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Succulents for Edible and Medicinal Gardens

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Abstract

Plants with thick fleshy tissues adopted to water storage are termed as succulents. Several species are growing as ornamentals for their attractive structure like leaves and colourful flowers. There are many species of succulent which are edible as well as have medicinal value. As succulent are drought tolerant or hardy, these medicinal succulents can be grown successfully in their native habitat as well as in xeriscape landscape and water efficient gardening for increasing the beauty of landscape, increasing the biodiversity, making water efficient garden as well as using their harvest for edible, nutraceutical and pharmaceutical use. These plants therefore can be used for improving desert or xeriscape landscaping as well as giving economic benefit to the society. In this review paper, literature related to ornamental use, planting and medicinal use of few succulents like yucca, aloe, opuntia, baobab, dragon fruit purslane, euphorbia and *Rhodiolarosea* has been discussed.

Key words : Edible use, medicinal use, ornamental use, succulents.

Introduction

Succulent, any plants with thick fleshy tissues and drought resistant plants (Rowley 1980). Some succulents stored the water in the leaves and other in the stem or roots. The specular characteristics of most of the succulents are having deep or broad root system. This succulent word has been derived from Latin word '*sucus*', its meaning 'juice', or 'sap'. These are called as xerophytic plants and are suitable for xeriscaping or rock gardening. There were more than 60 plant families found in succulent plants and which are the members of *Aizoaceae*, *Cactaceae*, and *Crassulaceae* being dominantly succulent. Worldwide the succulents were grown in indoor as well as outdoor gardening. In indoor gardening these plants are planted either as pot plant or in vertical wall for their indoor air purification value, aesthetic look, evergreen nature and less maintenance requirement etc. In outdoor landscaping these are planted as foundation plants, pot plants, green wall, for xeriscaping, in edible landscape, in rock garden, as bonsai (jade plant). In addition to landscaping importance, many succulents are edible and also have medicinal properties. Therefore, these edible and medicinal succulent plants can be grown commercially in xeriscape landscape for its commercial and industrial benefit. In addition to the bio aesthetic planning of these area with succulent plants, these plants can be harvested for their edible and medicinal use.

In this review paper, some succulent having medicinal properties has been discussed in details. These succulents have been researched for their antibacterial, antioxidants, anti-inflammatory, antidiabetic, wound

healing properties etc. and used for curing diseases like cancer, skin diseases and cardiovascular.

1. Yucca

Yucca (*Yucca filamentosa*) is commonly called Adam's needle, Spanish bayonet and needle palm. It is perennial shrub and because of its hardy nature it is used in xeriscaping landscape. *Yucca* belongs to *Asparagaceae* family. There are almost 40 and 50 different kinds of *Yucca*. It's native from North and Central America, as well as the Caribbean (Fowler 1991). *Yuccas* used in desert landscapes of North and South America. It is propagated by division, root cuttings, stem cuttings and seeds. Some species of *Yucca*, bear edible parts. It also includes fruits, seeds, flowers, flowering stems and more rarely roots and can also be used to make soft drinks and beverages (Piacente *et al.*, 2005).

Olas *et al.*, (2003) studied the medicinal properties of bark of *Y. schidigera*. Many researcher has found the medicinal use of these species and reported that it inhibits free radical generation in blood platelets and protect against cardiovascular diseases. Torres *et al.*, (2003) reported the bark of *Y. periculosa* have antioxidants properties, however Bassarello *et al.*, (2007) depicted the bark. *Y. gloriosahas* antioxidant activity. Fidan & Dündar (2008) examined that *Y. schidigera* has antidiabetic effects. Patel (2012) studied that yucca plant extracts can be used to allay joint pain, Skin emollient, soporific agents and antidiabetic urethral and prostate inflammations. The leaves of yucca also useful for common dandruff, hair loss and skin sores. In India, these yucca take care from sunburns and scratches. In Northern New Mexico yucca leaves used for tea and their roots to treat asthma and

headache. In America, the species, *Yucca filamentosa* used as medicines and soap (Lim 2014). The yucca plant parts used to regulate blood clots, wound healing, reduce thrombosis and eliminate heart attack risks. In Western New Mexico region the species *Yucca elatasap* used as hair growth stimulant. The extract of the crushed leaves of *Y. baccata* has been used as an antiemetic.

2. Opuntia

Opuntia (Opuntia ficus-indica) commonly called prickly pear or pear cactus, is a genus of flowering plants in the cactus belongs to family cactaceae. It is propagated through rooting its leaves. *Opuntia* has large genus of 150–180 species. It's native of America (Reyes-Agüero and Rivera 2011). *Opuntia* plants produce edible stems also known as pads, vegetable, cladodes, orpencas. The tender young part of the cactus stem consumed as vegetable in salads, while the cactus pear fruit is consumed as a fresh fruit. It is used in landscaping especially in cactus and succulent garden, rock garden, as a barrier or protective hedge, screen and textural accent. It is suitable for large desert landscape spaces and planted in higher traffic areas because of its spines and prominent glochids. Along with its ornamental and edible values, *Opuntia* is also a useful medicinal plant. Wolfram *et al.*, (2002) noted that the *Opuntia* prickly pears improves the platelet function and balance flow of blood and thus contributing to prevent the atherosclerotic risk. Tesoriere *et al.*, (2004) reported that *Opuntia* juice and fruits naturally prevents oxidative stress and improves the redox status human being. Mendis *et al.*, (2011) analyzed that *Opuntia* is very effective in controlling cardiovascular diseases. *Opuntia* fruit juice, stems, seed and roots, could stipulate an interesting anticancer strategy (Chavez- Santoscoy *et al.*, 2009). *Opuntia* help in reducing body weight by reducing fat (Uebelhack *et al.*, 2014). Osuna-Martínez *et al.*, (2014). Reported that *Opuntia* have Cholesterol-lowering properties and also antioxidant and antiatherogenic properties which is useful for human. Ribeiro *et al.*, (2015) researched that extract of *Opuntia* spp. used in curing for treatment of wound healing, skin disorders and burning.

3. Aloe

Aloe (Aloe vera L.) is a succulent plant species and commonly known as Barbados Aloe, Chinese Aloe, Indian Aloe and First Aid Plant. It is native to tropical southern Africa, Madagascar, Jordan, and island in the Indian Ocean. It belongs to as phodelaceae (Lillaceae) family containing 550 species of flowering succulent plants. It is propagated by offsets or pups. *Aloe* can be planted as pot plant or garden plant in indoor as well as outdoor setting for its ornamental and medicinal properties. Because of its

drought hardy nature, it can be successfully planted in xeriscape landscape and rock garden.

Aloe having various kinds of uses but mainly used as a food preservative and medicine. Bahrami *et al.*, (2019) investigated that *aloe* can be used in pills, jellies, sprays, ointments, liquids, drinks, lotions and creams. According to Jones (2007) and Miladi and Damak (2008) *aloe* has antioxidant properties and it fight against diabetic. *Aloe* has Anti-inflammatory and they protect against solar radiation. Kathi and Victoria (1999) reported that there were numerous *aloe* species around the world and used for dermatitis to cancer. However, *Aloe* leaf having many pharmaceutical activities, including antimicrobial (Bashir *et al.*, 2011). According to Kambizet *et al.*, (2005) *aloe* is used in cosmetic industries. Naveena (2011) reported that the *aloe* has anticancer properties. Soeda (1966) investigated anti-fungal properties of *Aloe ferox*. However, Shin *et al.*, (2005) and Kambizi *et al.*, (2005) examined sexually transmitted infections treatment through *Aloe ferox*.

4. Baobab

Baobab is deciduous trees which is medium to large type of species which belongs to *Adansonia* genus. World's largest succulent plants is Baobab (*Adansonia digitata*). It belongs to family malvaceae and propagated through seed. It has nine species, out of nine species six species natively from Madagascar, two are native to Mamland Africa and one is native to northwestern Australia (Pettigrew *et al.*, 2012). Venter and Witkowski (2010) researched that the baobab tree provides food, shelter, clothing and medicine as well as material for hunting and fishing.

Nordeide *et al.*, (1996) reported that leaves, tubers, fruits, twigs, flowers, and seeds of *adansonia* plant are identified as common ingredients in traditional dishes in rural and urban areas. Baobab bark, leaf, fruit pulp are the important plant parts of this tree and are useful for human begin health. Strong fibre of baobab bark is used in making ropes, mats, bags, and hats. Baobab bark also used to treat sores. However, In Nigeria stem bark of baobab beneficial to heart tonic with diuretic properties (Nnam and Obiakor 2003).

Baobab leaves are used for external bleeding, anaemia and also proved to lower blood pressure. It also cure iron and calcium deficiency, in the treatment of haemorrhoids (Codjia *et al.*, 2001).

The ingredients from baobab leaves useful against many herbal remedies and a mash prepared from the dried powdered roots is given to malarial patients as a tonic (Yusha'u, *et al.*, 2021).

(Sidibé *et al.*, 1998) researched that the fruit pulp of baobab is used to make cool and hot drinks in rural areas and has recently become a popular ingredient in ice products in urban areas. It is also used in the treatment of fevers and dysentery. Ghani and Agbejule (1986) studied that Nigerian people used the baobab leaves used for healing circumcision wounds. Pulp extract of baobab is used as eye-drops in cases of measles. Baobab fruit pulp improves the iron status in children with low iron levels in their blood. Baobab seed is used for curing of stomach ache in adults and also used to heal high blood pressure. Wickens (2008) reported that liquid obtained by boiling baobab roots, bark and fruit pulp is effective against HIV in Tanzania.

5. Purslane

Purslane (*Portulacaoleracea* L.) is also known as duckweed, little hogweed or parsley. It belongs to the Portulacaceae family. (Elkhatay *et al.*, 2008) concluded different names for the purslane plant in different countries viz; Rigla (Egypt), pigweed (England), pourpier (France), and Ma-Chi-Xian (China) and purslane (USA and Australia). It is an herbaceous succulent annual plant which grow in warm climate. It is native from some areas tropical and subtropical and also many parts of the United States (Palaniswamy *et al.*, 2002). Purslane is eaten extensively as a pot herb and is added to soups and salads around the Mediterranean and tropical Asian countries. In North America it has been considered as cooling diuretic. In Indo China the juice of the fresh leaves is applied to abscesses, and used as a collyrium, a decoction is given in dysentery and liver diseases (Nadkarni, 1976). Simopoulos *et al.*, (2005) reported that *P. oleracea* has properties to prevention and treatment of hypertension, coronary artery disease, cancer, and other inflammatory and autoimmune disorders.

P. oleracea has been used in salads and as a medicinal plant for hundreds of years. It is used for treatment of a blood-cleanser, and to refresh the digestive system. Many researcher have studied *P. oleracea* use for medical treatment such as Anti-inflammatory properties, problem related to urinary, acting as a febrifuge, antiseptic, vermifuge, antibacterial properties, antioxidant properties, wound-healing properties and also have properties against human cancer cells. The leaves of purslane have anti-hemorrhagic properties. The roasted seeds of *P. oleracea* considered diuretic and antidysenteric properties. The seeds are also used in applications for burns and scalds. (Maheshwari and Singh 1984).

6. Carpobrotus

Carpobrotus edulis is a ground-creeping plant commonly

known as pigface, ice plant, sour fig, hottentot fig, and clawberry. It belongs to family Aizoaceae and originated from South Africa. *Carpobrotus edulis* is a low-growing, evergreen, succulent perennial plant which propagated through leaves, cutting, offsets and seed. Its fruit used as preparation of chutney and pickles and used in salad, leaf juice, preparation of fruit syrup. It is used as ground cover in landscape.

The plant's leaves, fruits or flowers of *Carpobrotus edulis* are chewed raw or boiled in water use for various bacterial and fungal infections (Steenkamp *et al.*, 2007). The leaf juice of *Carpobrotus edulis* is very effective against soothing pain caused by spider and tick bites. By drinking boiled leaves treated the skin condition like wound, burns and also diseases like worms, dysentery, diarrhea and different stomach aches. (Ibtissem *et al.*, 2012). Buwa and Afolayan (2009) reported that the boiled leaves of *Carpobrotus edulis* are used in treatment of tuberculosis and other respiratory infections in Sub Saharan Africa. The treatment of chronic non communicable diseases like hypertension and diabetes is possible by *carpobrotus edulis* (Rocha *et al.*, 2017); Davids *et al.*, (2016); Al-Faris *et al.*, (2010). *Carpobrotus edulis* extracts used as antiproliferative activity, Antifungal activity, antioxidant activity and antibacterial activity against multidrug-resistant (MDR) bacteria (Martins *et al.*, 2010); (Ordway *et al.*, 2003); (Hafsa *et al.*, 2016).

7. Pig's ear

Cotyledon orbiculata commonly knowns as pig's ear or round leaf naval-wort, is a South African succulent plant belonging to genus *Cotyledon*. It belongs to the family Crassulaceae. Pig's ear is small shrub with fleshy leaves and its native from Southern Africa.

Aremu *et al.*, (2010) evaluated that the extraction of stem and leaf of *c. orbiculata* have antifungal activities against *Candida albicans*. Fouche *et al.*, (2006) studied that the root extraction of *C. orbiculata* have anticancer properties. Amabeoku *et al.*, (2007) reported that *C. orbiculata* have anticonvulsant activities by extraction of methanol leaf. *C. orbiculata* have anthelmintic properties (Molefe *et al.*, 2013). Akhalwaya *et al.*, (2018); Akhalwaya (2017) suggested that *C. orbiculata* have antibacterial properties. Amabeoku and Kabatende (2011) reported that the *C. orbiculata* have Antinociceptive properties. Ondua *et al.*, (2019) reported that the antioxidant properties and anti-inflammatory properties present in *C. orbiculata*.

8. Dragon fruit

Selenicereus undatus is botanical name of dragon fruit which grows on the *Hylocereus* cactus. It is originated from

Central America and southern Mexico. Dragon fruit is also called as strawberry pear, pitaya and pitahaya.

Pitaya can be generally used in the food industry, edible films, mainly formulations of dietary supplements, and coatings. As per taste dragon fruit can also use juice, jam, or preserving food. Hossain *et al.*, (2021) researched that the dragon fruit helps fighting against asthma and cough if we regular consume it. It contains maximum concentration of vitamin C which helps for healing wounds and cuts quickly because vitamin C helps to enhance immune system and it plays important role to stimulate the activity of antioxidant in the body.

Wijitra *et al.*, (2013) studied that Dragon fruit contain flavonoids that act as immune against cardio related problem and also treating bleeding problems of vaginal discharge. Pitaya improves eyesight and prevent hypertension also Vitamin B3 is present which lowering bad cholesterol levels. It has high amount of phosphorus and calcium which play an important role to form a tissue in body and formation of healthy teeth and it also helps reinforce bones of body. (Choo and Yong 2011). The fruits peels have effective antibacterial, antioxidant, it also helpful to control blood sugar levels act against diabetic properties. The essential fatty acids has capability of nourishing nails, hair, and skin, eradicating illnesses of psoriasis, dandruff, and eczema. (Darmstadt *et al.*, 2002); (Letawe *et al.*, 1998)

9. Euphorbia

Euphorbia milii commonly called as Spurge. Euphorbiaceae is family of spurge which is flowering plant. It's originated from Madagascar and propagated through Cutting. Euphorbia used as ornamental flowering plant in landscape, their root and leaves used as edible part and also make vinegar from spurge.

Euphorbia has ability to cure different diseases like microbial illness, respirational infections, nutritional diseases, body and skin irritations, blood syndromes, inflammatory infections, sensory disorders, genitourinary syndromes, digestion complaints, body pain, snake or scorpion bites, injuries, endocrine, pregnancy disorders, and cellular tissue ailments (Shi *et al.*, 2008); (Zeghad *et al.*, 2016); (Kemboi *et al.*, 2020). Kumar *et al.*, (2010) analyzed that *E. hirta* have capacity to treatment of female disorders, tumors, worm infestation in children, choleric effects, gonorrhoea, constipation, dysentery, jaundice, indigestion, biliousness, bloating, stercorrhagia, and the laxative.

There are many scientific publications reported that *E. sessiliflora*, *E. apios*, and *E. macroclada* and many more species of Euphorbia used to treatment of anthelmintic,

microbial infections, including malaria, tuberculosis, ringworms, cancer, and also sexually transmitted diseases such as gonorrhoea and syphilis (Lai *et al.*, 2004). In Burundi, Nigeria, China, and Philippines oftenly used abstraction of stem or leaves of *E. hirta* and *E. lathyris* for anti-diarrheal treatments. Kemboi *et al.*, (2020) stated that the Euphorbia latex has strong purgative and vesicant which has been used for the curing the diseases like domestic animals skin disease, lice infestations and scabies. Euphorbia species like *E. hirta*, *E. nivulia*, *E. seguieriana* and *E. humifusa* used to cure the parasitic infections like measles and anthelmintic.

10. Goldenroot

Rhodiolarosea commonly known as golden root, orpin rose, rose root, king's crown, roseroot, Aaron's rod, *lignum rhodium*, Arctic root. It is a perennial flowering plant which propagated by crown divisions or plugs and used as groundcover and belongs to Crassulaceae family. Its origin from wild Arctic regions of Europe North America and Asia. The young leaves and shoot of golden root are cooked like spinach or eaten as raw. The taste of rose root is slightly bitter, but small part of it used in mixed salad.

Mao *et al.*, (2010); Calcabrini *et al.*, (2010) stated that the golden root have Antioxidant, antiviral activity and anti-fatigue properties are present. Aaron's rod is cure lots of diseases in which most powerful treatment for cold and flu is *R. rosea* tea which commonly used in middle Asia during winter. *R. rosea* have healing ability of different health problem like hemorrhoids, headache, pain, scurvy this described by German researchers. Golden root have curing capacity of anemia, depression, nervous system disorders, fatigue, impotence, infections, and gastrointestinal ailments and to increase work productivity, physical endurance, resistance to high altitude sickness, longevity. (Hoppe 1993). Rose roots bouquet is given to couples before to marriage to improve fertility and healthy children in mountain villages of the Republic of Georgia. (Saratikov *et al.*, 1967).

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