrogen. The three numbers given on fertilizer packages refer to the percentages of nitrogen, phosphorus and potassium -- in that order -- in the fertilizer. All fertilizer used for cacti should have a much lower percentage of nitrogen than of the other two elements, since phosphorus and potassium help to increase a plant’s growth and flowering potential. However, fertilizers should be used as little as possible; if they are absolutely necessary, it is best to add to the soil a granular fertilizer that dissolves slowly. Contradictory advice is often given regarding the suitability of acid or alkaline soil. Many species live on chalky (limy) soil; therefore it is

advisable to add a few flakes of plaster or shells ground almost as fine as powder to the soil in order to strengthen the tough, colored spines. If too much is given, hypercalcification of the spines and a thickening of the tissues may ensue. Although some growers believe that many cacti prefer slightly acid conditions, it is undoubtedly true that highly acid soil is harmful to all genera except Rhipsalis. In the least serious cases, the plants appear perfectly healthy, but rather unnaturally florid. While this may make them attractive commercially, it can create problems for inexperienced growers, who should strive for the strongest plants possible. 1. 2 parts seasoned, slightly fibrous garden loam free of unrotted organic matter; 1 part coarse river or lake sand; 1 part very fine grit; a little granular fertilizer. This compost is suitable for Opuntia, Cereus and similar genera, Echinopsis and Mammillaria. For Selenicereus and Aporocactus, 1 part well-rotted leaf mold should be added. 2. Equal parts of garden loam, leaf mold and sand; 1/2 part grit; a little granular fertilizer. This is suitable for Echinocereus. For Rebutia and Lobivia the leaf mold may be reduced to 1/2 part, the other 1/2 part being made up with peat. 3. Soil that is predominantly inorganic: 3 parts sand; 2 parts garden loam; 1 part leaf mold; 1 part grit. This is suitable for Echinocactus and similar genera. Echinofossulocactus, Astrophytum and Gymnocalycium may need the loam reduced to 1 part and the leaf mold increased to 2 parts. 4. Equal parts of loam, leaf mold and sand, with a little fertilizer consisting almost entirely of phosphates. This is suitable for Epiphyllum and Schlumbergera. For Rhipsalis, fibrous peat should be substituted for the loam. Watering Many people believe that cacti should be watered a thimbleful at a time -- and usually those same people complain that in their homes no plant lives for very long. This is hardly surprising. It cannot be emphasized too strongly th

Totally useless to me as there are only cacti in this book and I’m trying to learn about succulents

Wonderful information on cacti, but I was disappointed to find so few succulents other than cacti.

Not many succulents named here , mostly cactus.

This is my second book on cactus. I like all of the information given as it is helpful to me in learning about the different types of cacti. Anyone in the hobby or just wanting to know about cacti should find it extremely helpful. Highly recommended.

Photos were extremely helpful in identifying un- or mi-labeled specimens. Also has the best growing instructions of any book I’ve read on the subject so far.

THIS IS A MUST HAVE FOR THE SERIOUS CACTUS COLLECTOR. SMALL, FAT, SUPER CLEAR AND CONCISE MODULARIZED ENTRIES WITH PICTURES, AND SPECIFICATIONS OF EACH CACTUS TYPE. THE ONLY THING I HAVE SEEN BETTER IS THE HUGE ANDERSON BOOK TITLED "THE CACTUS FAMILY", A BEHEMOUTH DEFINITIVE VOLUME. THIS LITTLE BOOK IS THE NEXT BEST THING I HAVE SEEN ANYWHERE.

Good

Book was recommended to me by David Clark, National Garden Spokesperson. Lots of useful information on the care of different cacti and full color pictures.