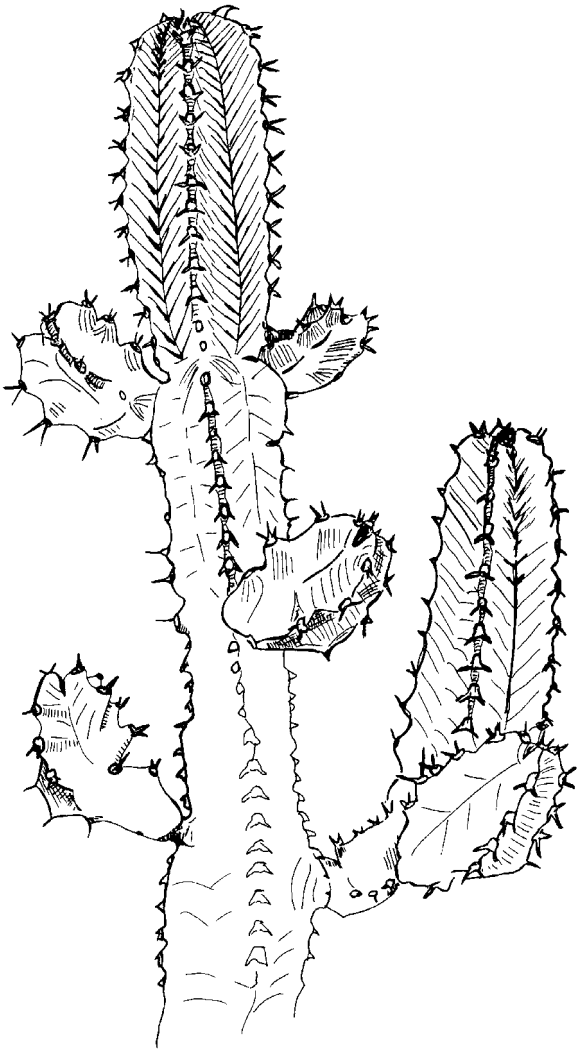
Artificially propagated versus wild-collected succulents

The difference between artificially propagated and wild-collected succulent plants



1. Introduction

1.1 Collecting succulent plants

Succulent plants have been cultivated in private collections and Botanical Gardens for more than 150 years because of their fascinating forms, and large quantities of plants were taken for cultivation long before CITES existed. The collecting of succulent plants has had various great periods historically, mainly 1885-1910, 1925-1940 and 1965-1985. In these periods, large shipments of wild-collected succulent plants came into trade, mainly in Europe and the United States of America. In the past ten years, the size of these shipments has decreased because of better enforcement of regulations in the countries where succulents are collected in their habitats. On the other hand, private collecting trips have increased with the worldwide increase of individual tourism. Wild-collected plants are transported in hundreds in suitcases and hand luggage, as various recent confiscations confirm, but also by mail.

1.2 What are succulent plants?

The majority of succulent plants come from semi-arid regions of the world. The most important semi-arid regions lay in the Horse Latitudes (two circumglobal belts between 23 degrees north and 34 degrees south of the equator). Some succulent plants also live in humid regions of the world but there they grow on rocks, in trees and in other places where rainwater runs off quickly. To survive dry periods, succulents store water in their roots, stems or leaves. These parts of the plant are thickened to increase the volume available for water storage. Storage of water is the only character shared by all succulents. Succulent plants have developed various sophisticated mechanisms to protect themselves against herbivores. They can be covered with spines, or they look very much like the substrate in which they grow (e.g. "living rocks"). Succulents are often covered with hairs, wool or thick wax layer to reflect the sunlight and to reduce evaporation. Succulents have evolved in many plant families (ca. 50). In adapting to similar, strongly selective conditions of the environment in their habitats, even taxa that are systematically quite unrelated may look very similar (such look-alikes are called convergent forms). Identification of succulent plant taxa can be difficult even for experts, in particular when no flowers and fruits are available. This manual therefore is not designed to enable identification of individual plant taxa but to enable the reader to determine whether plants are artificially propagated or not.

1.3 How to use this information?

This manual should help the user to identify whether the plants in a shipment are artificially propagated succulent plants or not, and to treat commercial shipments efficiently. It cannot give a 100% guarantee about the identification of any individual wild-collected plant. If there are doubts, an expert on succulent plants should be called-in for assistance.

How to distinguish between a shipment of wild-collected succulent plants and a shipment of succulent plants grown in a nursery? To provide a general idea about shipments that may require closer inspection, the following pages contain lists of the most often traded and most often wild-collected succulent plant taxa and their countries of origin, as well as a list of countries from which are exported significant quantities of succulent plants that are artificially propagated in nurseries. This list helps if plants are labelled and documented correctly. But this is not always the case. Therefore, the manual also provides checklists of characteristics indicative of wild-collected plants. The most significant characteristics are illustrated with photos of typical examples.

The checklists have to be applied step-by-step, in particular the one on morphological characteristics. If characteristics are found that might indicate wild origin, the lists of critical taxa and countries can be consulted. The documents that accompany a shipment have to be checked, as well as labels and packing material.

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1.4 Plant names and labels

- Significance of the label

  For non-experts, the label is the only means to identify a plant. If plants are labelled correctly, it is easy to compare the names on the labels with the names of the species included in the CITES appendices. But, unfortunately, information on labels is not always reliable - names on labels should be treated cautiously. In the context of this manual, plant names are much less important than the morphological characters listed in the chapters below.

- Problems with plant names

  Often, there are various synonymous names for one and the same plant taxon. (*Taxon* is a term that is used for the various levels in the classification of plants and animals. A taxon can be a genus, a species or a subspecies etc.) Experts not always agree about the name that should be applied to a certain taxon. Some authors regard a particular taxon as a species, naming it, for example, *Euphorbia cap-saintemariensis*. Others, however, regard the same taxon as a variety only, naming it *E. decaryi* var. *cap-saintemariensis*. Both names refer to the same entity and, in this particular case, it is included in Appendix I under *E. decaryi* [meaning that this and all varieties of *E. decaryi* (var. *decaryi*, var. *ampanihyensis* and var. *spirosticha*) are included]. However, by using only the name *Euphorbia cap-saintemariensis* the impression can be given that this taxon is NOT included in Appendix I.

  Also, recent research may have demonstrated that earlier conclusions about a taxon were not entirely correct. This may result in a re-grouping of the species, placing it in another genus. For example, *Lobeira macdougallii* was included in Appendix I under that name in 1983. A different opinion regarding the relationship of this species resulted in its name being changed to *Nopalxochia macdougallii* (1987). Currently, as a result of further investigations as part of the preparation of the CITES Cactaceae Checklist, the same species has, since 1992 been included in the appendices under the name *Disocactus macdougalii*.

  But even if there is an agreement on the names that should be used, synonymous names are continuously applied by nurseries and enthusiasts, because they refuse to use the recent ones, or do not know them. In the nursery trade there is great reluctance to accept new names, since the older ones are well established. The International Organization for Succulent Plant Studies (IOS) is working on a worldwide consensus on nomenclature and taxonomy of succulent plant taxa. For the most important group of succulent plants in trade, the Cactaceae, there is a checklist of names generally accepted by experts and approved by the Conference of the Parties, the "CITES Cactaceae Checklist". Where possible, check the names using the CITES Cactaceae Checklist for wild-collected plant specimens. Another useful reference is the "List of Names of Succulent Plants other than Cacti". Both are published by the Royal Botanic Gardens, Kew, United Kingdom.

2. Trade in succulent plants

2.1 Countries and regions, where succulent plants are frequently collected in the wild

- Countries and regions of the Old World

  Africa: Ethiopia, Kenya, Madagascar, Malawi, Morocco, Namibia, Somalia, South Africa (Cape Province, Natal, Transvaal), United Republic of Tanzania, Zimbabwe.

  Asia: Arabian Peninsula.

- Countries and regions of the New World

  Central America: Costa Rica, Guatemala, Honduras.

  North America: Mexico, Southwestern states of United States of America (Arizona, California, Colorado, Nevada, New Mexico, Texas, Utah).

  South America: Argentina, Brazil, Chile, Ecuador, Paraguay, Peru, Uruguay, Venezuela.

  Caribbean Islands.

2.2 Countries and regions, where succulent plants are frequently produced in nurseries

- Commercial outdoor cultivation in semi-arid regions

Big nurseries that produce large numbers of plants under optimal climatic conditions are found in the following regions and countries:

Africa (excl. Mediterranean region): South Africa.

Mediterranean countries: Israel, Italy, Morocco, Spain (in particular the Canary Islands).

United States: Arizona, California, New Mexico.

- Commercial greenhouse cultivation

  European countries with significant horticultural mass production: Denmark, Germany, Netherlands.

  European countries with less significant horticultural production: Austria, Belgium, Czech Republic, France, Hungary.

- Plants propagated by enthusiasts

  Succulent plants have been very popular in private collections for at least 150 years, particularly in Europe (Austria, Belgium, Czech Republic, France, Germany, Hungary, Italy, Malta, Switzerland, United Kingdom), and - more recently - also in Japan and the United States of America. In most of these countries there are cactus and succulent societies, some of them founded in the last century. Cactus and succulent enthusiasts often get very good results in cultivating and propagating rare and difficult-to-grow taxa. Small amounts of plant material propagated by enthusiasts are exchanged or traded at society meetings or offered or advertised in society journals. Sometimes, however, there are wild-collected plants among this material.

2.3 The most frequently traded succulent plants (artificially propagated and wild-collected)

The following list is based on information from the annual reports presented to the CITES Secretariat.

CITES taxa in **bold**.

Family	Species
Agavaceae	*Agave victoriae-reginae*
Aizoaceae (Mesembryanthemaceae)	*Argyroderma* spp., *Cheiridopsis* spp., *Conophytum* spp., *Delosperma* spp., *Faucaria* spp., *Gibbaeum* spp., *Lampranthus* spp., *Lithops* spp., *Pleiospilos* spp., *Ruschia* spp., *Trichodiadema* spp.
Apocynaceae	*Pachypodium bispinosum, P. brevicaule, P. lamerei*
Asclepiadaceae	*Ceropegia armandi, C. volubilis, C. woodii*
Cactaceae	*Ariocarpus fissuratus, A. kotschoubeyanus, A. retusus, Arthrocereus* spp., *Astrophytum asterias, A. capricorne, A. myriostigma, A. ornatum, Browningia* spp., *Cephalocereus senilis, Cereus peruvianus, C. jamacaru, Cleistocactus strausii, Coleocephalocereus* spp. (incl. *Buiningia*), *Copiapoa humilis, Coryphantha elephantidens, C. bumamma, Discocactus* spp., *Disocactus* species and hybrids, *Echinocactus grusonii, Echinocereus* spp., *Echinopsis chamaecereus* (= *Chamaecereus silvestrii*), *Epiphyllum* (species and hybrids), *Epithelantha micromeris, Espostoa*

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Family	Species
	lanata, Ferocactus spp., *Gymnocalycium baldianum, G. mihanovichii* (mainly grafted coloured forms), *Haageocereus* spp., *Heliocereus* spp., *Hylocereus* (often used as root stock for grafts), *Mammillaria bocasana, M. elongata, M. hahniana, M. magnimamma, M. zeilmanniana, Melocactus bahiensis, M. oreas, Monvillea* species (see also *Cereus*), *Myrtillocactus geometricans, Neobuxbaumia polylopha, Neolloydia* spp., *Neoporteria* spp. (see also *Eriosyce*), *Notocactus* (see also *Parodia*): *N. haselbergii, N. leninghausii, N. magnificus, N. scopa, Opuntia leucotricha, O. microdasys, O. robusta, Oreocereus trollii, Pachycereus* spp., *Parodia* spp., *Pilosocereus* spp., *Polaskia chichipe, Rebutia minuscula, Rhipsalidopsis* (mainly hybrids), *Schlumbergera* (mainly hybrids), *Selenicereus grandiflorus, Stenocactus* (syn. *Echinofossulocactus*) spp., *Stetsonia coryne, Thelocactus bicolor, T. setispinus, Weberbauerocereus* spp.
Crassulaceae	*Adromischus* spp., *Aeonium* spp., *Cotyledon* spp., *Crassula* spp., *Echeveria* species and hybrids, *Kalanchoe blossfeldiana, K. manginii, K. scapigera, K. tomentosa, Pachyphytum* spp., *Graptopetalum* spp. (incl. *Tacitus*), *Sedum* spp.
Didiereaceae	*Alluaudia ascendens, A. procera, Didierea madagascariense, D. trollii*
Euphorbiaceae	*Euphorbia alluaudii, E. angustiflora, E. cap-saintemariensis, E. cylindrifolia, E. decaryi, E. grandicornis, E. ingens, E. lactea, E. lophogona, E. millii, E. trigona*
Liliaceae (Aloaceae)	*Aloe arborescens, A. ferox, A. variegata, A. vera* (*A. barbadensis*), *Haworthia* spp., *Gasteria* spp.

2.4 Genera (and their origins) that are frequently wild-collected (legally and illegally)

Family	Genus	Origin
Asclepiadaceae	*Brachystelma*	South Africa, Zimbabwe
	Trichocaulon (= *Lavrania*)	Namibia, South Africa
Apocynaceae	*Pachypodium*	Madagascar, Namibia, South Africa
	Adenium	Arabian Peninsula, Kenya, Namibia, Somalia, South Africa
Anacardiaceae	*Operculicarya*	Madagascar
Burseraceae	*Commiphora*	Madagascar, Namibia, South Africa
Cactaceae (names in accordance with CITES Cac	*Ariocarpus*	Mexico

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Family	Genus	Origin
tacea eaeCheck list)		
	Copiapoa	Chile
	Coryphantha	Mexico
	Discocactus	Bolivia, Brazil
	Echinocereus	Mexico, USA
	Escobaria	Mexico, USA
	Lobivia	Argentina, Bolivia
	Mammillaria	Mexico
	Melocactus	Brazil, Caribbean Islands, Venezuela
	Neolloydia	Mexico
	Neoporteria	Chile
	Notocactus	Argentina, Brazil, Uruguay
	Parodia	Argentina, Bolivia
	Pediocactus	USA
	Rebutia	Argentina, Bolivia
	Sulcorebutia	Bolivia
	Sclerocactus	Mexico, USA
	Thelocactus	Mexico
	Turbinicarpus	Mexico
	Uebelmannia	Brazil
Cucurbitaceae	*Xerosicyos*	Madagascar
Euphorbiaceae	*Euphorbia*	Arabian Peninsula, M

Family	Genus	Origin
		adagascar, South and East Africa
	Monadenium	Kenya, Malawi, United Rep. of Tanzania, Zimbabwe
	Jatropha	Madagascar, Mexico
Geraniaceae	*Pelargonium*	Namibia, South Africa
	Sarcocaulon	Namibia, South Africa
Liliaceae (Aloaceae)	*Aloe*	Arabian Peninsula, Mada

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Family	Genus	Origin
		gascar, South and East Africa
	Gasteria	South Africa
	Haworthia	South Africa
Passifloraceae	*Adenia*	Madagascar
Pedaliaceae	*Uncarina*	Madagascar
Portulacaceae	*Anacampseros* incl. *Avonia*	Namibia, South Africa, Zimbabwe
Vitaceae	*Cyphostemma*	Madagascar, Namibia, South Africa

2.5 Succulent plants in shipments

Succulent plants are traded for various purposes. Most often, they are shipped to be sold to plant traders or enthusiasts for cultivation. But there are also shipments of living or dead samples for scientific research. They must be accompanied by the same documents as commercially traded plants (permits and/or phytosanitary certificates) unless they bear the appropriate labels in case of exchange between two registered scientific institution. International trade in wild-collected plant material is legal only with appropriate CITES documents, except for some parts and derivatives specified in the Interpretations of the CITES Appendices I, II and III.

Potted plants: mass production of young, small plants in peaty substrate in pots or bowls of clay or plastic.

Non-potted plants: shipment mostly by air-freight or by post, but also by boat or road in container loads. The stems have bare roots, the root system is usually reduced (cut back or damaged). Big plants may originate from nurseries that cultivate plants outdoors in a semi-arid climate or from the wild in countries that permit the export of wild specimens (e.g. United States of America).

Plant cuttings without roots: apical stem parts of treelike and big shrubby species (see Photo 9).

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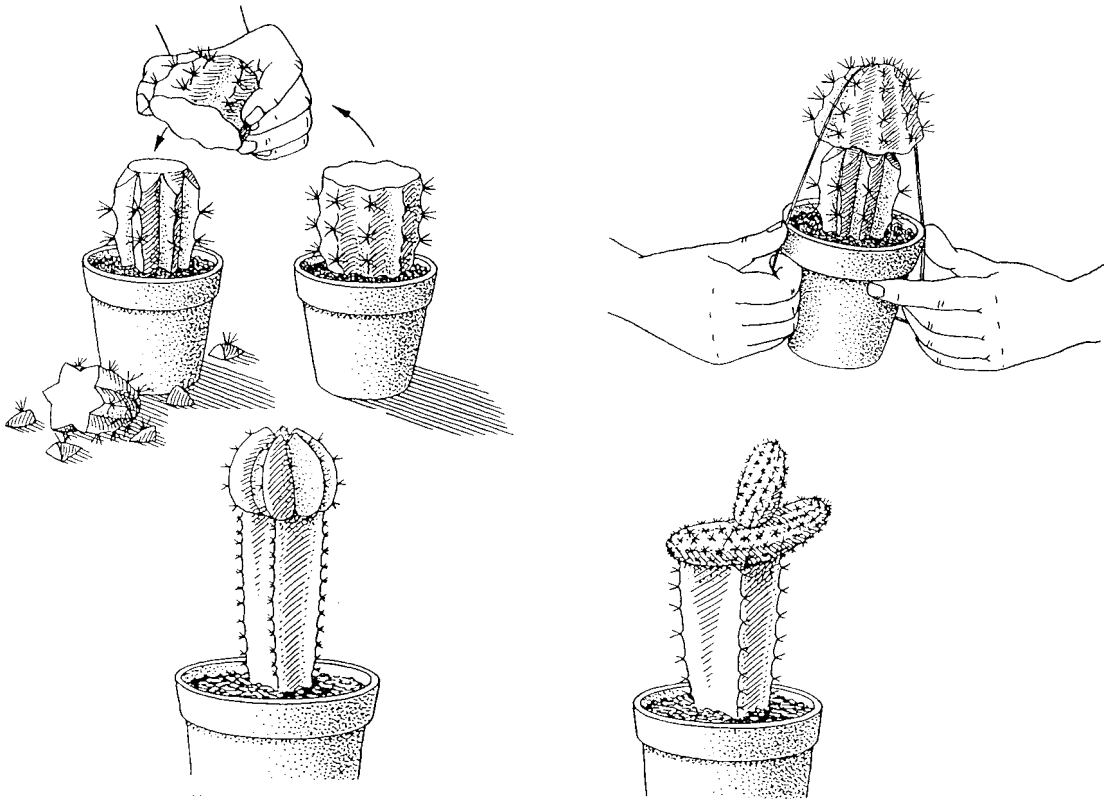
Grafted plants (potted or non-potted): mostly cacti, but sometimes other succulents such as *Pachypodium*. Cacti: mutants that have lost the ability to produce chlorophyl that provides the green colour to all plants (non-green cacti, e.g. the red "strawberry cactus") or species that are rare and difficult to cultivate and that are grafted on root-stocks of selected more robust, well-growing species (see figures below). The species most often used for grafting of "strawberry cactus" and similar mutants are from the genera *Hylocereus* (a cactus with a triangular green stem with a few soft spines) or *Selenicereus* (a cactus with slender, stems with 4-5 angles and with a few soft spines); rare cacti are more often grafted on *Eriocereus* or *Echinopsis* (cacti with stems with 4 or more angles and with many short but strong spines).



This technique is used for specimens of species that are difficult to grow, for the hybrid varieties that can not grow on their own because of lack of chlorophyll, or to boost growth of slow growing species.

The top of the rootstock is cut off to obtain a smooth surface of exposed plant tissue. A similar treatment is given to the bottom part of the scion (the part to be grafted on to the root stock). The two parts are tight together (rubber band or sometimes sellotape) with the freshly cut surfaces touching each other. After one to several weeks, depending on the species used, the tissues of the graft and the scion have grown together and the ties can be removed.

Seeds and fruits: there are many companies worldwide that trade in seeds of succulent plants only. Seeds are often shipped in small quantities in envelopes, usually with a catalogue number or sometimes with a label with a scientific name. Note that seeds of species included in Appendices II and III are not subject to CITES controls, although collecting may be prohibited in their countries of origin (e.g. Mexico).

In-vitro cultures: the propagation of meristem material, especially of rare species, is becoming more and more popular for succulent plants (as it is for orchids). Small plants are grown in sterile containers.

Herbarium specimens: dried plants or parts of plants, e.g. fruits and seeds mounted on sheets and labelled or containers with plants conserved in alcohol.

Succulent plants that are most certainly artificially propagated: grafted plants of equal size, shipped in large quantities, such as those with non-green grafts (e.g. "strawberry cactus"); horticultural mass production, in-vitro cultures.

3. Checklist of differences between artificially propagated and wild-collected succulent plants

3.1 Introduction

Plants grown under controlled conditions show characteristics different from those plants that grow in their natural habitat.

In natural habitats, plants grow under conditions of stress. They have to struggle for water and nutrients and are attacked by diseases, herbivores and parasites. They grow under individual, unique conditions, very often in special microhabitats, such as rock fissures, etc. Therefore, these plants show very individual characteristics, even if they come from the same locality and belong to the same taxon. Invariably they have widespread root systems that have to be cut off when they are dug out of the substrate. Illegal shipments of wild-collected plants are very varied. They usually contain plants of many different sizes and shapes and they contain specimens of many different taxa.

Nursery-grown plants are uniform and healthy. Such plants in a single shipment usually are of about the same age and size within a taxon. They are carefully grown and carefully prepared for shipment.

To know these differences helps in identifying wild-collected plants. In the following checklists, the most important characters are listed and illustrated.

3.2 "What the hell is that?"

In a shipment, plant specimens may be found that can not be identified easily, such as bulbs, rhizomes or cuttings that show no characteristics that could help with identification. If there are problems or doubts, a trained botanist or an expert in succulent plants should be called. Botanical institutes of universities may help to find specialists. In many countries, there are resident members of the IOS (International Organization for Succulent Plant Studies) who may be able to help. IOS members are often associated with botanical institutes. To find the nearest specialist, the national CITES Management or Scientific Authority should be contacted.

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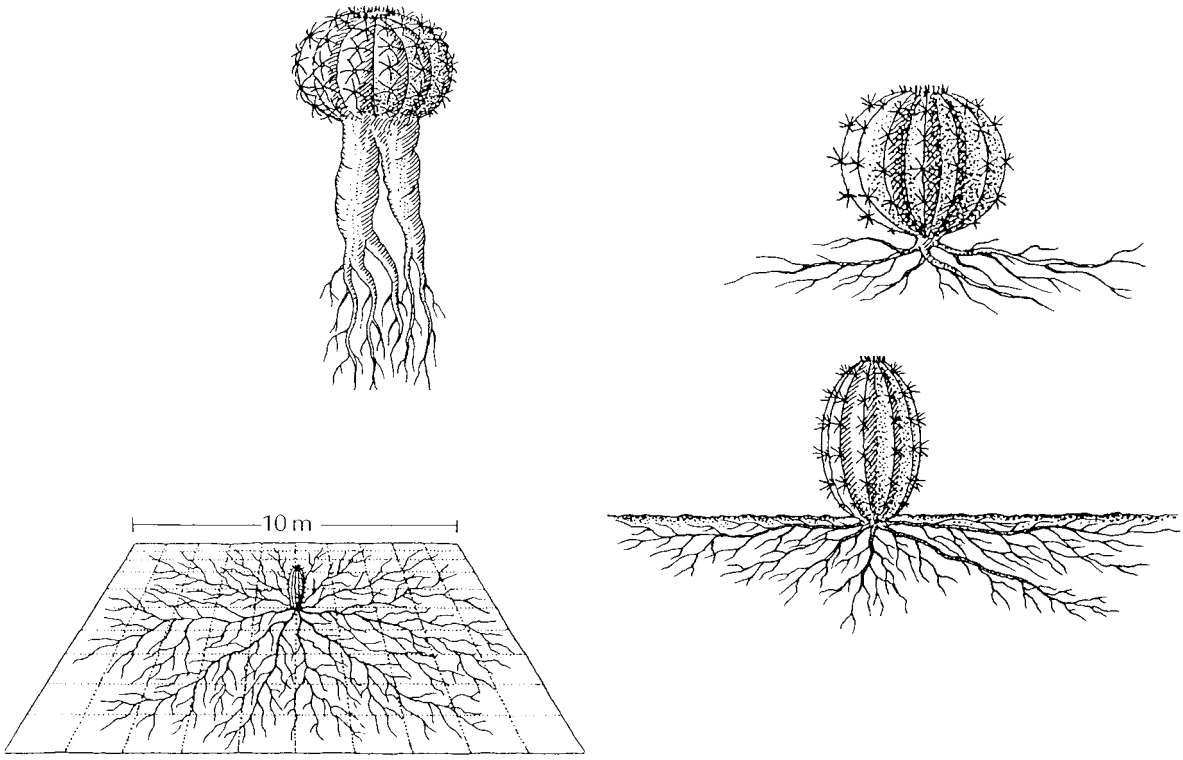
3.3 Checklist of morphological characteristics

ROOTS

The shape and size of roots is determined by the substrate in which they grow. Cultivated plants do not have to struggle for water and nutrients. They grow in soft, gravelly or peaty substrate of a uniform consistency and are supplied by plenty of water and fertilizer. They form relatively small, compact roots systems of a regular shape, which fill the container in which the plant grows. If the plants are taken out of a soft substrate, not much damage is done to the root system. Only minor roots break.



Top left: Taproots

Others: Example of superficial root systems, that may reach a diameter of 10 m or more.

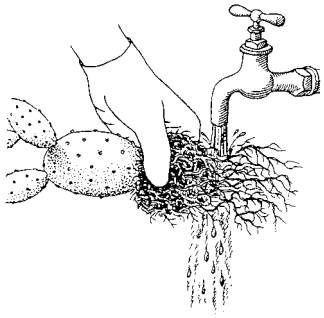
In natural habitats, succulents normally grow in hard substrate. Often, they form only one main root, which reaches deep into the soil. If plants grow in rock fissures or in rocky soil, the development of their root system is limited by the space available, that means the roots are laterally compressed or irregularly bent. In gravelly substrate, roots stretch out over considerable distances to collect water, mostly near the soil surface. When wild plants are collected, these root systems can never be taken out of the substrate without major damage. Usually, some, if not all, of the roots brake or are simply cut off. If the substrate is clay, traces of substrate usually stick to the roots and the lower parts of the plants. If the substrate is gravelly, some pieces of gravel often stay on the plant base. Some succulents grow in shallow humus layers in tufts of moss and small ferns on rocks and cliffs. Their root system therefore stretches out only horizontally, quite unlike a root system that develops in a pot. Plants with simple taproots most often send one or several roots upwards to the soil surface to collect moisture from dew and from short rainfalls that do not penetrate deeply into the soil.

Indicators of wild-collected plants are:

- Broken roots, roughly cut roots, or missing or damaged root systems (attention: big plants from outdoor cultivation may have *cut-back* roots, but the remaining root system has a regular shape)
- Only one or few main roots
- Lateral compression of root systems, mainly visible in taproots and at the base of the main root
- Only horizontally spreading roots
- Traces of clay, laterite soil or gravel
- Taproots with one main secondary root directed towards the soil surface

Indicators of nursery-grown plants are:

- Root systems with a regular shape
- Compact, small but complete root system
- Several main roots of similar size
- Damage only in small roots, main roots intact (but sometimes cut back)
- Traces of peaty/sandy *homogeneous* substrate mixtures



Roots of artificially propagated succulents are frequently cleaned from soil before they are exported.

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STEMS AND LEAVES

The stems and/or the leaves (if they have any) of succulents plant growing in their natural habitat are confronted with many unfavourable habitat conditions, each of which leave its traces. Wounds caused by herbivores, fire, rock slides, frost and diseases leave corky scars or corky spots on stems and leaves. Wax layers are especially sensitive. They get scratched or damaged by natural factors in the habitat and also when plants are taken from their habitat. Especially in Crassulaceae, leaves are very fragile. Wild-collected plants often have dry leaves or show traces of attacks by herbivores. Leaf-rosettes are often of irregular form because they have grown on perpendicular rocks or in shaded places, where they turn towards the sunlight. In rocky habitats, imprints of rock edges can be found on the base of stem succulents, or the plants are compressed laterally because they grow in rock fissures. If plants get burned by the sun or damaged in another manner, the formerly green epidermis of stems and leaves turns into a layer of cork. Many cacti grow with part of the plant body into the soil. Small ones even withdraw almost all of the plant body in the soil in dry periods by contraction of the main root. Consequently the lower stem base is frequently corky and does not bear any spines. In areas with a sandy surface, the wind may blow sand to one side of the plant, partly burying it and thus causing unequal cork formation. If columnar plants fall, their new growth grows upwards at an angle. If the plant apex gets damaged, plants that are normally single-stemmed sprout unnaturally (many shoots of the same size develop on the stem apex or at the edge of a wound or hole). If plants collected in the wild are grown for a while in controlled conditions (i.e. cultivated) before being traded, their new growth looks different from the old growth. In greenhouses, the ultraviolet radiation is much weaker than in the natural habitats of succulent plants. Also, under nursery conditions, there is no shortage of water and nutrients. Consequently the plants may grow faster, and the distance between the spines will be greater. The plant body may be greener or, owing to a thinner cuticle or wax layer, less grey. Contrary to this, old wild-collected specimens suffer from transplantation. They often do not grow well in cultivation. Old cacti most often produce weaker spines and have a smaller stem diameter in their new growth. In spiny plants or in clustering plants, traces of vegetation, e.g. dry grass, often stay on the plant.

Indicators of wild-collected plants are:

- Corky spots and scars, holes
- Damaged/scratched, relatively thick wax layer giving the plants a greyish hue
- Dry leaves
- Irregular, asymmetrical shape of leaf-rosettes (growing to one side)
- Imprints of rocks on stem base, compressed stems
- Unnatural sprouting
- New growth looks different from old growth (not applicable in cacti with a cephalium, e.g. *Melocactus, Discocactus*; see plate 21)
- Traces of vegetation, e.g. dry grass, in plants that grow in clusters

Indicators of nursery grown plants are:

- Uniformly green epidermis
- Undamaged, thin wax layer
- No dry or dead plant parts
- Regular stem or rosette shape
- Uniform growth

THORNS AND SPINES

The thorns or spines on plants growing in natural habitats get withered by sunlight and wind. They can get a fibrous surface and are sometimes strongly bleached. Often they brake because of natural factors or especially when plants are taken out of their habitat and are wrapped in paper. If plants collected in the wild are cultivated before entering trade, the thorns or spines of their new growth tend to be thinner and softer than on the old growth (not applicable in cacti with a cephalium, e.g. *Melocactus, Discocactus*; see plate 21). This is in particular evident for species that, in the natural habitat, are densely covered with spines.

Indicators of wild-collected plants are:

- Bleached, withered (fibrous) thorns/spines
- Broken thorns/spines
- Notably weaker thorns/spines in new growth

Indicators of nursery grown plants are:

- Unwithered, colourful, undamaged thorns/pines
- Spines all of equal size and structure

FRUITS OR FLOWERS

Fruits or remnants of flowers can be found sometimes on plants in shipments. They have some diagnostic value for the identification of wild-collected plants. Generally, nursery grown plants are shipped without flowers. Flowers and fruits, squeezed or damaged during shipping may cause fungal infection and loss of the plant. Also, a nurseryman would harvest the seeds and use them himself rather than shipping them to his clients.

3.4 Checklist for shipment characters

Documents: when possible, and applicable, one should check the consistency between the CITES documents and the delivery note or invoice with the shipment (in particular with regard to the plant names and the number of specimens).

Country of origin: plant shipments from countries where succulent plants are often wild-collected (see list), have to be given special attention. Some senders are collectors of wild plants and plant traders at the same time. In case of doubt, an expert must be consulted. Special attention should be given to shipments from sources (persons, nurseries) from which it is believed or proven that illegally wild-collected plants have originated.

Packaging: normally the packaging does not provide clues about the legality of origin of the specimens. Both highly qualified nurseries, producing only artificially propagated plants, and smugglers wrap plants in newspaper to avoid sharp spines damaging other plants. Normally, artificially propagated specimens are shipped in boxes with the name of the nursery printed on them, and with the plants packed tightly together and frequently with a name label attached. Shipments of illegally collected wild plants normally contain plants of different sizes.

Sometimes the labels attached to wild-collected plants, contain interesting information such as collection numbers, sites and dates, mostly marked by hand on leaflets or card labels. This is rarely found with artificially propagated plants. Wild-collected plants are often not identified to species level but only to genus level. Names on labels consist of the genus name in combination with "spec.", "sp." or "spp.".

Shipment composition: shipments of wild-collected plants usually consist of small samples of many different taxa. Enthusiasts who want to propagate wild-collected specimens in cultivation need at least two individual clones for cross-pollination and seed production. The collected specimens are not necessarily young or small individuals. It is more interesting for a succulent enthusiast to collect specimens of as many different taxa as possible during one field trip than to collect big specimens of a few taxa only. Shipments of wild-collected plants therefore often contain a high number of different taxa. Within one taxon, there are specimens of very different sizes. Some taxa are rare and quite difficult to find in their natural habitat. Therefore, also damaged plants are collected. Wild-collected plants are often sent in small shipments. Frequently several small parcels (less than 1 kilogram) are sent by post. The probability, that all or a great proportion of a series of such small parcels reaches the destination is higher than shipping all plants in one single consignment. Wild-collected succulents are also frequently carried in personal luggage.

Note: The fact that there are small quantities of specimens of several species in a mail parcel does not automatically mean that the specimens are wild-collected. There are a number of highly specialized nurseries that produce cacti of species that are of no or little interest to the wholesale market. Those who

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Artificially propagated versus wild-collected succulents

buy from these nurseries normally purchase small quantities of several species. These are also sent by mail. In most instances these parcels contain all the required CITES and phytosanitary documentation.

Indicators of wild-collected plants are:

- Missing documents, incorrect documents
- Shipment from country where succulent plants are often collected in the wild (see list)
- Sender known to trade or to have traded in wild-collected plants
- Information on sender missing
- Unprofessional package, such as toilet paper, etc.
- Handwritten labels or tags with collection numbers, dates, sites
- Small samples of many different taxa within a shipment
- Plants of very different sizes within the same taxon
- Damaged plants

Indicators of nursery-grown plans are:

- Correct documents
- Nursery name included on all packages
- Professional package
- Potted or grafted plants
- High numbers of plants of one taxon, of uniform size
- Only healthy plants
- Printed labels

1. Wild-collected cactus (*Echinomastus*) with traces of soil and vegetation. Usually, plants are cleaned more cautiously before shipment than is shown in this illustration. (Photo J. Lüthy)

2. A specimen of the same species (Fig. 1) in habitat, with the stem base buried in clayey substrate and grasses growing in the protection of the spines.

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3. Wild-collected cactus (*Echinocereus*) with damaged root system. The main roots are missing, most roots are broken. (Photo J. Lüthy)

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4 Wild-collected cactus (Astrophytum). The roots are almost co

6. Wild-collected cactus (*Echinocereus*).

5. Wild-collected cactus (*Uebelmannia*). Clustering plant with only one single stern. Especially in rare species plants are broken from transport, the stem are collected even if they are badly, base is strongly withered and corky, damaged. (Photo J. Lüthy) only the stump of the main root remains (Photo AID; Netherlands)

Spines in the upper part of the stem

7. Wild-collected cactus (*Echinocereus*) with corky epidermis on old growth. Such a plant would not be in trade but thrown away if it were an artificially propagated specimen. (Photo J. Lüthy)

8. Wild-collected cacti (*Turbinicarpus*) with collection number on label. Taproots with irregular shape, one big secondary root typically directed upwards (toward the soil surface). (Photo AID, Netherlands)

9. Wild-collected cactus (*Pilosocereus*) cutting. Artificially propagated specimens of this taxon are normally traded as rooted seedlings. (Photo BLW)

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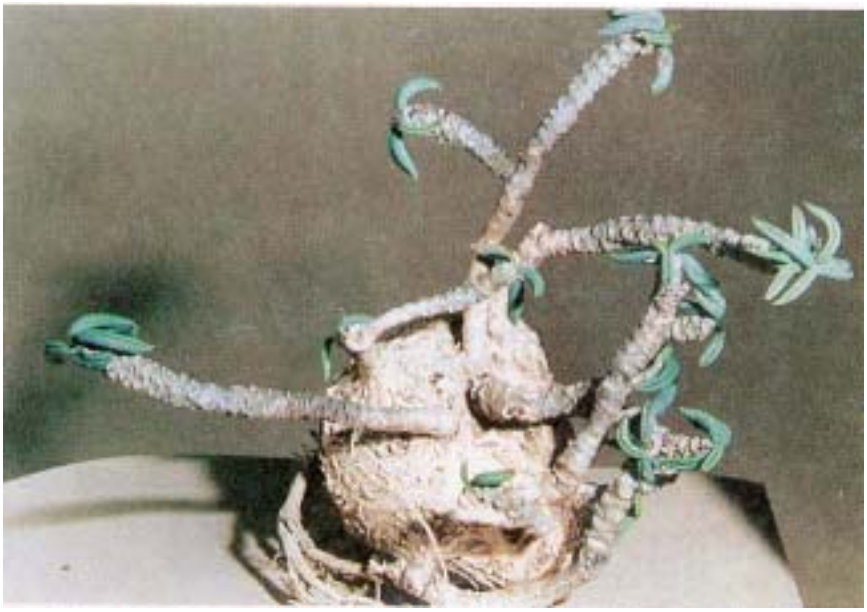
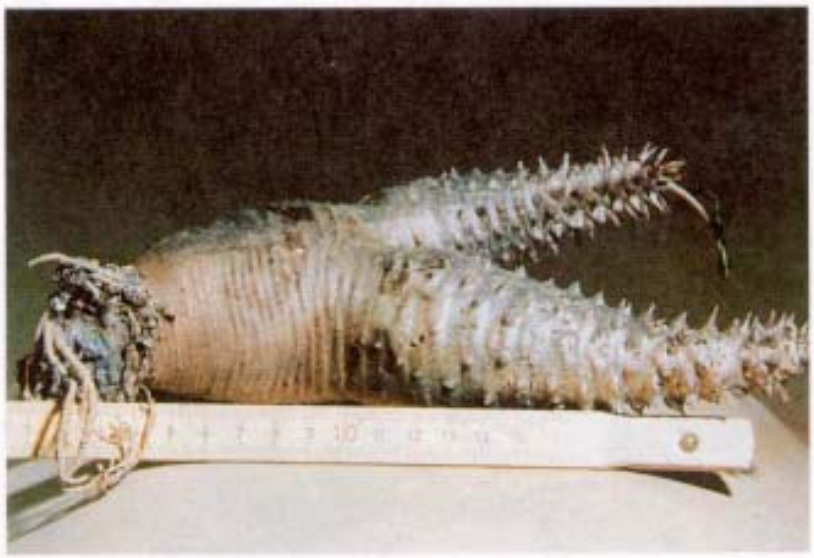
10. Wild-collected cactus (*Astrophytum*) with new growth from cultivation. Weaker spines and smaller stem diameter in new growth. (Photo J. Lüthy)

11. Wild-collected cactus (*Thelocactus*), showing the difference between the withered spines on the old growth on the stem base and unwithered spines on the new growth (produced after the plant has been collected from the wild and cultivated) on the same plant. (Photo J. Lüthy)



12. Wild-collected caudiciform (*Euphorbia*) v



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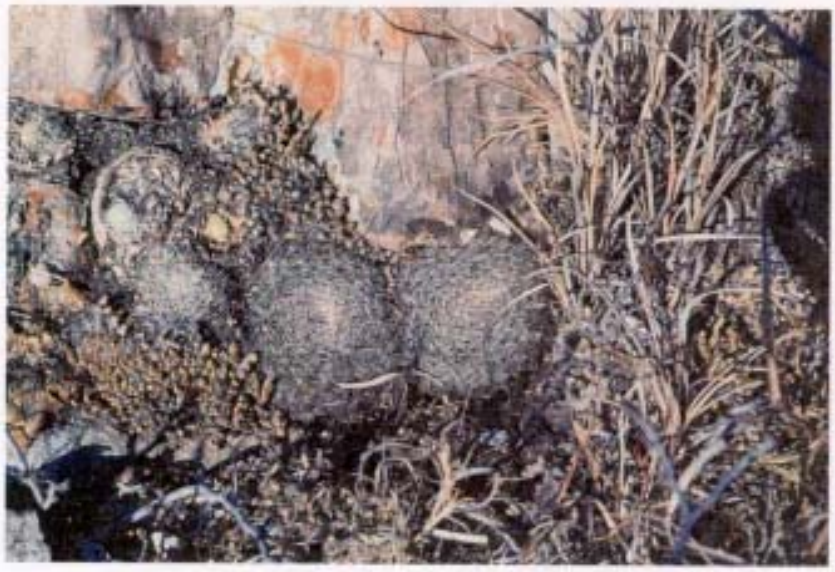
13. Wild-collected stem-succulent (*Pachypodium*). Leaves dried off, most roots missing, remaining roots bent by wrapping for shipment. (Photo BLW)

14. Wild-collected rosette of leaf-succulent (*Echeveria*; not in the CITES appendices) with damaged leaves and irregular, asymmetrical growth. (Photo J. Lüthy)

15. Wild-collected rosette of leaf-succulent (*Agave*) with many dry leaves and traces of moss at the base. (Photo J. Lüthy)

16. Confiscated shipment of wild-collected



17. Cacti (*Mammillaria*) in habitat. Squeezed into a small space between rocks, retreated deeply into the soil and hidden in surround vegetation. (Photo J. Lüthy)

18. Cactus (*Encephalocarpus*) in habitat. Plant

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Artificially propagated versus wild-collected succulents

19. Artificially propagated cactus (*Pachypodium*) three years old, from outdoor cultivation. Healthy plant without corky scars, no broken spines, root system regularly shaped, small and compact, undamaged. (Photo CITES Secretariat)

20. Artificially propagated stem-succulent (*Ferocactus*) from outdoor cultivation in Madagascar. Undamaged, regularly shaped root system. (Photo D. Supthut)

21. Cacti (*Melocactus*) growing in outdoor cultivation under controlled conditions on the Canary Islands. Healthy plants of uniform size and appearance. The reddish hairy 'crown' on top of the plant body is called 'cephalium' and carries the flowers. Once the cephalium is formed, the green plant body will no longer increase in size. (Photo D. Supthut)

22. Two-year old cactus seedlings (*Echinocactus*) growing in outdoor cultivation under controlled conditions on the Canary Islands. Plants of uniform size and appearance. (Photo D. Supthut)

23. Cactus seedlings (*Notocactus*) growing in outdoor cultivation under controlled conditions in California. Plants of uniform size and appearance. (Photo D. Supthut)

24. Artificially propagated cacti (grafted "strawberry cactus" and others) from mass production in greenhouses, for sale in a supermarket (Switzerland). (Photo J. Lüthy)

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