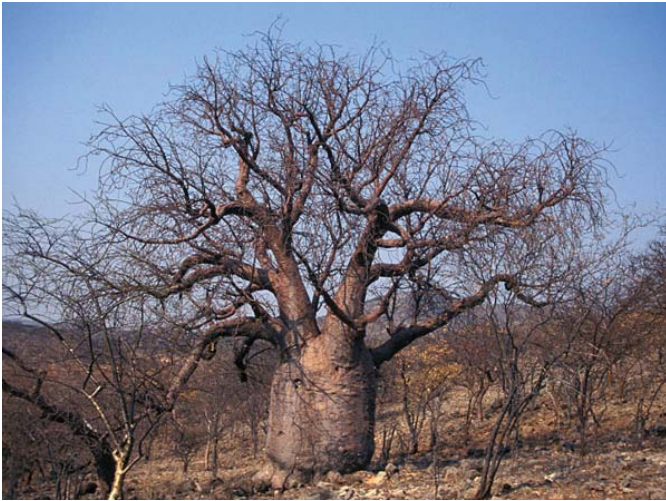


Fat Plants: Living Sculptures from the World's Deserts



The African baobab is one of many “fat plants”.

“Fat plants” is a term coined for an eclectic assemblage of plants, often with weird shapes, that live mostly in the world’s dry places, where it is advantageous to be able to store water. When people think about desert plants, cacti often come to mind. True cacti are native to the United States and much of the rest of the New World. During the infrequent rains in the desert, cacti store water in their stems to help them survive the prolonged dry periods that are frequently encountered. But the Cactaceae is only one of about 60 plant families that have evolved the ability to store water in enlarged leaves, stems, or roots. All such plants, cacti included, are best referred to as “succulents.”

Whereas most cacti do not have true leaves, many succulents do. Many such leafy plants store water in grossly inflated stems or roots. The giant baobab trees of Africa, Madagascar, and Australia (9 species in the genus *Adansonia*) are examples that are commonly recognized. With their enlarged water-storing trunks and branches, baobab trees are good examples of “stem succulents.” Leafy stem succulents with a markedly fattened, generally tapering main trunk are termed “pachycaul succulents” (“pachy” = thick; “caul” referring to the trunk or main stem). On the other hand, if the base of the plant (either the root or the base of the trunk) is more spherically shaped, the plant is referred to as a “caudiciform succulent,” and the round base of the plant is called the caudex.



Madagascar baobabs *Adansonia rubrostipa* (L) and *A. za* (R).

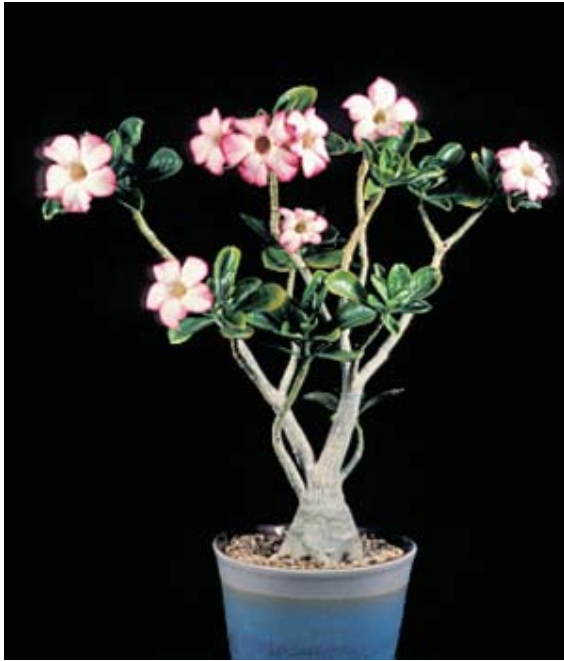


Adenium crispum as a container plant (the round caudex, part of the root, would be under ground in nature).

What a mess of technical terms! People who grow these decidedly plump plants call them, simply, “fat plants.” Because of their grossly fattened bodies and often very weird shapes, they are very popular horticultural subjects with those who grow cacti and other succulents. There are many hundreds (some estimate over a thousand) species of fat plants, and hundreds of types are readily available from specialist nurseries that sell succulent plants. A few of them, such as ponytail palms and desert roses, even show up in the succulent plant section of the big box stores. Generally they have the same cultural requirements as other types of succulents, and, with a sunny room or windowsill, or with artificial lights, they are easily grown here in Wisconsin.

Not all succulents are “fat plants”, and very few cacti are. Fat plants are generally characterized by a noticeably thickened base or trunk, and most types have leaves or even vines during the growing season. There is a great diversity of fat plants and they occur in many plant families. Here are a few examples.

Popular Groups of Fat Plants



Adenium obesum, 30 years old and 20 inches tall. The photo was taken as the plant was beginning new growth and flowering in the spring (mid March).

Although still not widely grown, the desert rose, *Adenium obesum*, from southern Africa is one of the more popular fat plants. There are several different varieties and subspecies; these are often considered as separate species. Some have a subterranean caudex, others an above-ground caudex, and still others grow to be small pachycaul trees. They have beautiful pink-to-red and white flowers, and some cultivars are pure white. New hybrids out of Thailand and Taiwan have a great diversity of colors from nearly black to predominately yellow; some types have double or triple the normal number of petals; others bloom in great profusion nearly year round. One of the large Florida wholesale growers produces these by the hundreds of thousands so more and more commonly the desert rose can be found sold at large chain stores such as Wal-Mart,



Adenium plants for sale at a local retailer.

Lowe's, and Home Depot.

Related to the desert rose are the pachypodiums (= “thick foot”). This small genus occurs in southern Africa and Madagascar. Depending on species, they can be either caudiciform or pachycaul succulents, and they have attractive flowers that are either bright red, yellow, or white. Given sufficient light, they readily bloom here in Wisconsin. Unlike the desert rose, almost all pachypodiums have spiny stems. Adeniums and pachypodiums are in the periwinkle and oleander family.



Pachypodium lealii (L) in Namibia, and *P. namaquanum* in habitat (C) and grown in a bonsai pot (R).

Also in the periwinkle family are the milkweeds (including our native milkweeds such as butterfly weed, *Asclepias tuberosa*). In Africa, many members of this group have become caudiciform succulents, with enlarged water-storing roots, and vining, often deciduous stems. *Fockea* is a small genus, and some species have massive, silvery, warty roots; *F. edulis* and *F. crispa* are two popular species. The long time popular houseplant known as string-of-hearts is *Ceropegia woodii*, which grows a small underground caudex, as do certain other members of this genus. Related to *Ceropegia* is the genus *Brachystelma*, most species of which form small (1-5") round caudexes. *Brachystelmas* willingly produce fascinating star-shaped flowers in various colors, but members of this genus are considered a bit difficult to keep alive in cultivation.

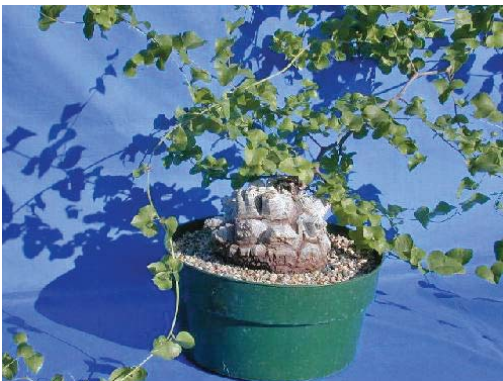


Fockea multiflora (white blob in foreground) in habitat in Namibia (L), *F. edulis* (C) and *Brachystelma pachypodium* (R) in cultivation.

The genus *Cyphostemma* is in the grape family. Again from Africa, these are also either caudiciform or pachycaul plants; some are viners while others have very large succulent, deciduous leaves. *C. juttae* is the most common in cultivation and is easy to grow.



Cyphostemma currori (L), *C. uter* (LC), and *C. juttae* (RC) in habitat in southern Africa and *C. juttae* in a pot (R).



Dioscorea in cultivation.

So-called turtleback plants are in the genus *Dioscorea*, in the yam family. Two very popular species have a large above-ground caudex that is reticulated like the shell of a tortoise, from which arises an amazingly vigorous annual vine. *Dioscorea elephantipes* is from Africa and the very similar *Dioscorea mexicana* (sometimes called *D. macrostachya*) from Mexico. In other species, the vine arises from an underground caudex.

Another group that is relatively commonly found in large chain stores and well-stocked garden centers are the ponytail palms, *Beaucarnea*. These have an enlarged caudiciform base from

which one or more stems arise, each stem being topped with an abundant crop of long, hanging, grass-like leaves. Unlike most fat plants that require bright light throughout the year, ponytail palms do fairly well as houseplants as long as they get a few months of bright sun during their summer growth period.



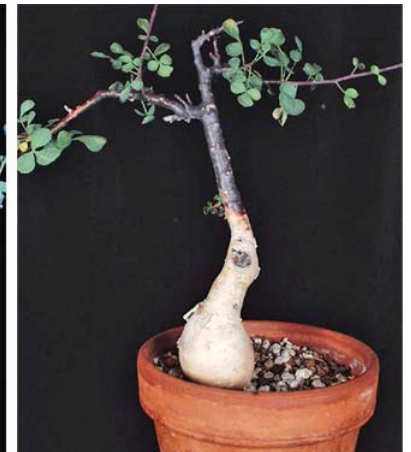
Cephelopentandra ecirrhosa during the dormant season.

One of the largest groups of fat plants is the cucumber (cucurbit) family. There are dozens of types that have enlarged, rounded, subterranean caudexes from which arise rampant, annual vine growth. One unusual species that grows only on the island of Soqotra off the horn of Africa is a pachycaul tree, the only arborescent cucurbit in the world. Two vining species that are easy to grow and have quite interesting above-ground caudexes are *Momordica rostrata* and *Cephelopentandra ecirrhosa*.



Beaucarnea recurvata

There are several groups of otherwise rather typical trees that have developed noticeably thickened trunks for water storage; the above-mentioned baobabs are an example. Another commonly grown group includes three genera of highly aromatic plants in the family Burseraceae. *Boswellia* produces sap that is the frankincense of the bible. *Commiphora* is also an Old World genus with aromatic sap; several species are the source of myrrh.



Commiphora wildii in habitat in Namibia (L), and *C. campestris* (C) and *C. katar* (R) in cultivation.

The New World counterpart of *Commiphora* is the genus *Bursera*, which extends from the southwestern United States through Mexico and the Caribbean to South America. Of all of these, one of the easiest to grow is *Bursera fagaroides*, one of the so-called elephant trees of Mexico. Young seedlings develop a noticeably-thickened trunk in their first year, and just keep getting fatter. *Burseras* are also aromatic and produce the fragrant sap known as copal.



Wind-stunted *Bursera hindsiana* (L) and upright specimen with smooth grey bark (LC), *B. odorata* with peeling green bark (RC) in habitat in Mexico, and *B. fagaroides* in cultivation (R).

There are many other groups of pachycaul trees that make interesting horticultural subjects. Often, such succulent trees (and other fat plants as well) are grown as “succulent bonsai” specimens. Grown in this way, they can be kept as relatively small potted plants for many years.

The genus *Adenia* (not to be confused with *Adenium!*) is in the passionflower family. Several African species are caudiciform plants, some with an underground caudex, others with the caudex aboveground. *Adenia spinosa* and *A. glauca* are two common and attractive species.



The author with *Adenia pechuelii* in habitat in Namibia (L), and *A. glauca* (C) and *A. spinosa* (R) in cultivation.

The genus *Euphorbia* is in the spurge and poinsettia family. In Africa, there are hundreds of succulent species, some of which can be regarded as fat plants; most have below-ground tuberous roots and with succulent stems and/or leaves. There are some choice miniature species in Madagascar, that can stay happily in small pots for years, such as *E. francoisii*, *E. cylindrifolia* var. *tuberifera*, and *E. tulearensis*. There are two other genera in the Euphorbia family that have fat plant representatives.



Container-grown *Euphorbia primulifolia* (L), *E. persistens* (C) and *E. ambovombensis* (R).

Jatropha podagrica is from tropical Central America. It has large, lobed leaves and clusters of small brilliant orangish-red flowers that it produces almost continuously. It is self-fertile and easily grown from seeds. The genus *Monadenium* is mostly from tropical east Africa. Many species have tuberous roots that are showy when raised above the soil level, and they have most unusual flowers.



Jatropha podagrica plant (L) and flowers and fruit (LC) and *Monadenium* plant in cultivation (RC) and flowers (R).

Ficus is the genus that contains the figs, both the edible kind as well as several species of house plants. In arid parts of the world there are several species that have caudiciform tendencies, especially as young or bonsaied plants. The Mexican rock figs, *Ficus petiolaris* and its variety *palmeri* are two types commonly in cultivation. *F. petiolaris* is particularly handsome, with leaves of complex bronze coloration and reddish veins. A few species of African rock figs are also in cultivation.



Mexican rock fig, *Ficus petiolaris*, in habitat (L) and in cultivation (LC); *F. petiolaris palmeri* (RC) in cultivation; African species *Ficus abutilifolia* in cultivation (R).

Very closely related to *Ficus* is the genus *Dorstenia*, which has no arborescent species. Most of these are small and will live in 3-4" pots for years. Some have underground tubers whereas others have pachycaul tendencies. *Dorstenia gigas* from Soqotra is the giant of the group and will eventually reach a height of 4-5 ft in great age. All dorstenias have very interesting complex inflorescences that are called hypanthodia (sing. hypanthodium). There is an inner disc of nearly microscopic flowers surrounded by fleshy or elongate rays, making these plants look somewhat alien.



A *Dorstenia* in cultivation (L) and its flower (LC); *D. gigas* in flower (RC) and close-up of hypanthodium (R).

Most fat plants are native to areas with summer rainfall and, therefore, are summer growers. A few desert areas, however, receive primarily winter rainfall and the plants native to those areas are winter growers. These can be a bit of a challenge to grow here in Wisconsin. They need a very bright location which is warm (but not excessively hot) during the daytime, and cool (40-50° F) at night. One area of the world where winter-growing succulents are plentiful is the northwestern corner of South Africa, especially the area known as the Richtersveld. Fat plants from here include the genera *Othonna* (from the composite, or daisy family), *Tylecodon* (from the stonecrop, crassula, or jade plant family), and *Pelargonium* (related to our garden geraniums).



Othonna cacalioides in cultivation (L); *Tylecodon paniculata* in habitat in the Richtersveld, South Africa (LC) and *T. pearsonii* in cultivation (C); *Pelargonium crithmifolium* in habitat in South Africa and *P. incrassatum* in pot (R).

The above is just a sampling of the groups of fat plants that are available from succulent plant nurseries; there are many other weird and wonderful types.

Growing Fat Plants

In general, fat plants are grown as any other type of succulent plant. They need warmth during the growing season, they need bright light, they do not like to be over-watered, and they need a fast-draining soil mix.

Temperature. Fat plants generally grow best at temperatures in the range of 75-90°F. They do better when night temperatures are at about 70°. They get very unhappy when they have prolonged periods when temperatures are below 60°; during such periods they should be kept dry to keep the roots from rotting. When temperatures exceed 90° they tend to stop growing to conserve water.

Light. Most fat plants grow in deserts and other arid environments and are exposed to rather intense sunlight. Their growth is more compact (fatter) under such conditions. However, many of the smaller species (such as ceropegias, brachystelmas, and some euphorbias) grow under bushes or in tall grass and therefore receive substantial shading. These plants are best grown in a very bright location, but not necessarily full sun. (Also, remember that “full sun” in the desert tropics is much more intense than full sun in Wisconsin. Plants that thrive in full sun here may rapidly get scorched in Arizona.) Fat plants can be grown very well under artificial lights. Generally, fluorescent “grow lights” do not provide adequate intensity for succulents, but a combination of standard cool white and warm white fluorescent tubes are adequate, providing there are several lights close together. Even better are the high intensity plant lights such as metal halide or the newer LED plant lights. There is substantial information on growing succulents under lights in various books and on the internet.

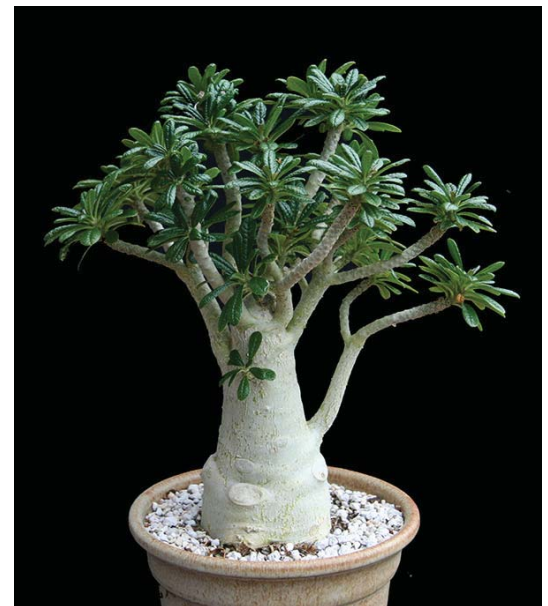


Pachypodium saundersii

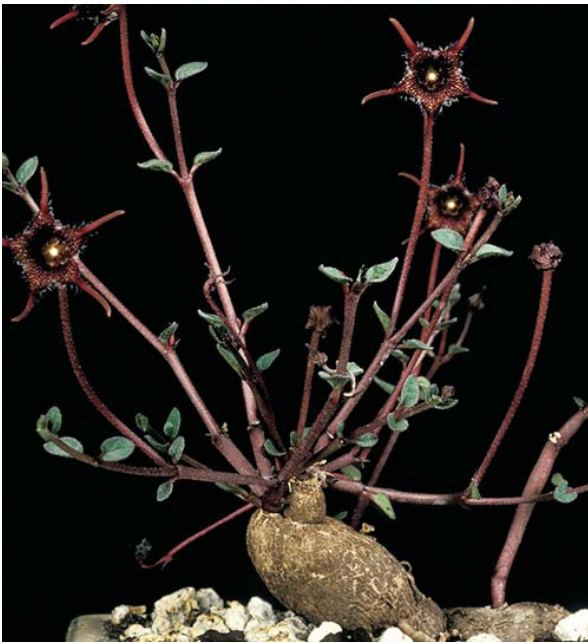


Ceropegia rendallii

Water and soil. Fat plants, like most other succulents, tend to dislike being over-watered, especially when they are not in active growth. In particular, they don't do well if the soil around their roots is continuously wet. On the other hand, many fat plants come from areas that get torrential rains for a month or two during the growing season (but are dry the rest of the year). In cultivation, some types can be watered almost daily during the warm growing period. So, how do we best address these seemingly conflicting needs? Foremost is to use a fast-draining soil. Several horticultural products are on the market which are used by succulent growers in their soil mixes to improve drainage. Perlite is one such product that is readily available, though somewhat less than satisfactory because it floats to the surface during watering. Horticultural pumice is a better choice, but not easily available here in the upper Midwest (though check the local farm supply store for “Dry Stall” used in horse barns; this is pumice). Other alternatives include crushed granite with the fines removed, and poultry grit, available in various sizes at farm supply stores. High-fired clay particles



Dorstenia gigas



Brachystelma pygmaeum

used in hydroponics and for other purposes are also ideal. The percent of organic matter in soil mixes should be very low, usually in the range of 10-30%; some growers use no organic matter. Do not use sand in your mix as it has a small particle size, resulting in a non-porous soil mix that dries very slowly under our conditions.

Commercially-available cactus soil mixes work reasonably well in the desert southwest, but contain too much organic matter and not enough drainage material for conditions here. They can be used in a soil mix, but additional drainage material should be added.

During the growing season, when temperatures are warm, leafy fat plants can cycle water very quickly, removing it from the soil by rapid evapotranspiration. In such cases, plants can be watered once or twice weekly. However, when there is a prolonged period of cool, cloudy weather, water plants only after the soil has dried. When the plants

are leafless and dormant water very infrequently, only monthly, and then on bright sunny days.

The underground caudex. Generally when growing a species that has a large underground caudex, in cultivation we set the caudex on the soil surface, with the fibrous roots down in the soil. This is done for two reasons. First, the caudex is the focal point of the plant, the area of sculptural interest, so we want to display it. Second, if overly watered, such caudexes are prone to rotting, resulting in death of the plant; this is avoided when the caudex is raised to the soil surface.

Fertilizer. Fat plants respond well to fertilizer; often too well! They are adapted to low-nitrogen conditions and the most compact growth occurs when they are not over-fertilized, especially under low light conditions. Use a standard liquid or soluble houseplant fertilizer, but at half strength, about twice monthly during the growing period.

Pots. Fat plants can be grown in any type of pot, either plastic or ceramic. Essential is that they have a drain hole, and that they do not sit in a saucer full of water. Because of their random shapes and growth forms, many appear to be natural bonsai specimens and many growers use bonsai pots for some of their fat plants.



Trichodiadema densum

Growing outdoors. No fat plants are winter hardy in Wisconsin and they should not be grown outdoors if temperatures are expected to be below 40°. However, the summer growers love our summer warmth and thunderstorms; they can do very well grown outdoors, usually from early June to the middle or end of September. However, during this period, they should not be subjected to prolonged periods of cool wet weather. If you summer your plants outdoors, remember to check for bugs before you bring them indoors at the end of summer.

Sources of Plants

Fat plants are available by mail-order from most cactus and succulent nurseries. A listing of such nurseries, with links to many websites, can be found on the cactus-mall (<http://www.cactus-mall.com/nurseryusa.html>). Some of my favorite nurseries include Out of Africa, Arid Lands, Grigsby, Miles to Go, Plants for the Southwest (Living Stones), and Highland Succulents (this nursery has been closed for an extended period because of storm damage – check their website).

A Cautionary Note

In nature, fat plants are juicy morsels for hungry and thirsty animals. Therefore, many have evolved defense mechanisms to reduce the possibility of being eaten. The obvious defenses are the fierce spines, such as seen on pachypodiums. Less obvious are the nasty caustic and toxic chemicals inside the plants. The saps of some plants are so toxic that they have been used as arrow poisons. The milky sap of euphorbias is both toxic and caustic, and contact with skin and eyes must be avoided. Other plants known to be toxic include adeniums, adenias, and tylecodons. Always use caution when pruning and handling plants, and keep them out of the reach of curious pets and small children.

– Dan Mahr, Emeritis University of Wisconsin – Madison

Additional Information:

- There are a few good books on fat plants. One is by Gordon Rowley, entitled *Caudiciform and Pachycaul Succulents*. It is out of print but often available from dealers of used horticultural books. Two more recent books by Philippe de Vesjoli are *Pachyforms: A Guide to Growing Pachycaul and Caudiciform Plants*, and *Pachyforms II: Bonsai Succulents*. All three are beautifully illustrated and contain good cultural information, but the latter two tend to be a bit slanted toward Southern California growing conditions. There are also specialized books on specific groups, such as euphorbias, burseras, tylecodons and many others.
- The Cactus and Succulent Society of America (<http://cssainc.org/index.html>) produces a beautiful Journal 6 times yearly, often with articles about fat plants.
- There is much information about fat plants on the internet, even including chat groups. One site that is nicely illustrated is Bihrmann's Caudiciforms that has 1300 types of plants illustrated and briefly described at <http://www.bihrmann.com/caudiciforms/>.