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## A Review on Nutritional Constituents and Medicinal Values of *Portulaca grandiflora* Hook



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### ABSTRACT

The plant *Portulaca grandiflora* belongs to the family Portulacaceae, a plant native to southern Brazil, Argentina, and Uruguay that is frequently cultivated in gardens. It is also known as Moss rose, Mexican rose, and Eleven o'clock. The *Portulaca grandiflora* has been used in various diseases. The plant is used therapeutically as an antioxidant, antibacterial, antidiabetic, sore throat reliever, rash, and detoxifier, a powerful catalyst for the biotransformation of L tyrosine to LDOPA, cytotoxic effect on cancer cells. This review focuses on the cultivation, nutritional and chemical composition, as well as medicinal and therapeutic properties of this plant.



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## INTRODUCTION:

About 200 species of herbaceous plants belonging to the *Portulaca* (Moss Rose) genus, practically all of which are succulent and have fleshy stems and leaves that are more or less dark green in color. Synonyms are *Portulaca hilaireana* G. Don, *Portulaca immersostellulata* Poelln, *Portulaca mendocinens* is Gillies ex Hook, *Portulaca multistaminata* Poelln. *Portulaca grandiflora* is possibly a small non-woody annual plant in the caryophylloid dicot family.

This is one of the most widely grown annual flowering plants in the tropical world due to its ease of cultivation, abundant flowering and flowers in various colors such as red, yellow, pink, purple, white, orange and/or mixed. It comes in 4,444 different varieties with single, folded, or multiple petals. This ornamental plant can be grown in small spaces, gardens and pots. In addition, *P. grandiflora* is an important medicinal plant with putative immunostimulating and detoxifying activity in hepatitis B. [14]

Inside plants as well as fruits, fresh vegetables, and healthful herbal treatments include a range of antioxidants, like man-made resin ingredients, N- compounds, nutritional vitamins, and terpenoids. However, a lot of attention is aimed at phenolic which can have higher inhibitor activities than patients of standard nutritional vitamin supplements C, E, and  $\beta$ -carotene. [9]

### ❖ Various Names of *Portulaca grandiflora*:

English- Eleven o'clock, Moss-rose, Rose moss, Sun plant;

Sanskrit- Paciri, Paviri;

Telugu- gaddi roja, Goddu Pavelli;

Hindi – luaniya;

Kannada- kaama sakkare;

Marathi- chinigulab;

Malayalam-Neelakeera;

Manipuri - Pung mapan satpi;

Urdu: Gul-e shama.

- **Taxonomy of *Portulaca grandiflora*:**

**Table 1: Taxonomical Classification** <sup>[5-8]</sup>

Kingdom	Plantae
Clade	Tracheophytes
Order	Caryophyllales
Family	Portulacaceae
Genus	Portulaca
Species	<i>P. grandiflora</i>

- **Plant**



**Figure 1: *Portulaca grandiflora* plant**

• **Phytochemical Analysis:**

**Table 2: Phytochemical Analysis**

Sr No.	Phytoconstituents	Observation
1	Alkaloids	+++
2	Flavonoids	+++
3	Glycosides	++
4	Carbohydrates	+++
5	Steroid	+++
6	Resins	-
7	Tannins	+
8	Saponins	++
9	Triterpenoids	+++
10	Comorians	++

(+++ Strongly Present, ++ Moderate Present, + Trace amount, - Completely Absent)

**Morphology** <sup>[14]</sup>

**Macroscopical characteristics of *Portulaca grandiflora***

**Habit:** Annual or perennial, erect or prostrate herb with upright branches, about 20 cm long.

**Root:** Tap root with fibrous secondary roots, 10 cm long, usual roots at the regions of a node.

**Stem:** Cylindrical, smooth, succulent, and glabrous. Stems and branches are purplish green in color.

**Leaves:** Fleshy and glabrous; alternate or irregularly scattered, sub sessile, semi-cylindrical or subterete, linear-oblong, acute tip, 2-3 mm broad, entire margin; few stipular white hairs in axils. Inflorescence: cymose; 1-3 or rarely 4 flowers in sessile clusters subtended by a dense growth of hairs and 5-8 leaved involucre. Flowers are large, showy, sessile, yellow, pink or scarlet, 2-5 cm across. Sepals slightly unequal and united at the base into a short tube, ovate, 6-7 mm long, 3.5-4.5 mm broad, somewhat hooded at the apex, acute apex. Petals 5 or multiples of 5, united at the base, obovate, pale brown or yellow spotted at the base, 16-18 mm long, 12-14 mm wide, emarginate. Many stamens, united at the base. The filaments are

not equal and the color is scarlet. Carpels 5, Synchronous Ovary; Style 5fid; Stigma 5, Linear, Reflex.

**Fruit:** Capsule, 5 mm long, oblong, obtuse in shape, 3 mm in diameter.

**Seeds:** Minute, 0.5-1 mm in diameter, compressed, metallic grey or greyish-black in color.

### **Microscopical characteristics of *Portulaca grandiflora***

**Root:** The transverse section of root showed periderm as the outermost layer. Periderm was followed by cortex. The mature root shows secondary growth. It has a central core of primary xylem and wide secondary xylem. The cortex consists of 4-6 layers of thin-walled, tangentially elongated parenchyma cells. Cells of cortex consist of abundant deposits of starch grains. The vascular tissue is wide occupying the remaining cortex region. The xylem bands are thick walled; phloem occurs only along the xylem bands. Calcium oxalate crystals are fairly abundant in the xylem cells of old root. Pith is almost reduced in young roots and is visible only in roots with secondary growth.

**Stem:** It consists of epidermis, cortex and pith. The epidermal cells were polygonal in shape and the outer wall of the epidermal cells slightly bulged out. The epidermis was followed by cortex. Outer cortex is composed of 2-4 layers of collenchyma. Inner cortex is composed of thin-walled parenchyma, more or less isodiametric cells without any intercellular spaces. Collateral vascular bundles were arranged in a ring with end arch xylem and phloem towards outer surface. Pith is composed of thin-walled parenchymatous cells. Calcium oxalate crystals are abundant in the cortex and pith regions. Microscopical characteristics of epidermal cells are showing two types of cells. Cells in the lower part are tubular in outline with oblique walls. Abundant calcium oxalate crystals are present. Anthers are bilobed with many circular pollen grains.

**Leaf:** The transverse section of leaf is somewhat ovoid in outline and exhibits isobilateral nature with characteristic Kranz tissue. The outermost layer is epidermis with rectangular to polygonal cells and contains parasitic stomata. Epidermis was followed by palisade parenchyma and spongy parenchyma. The mesophyll showed the presence of crystals of calcium oxalate. Stomata occur on both adaxial and abaxial surfaces of the leaf. The ground tissue consists of large, thin-walled compact parenchyma cells. The midrib consists of collateral vascular bundle. The vascular strand has arranged in a shallow arc, the phloem cells

occur on the abaxial convex part of xylem strand. A ring of dilated bundle sheath cells surrounds the vascular bundles of the lamina region; these bundle sheath cells are called Kranz tissue, which are characteristic C4 type of photosynthesis of some selected plants. Crystals of calcium oxalate are in the form of druses and are fairly abundant in the mesophyll cells.

### **Therapeutic Uses:**

The plant as a whole is purgative. There are so many uses i.e., treatment of hepatitis, swelling and pain in the pharynx, cirrhosis of the liver with ascites. Externally, the fresh juice of the leaves and stems is used to treat snake and insect bites, burns, scalds, and eczema. It's used for sore throat alleviation, skin rashes, and detoxification.<sup>[9]</sup> Leaves are used to treat scurvy. It is used to treat a variety of malignancies in Chinese medicine. It's one of the constituents of Tumoclear (Kang zhong pian), a Chinese herbal medicine used to treat tumors and cancer. Aerial parts are utilized in Thai medicine to heal sore throats, skin rashes, and detoxification. Flowers and leaves are worn around the neck to ward off evil spirits.<sup>[14]</sup> Nanotechnology has also been used to treat cancer with *Portulaca grandiflora*.<sup>[2]</sup> These chemical compounds can be used to create and discover new anti-diabetic drugs. Many phytochemicals extracted from plants have been shown to have anti-diabetic properties.

### **Pharmacological studies:**

#### **Antioxidant Activity:**

Ilakkiya V. D. *et al.*, work is intended to precede the phytochemical characterization of purslane (*p. oleracea* and *p. grandiflora*) from aqueous extract and study of its antioxidant activity. Crude extracts from the whole plant of *Portulaca oleracea* and *Portulaca grandiflora* were screened for their total phenolic content. The plant *Portulaca grandiflora* shows the highest antioxidant activity. They may well be used as a supply of natural antioxidant.<sup>[9]</sup>

Choon Kiat Lim *et al.*, the total phenolic content and antioxidant activity of different colour varieties of *P. grandiflora*. Total phenolic content in lots of solvent extracts assorted widely, ranging from 46.39-82.19 mg GAE/100 g in methanol extracts; acetone extracts from 36.72-56.45 mg GAE/100 g and ethanol extracts from 41.46-85.70 mg GAE/100 g in all varieties assessed. Only crude extracts were used in this study, so the higher yield might be contributed by other polar ingredients besides phenolics, specifically polysaccharides, plant

dirt and so on. This study suggests that *P. grandiflora* could be used as a source of natural antioxidant. The phenolic compounds that contributed to the antioxidant activity of this plant can be characterised in future.<sup>[3]</sup>

### **Evaluation of Diabetic Nephropathy:**

Pradeep Kumar *et al.*, It states that is to prevent nephropathy due to antioxidant activity by using endogenous plant extract *Portulaca grandiflora* in alloxan-induced diabetic rats. Nephropathy was confirmed by measuring the levels of urea, creatinine, glucose and uric acid in the blood one week after administration of alloxan. The animals are then evacuated and histopathological examination of the kidney tissue from the induction test control group is performed. Alloxan to provide increased blood glucose quantity that generates diabetes, which in flip causes rigorous injure to the kidneys. Results showed that oral administration of *Portulaca grandiflora* plant extracts significantly reduced glucose, uric acid, creatinine and urea levels in diabetic rats. <sup>[2]</sup>

### **Antibacterial Activity**

Shinde P. R *et al.*, The zones of inhibition measured during the antimicrobial test by Agar well diffusion method. It was observed that all the tested samples of alcoholic extract of *P. grandiflora* Linn possessed broad spectrum antimicrobial activities on both gram-positive and gram-negative bacteria and the fungi used.<sup>[13]</sup>

### **Antidiabetic Activity**

Devi M *et al.*, A study was concluded that antidiabetic activity of the ethanol extract of the whole lift plant *Portulaca grandiflora* Hook in rats with streptozotocin-induced diabetes mellitus. In control diabetic rats treated with STZ, blood glucose levels were significantly increased, accompanied by weight loss. The results of this study showed that a potent antidiabetic activity was present in the aerial part of plant *P. grandiflora* H. extract.

In vitro antidiabetic effect of ethanolic extract of *P. grandiflora* Hook results relating to the diffusion effects of *P. grandiflora* Hook and glucose by diffusion assay. There was a significant decrease in the glucose movement across the membrane for ethanolic extract when compared to the control.

In vivo antidiabetic effect Results relating to the effects of *P. grandiflora* Hook whole plant extracts and metformin to the diabetic rats. Effect of ethanolic extract of *P. grandiflora* Hook

on whole blood glucose in streptozotocin induced diabetic rats showed a significant increase in blood glucose. [4]

### **Lymphocyte activity**

Sriwanthana, B *et al.*, It was shown that the responses were significantly elevated with the *P. grandiflora* extracts ranging from concentrations of 1 ng/ml to 100 µg/ml. The components of *P. grandiflora* did not change natural killer cells perform. *P. grandiflora* had excessive potential for further more development as drugs. Results recommended that the components of plants have stimulating activity on human lymphocytes and could be medically useful for modulating immune functions of the body. [1]

### **Cytotoxic effect against cancer cells**

T. Ashokkumar *et al.*, demonstrated an eco-friendly way for the synthesis of gold nanoparticles using eco-friendly roof structure plant components. The leaf and stem extracts of *P. grandiflora* bacteria acted as a minimizing agent as well as stabilizing/capping broker. The biosynthesized gold nanoparticles have already been methodically characterized by several analytical techniques. Evaluated the cytotoxicity impact of synthesized gold nanoparticles against human C6 glioma cancer cellular lines. In brief, the current investigation is very valuable for exposing the system of biosynthesis of gold nanoparticles along their anti-cancer therapeutic possible. [15]

### **Miscellaneous Uses:**

#### **Cell Suspension Cultures on Anti-Parkinson's Drug**

Nisha Rani *et al.*, In this study 3,4-Dihydroxy L-phenylalanine (L-DOPA) is considered an amazing drug for the remedy of Parkinson's disease, a neurologic disorder. Enantiomerically natural L-DOPA is made from L-tyrosine in a single-step biotransformation procedure the use of callus cultures of the plant *Portulaca grandiflora* Hook (Portulacaceae). Callus cultures had been precipitated in Murashige and Skoog medium furnished with growth regulators consisting of benzyl aminopurine and 2,4-dichlorophenoxyacetic acid and had been located to be a top-notch supply of tyrosinase, which in flip become used for the biotransformation of L tyrosine into L-DOPA. Biotransformation needed for detoxification and protect the body from ingested toxins.



Biotransformation of L-tyrosine into L-DOPA using *Portulaca grandiflora* suspension way of life become located to be one of the fine and maximum cost-powerful strategies for green and fast manufacturing of L-DOPA. [11]

### **Synergistic degradation of diazo dye Direct Red 5B**

V. Khandare *et al.*, Plants and bacterial consortium of *Portulaca grandiflora* and *Pseudomonas putida* confirmed entire decolorization of a sulfonated diazo dye Direct Red 5B. The considerable induction in the activities of lignin peroxidase, tyrosinase, 2, 6-dichlorophenol indophenol reductase and riboflavin reductase was seen in the roots of *P. grandiflora* during dye decolorization; while, the activities of laccase, veratryl alcohol oxidase and 2, 6-dichlorophenol indophenol reductase were induced in the cells of *P. putida*. Consortium achieved an increased and efficient wreckage of Direct Crimson 5B. A phytotoxicity review revealed the nontoxic nature of metabolites formed after parent or guardian dye degradation. Make use of such combinatorial devices of plant together with bacteria could verify to be an efficient and efficient method for the removal involving textile dyes via soil and rivers. [12]

### **Development of a low-cost, phyto-tunnel system**

Rahul V. Khandare *et al.*, A phyto-tunnels turned into evolved the use of a drilled PVC pipe. It turned into planted with *Portulaca grandiflora* and used for the remedy of a fabric effluent and a dye aggregate. Significant induction in sports of lignin peroxidase, tyrosinase reductase turned into determined in root tissues of the plants. The particular phyto-tunnel effectively reduced ADMI values, Chemical oxygen demand, biochemical oxygen demand, total organic carbon, conductivity, and turbidity of the effluent and dye mixture and therefore can be used for primary and secondary treatment procedures. The construction of such phyto-tunnels will not require large room or area. Further studies are underway to use these phyto-tunnels in the form of long organizations at the genuine site of linen wastewater disposal. This may add to their efficacy of the system as it increases the hydraulic retention time. [13]

### **CONCLUSION**

In the present article, we include reviewed the pertinent literature to gather the botanical, pharmacognostical, phytochemical and medicinal information on *Portulaca grandiflora* hook. Some sort of survey of literary works revealed that typically the plant has appealing

antioxidant activity, antibacterial activity, antidiabetic activity, examination of diabetic nephropathy, lymphocyte activity, toxic effect on cancer cells, other miscellaneous use of i.e., *Portulaca grandiflora* cell postponement, interruption cultures as powerful catalysts to the biotransformation of L-Tyrosine straight into L-DOPA, an anti-drug Parkinson's, *Portulaca grandiflora* and *Pseudomonas putida* degrade the diazo dye Direct Red 5B synergistically colored 5B, development and even application of some sort of low-cost phyto-tunnel technique based on *Portulaca grandiflora* for typically the treatment of dye-containing wastewaters. The results of this study can be a valuable source of information and provide an appropriate standard for the identification of this plant material in future studies and applications.

### Conflict of interest

We declare that we have no conflict of interest.

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