

Medicinal Plant Treasures of India

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Medicinal Plant Treasures of India

Medicobiological applications of some promising plants

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Portulaca oleracea: A Traditional, Oldest and Common Wild Medicinal Vegetable

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Abstract

Portulaca oleracea L. is a traditional, oldest and common wild vegetable used by man as a part of folk medicine. It is a genus of succulent herbs distributed in the warmer parts of the world. Four species are found wild in India and two exotics have become naturalized. It is a rich source of highly nutritional values and also richest source of secondary metabolites as alkaloids, flavonoids, omega-3 fatty acids, polysaccharides, proteins, minerals, vitamins, terpenoids and sterols. The *Portulaca* is an easily available wild vegetable and also found in all the parts of the xeric climates. It is having a very good potential of near about thirty one biological activities from all the parts of plant like root, stem and leaves. Whole plant is a richest source of unique phytochemicals. *Portulaca* has been proved to have potential as best ethnobotanical and pharmacological actions. It has a very good antioxidant, antidiabetic, anti-inflammatory, antimicrobial, neuroprotective, and anticancer, antihypertensive activities. This attempt was made to high lighten the detailed information on various bioactivities along with its natural bioactive compounds which are

responsible to give pharmacological aspects of *Portulaca* to push this plant in our daily common food as a source of nutritional and balanced diet.

Keywords: *Portulaca oleracea*, Phytoconstituents, Ethnobotanical and Pharmacological actions.

I. Introduction

The most common plant in India is herb, with fleshy succulent leaves, evergreen and forms a mat over an area due to its special propagation method. The name of this plant is *Portulaca oleracea* L. commonly, we called it as Purslane and in Marathi it is Ghol because of its mat, we never find from where it starts its propagation. Because of its ability to produce large numbers of seeds, common *Portulaca* can rapidly colonize at any warm, moist site. It prefers a moist light rich well-drained soil in a sunny position (Huxley, 1992). It is common vegetable used by us as wild vegetable due to its medicinal value. It is known by various names by local people at various places of the world like, as in USA and Australia it is Purslane, in England as Pigweed, in Malaysia as Andulam in France as Pourpier, (Elkhayat *et al.*, 2008). It comprises from family *Portulacaceae*, and it is an annual prostate herb. The name nomenclature of plant *Portulaca* is derived from the Latin words as ‘porto’ meaning “to carry” and ‘lac’ meaning milk. The plant contains a milky juice (Loutfy and Nabil, 1994). It shows diuridinal fluctuations as it follows Crassulian acid metabolism (CAM) pathway. During night it captures carbon dioxide and utilizes it in day time. This is a capacity of plant to defend against water stress as it faces xeric stress conditions.

The swollen stems of *Portuulaca* can remain moist and viable for several days after cultivation and hoeing, and reroots to form “new” plants when gardens or fields are irrigated. To produce a plant from seed, it takes near about six to eight weeks and then it was harvested on a cut periodically and providing edible leaves for most of the summer season (Grieve, 1995). It is distributed in various countries like French, Mexican, Spanish, and Venezuelan Pharmacopoeias along with India (Eduardo, 1978). Now, it becomes very common and distributed through in the all tropical and subtropical areas of the world including the United States, India.

Due to its nutritional value Ghol has been used in salads and as a medicinal plant from ancient times from hundreds of years ago. The various records were found on ethnobotanical uses of the Ghol plant parts like leaves and stem are used by various people of world to cure a lot of troubles. In Jamaica, the juice of the stems and leaves are rich sources of acid and is applied as a cooling and moistening herb in fevers and also on to scorpion sting. In Indo China the fresh leaves juice is applied to abscesses, and used as a collyrium, and also employed its decoction over dysentery and liver diseases (Nadkarni et al., 1999). In Nigeria the leaves are used as a local application to swellings (Kirtikar *et al.*, 2000). In North America, the seeds are used as a cooling diuretic, and also as to be anthelmintic, though now known to be inert.

Due to its nutritional aspects now, it will gain the interest of researchers. Around the Mediterranean and tropical Asian countries, it is eaten widely as a main content to soups and salads. Its soft stem and leaves are used a raw, alone or with other green vegetables to make various dishes from it. (Palaniswamy *et al.*, 2002). Their young leaves are a very acceptable addition due to its high content of mucilage and quality it added to salads and also major content of a good substitute for okra and as a thickener in soups too. (Facciola, 1990 and Grieve, 1984).

This plant is also preferred by the Ancient people of Romes as a remedy of dysentery, headache, stomach ache and it has the potential of vermifuge (Duke, 2002). The ground seed powder is mixed with cereals and used in gruels, bread, pancakes (Khare, 2007). The plant is reported to have antibacterial, antiscorbutic, depurative, diuretic, febrifuge and its fresh juice is also used in the treatment of strangury, coughs and sore (Chiej, 1984; Arruda *et al.*, 2004; Xiao *et al.*, 2005 and Movahedian *et al.*, 2007). The juice of plant and leaves are very effective in the treatment of skin diseases and insect stings (Bown, 1995 and Chiej, 1984). The leaf juice is applied to earaches, it is also said to alleviate caterpillar stings. Foster, S. and J. A. Duke (2000) reported that the application of leaves as a poultice is very useful on burns. They also prepared tea from these leaves is also effective in the treatment of stomach aches and headaches.

Every part of plant is a medicinal and variety of research was made to study a lot of bioactivities. This plant also has a potential of an antimicrobial plant (Dan, 2006), and an antioxidant potential of plant as reported by Karimi *et al.* (2011). All the plants parts such as seeds, leaves,

stems, and roots of extracts shows a very good antioxidant property (Habibian. *et al.*, 2020). It also proved to have a potential of anti-inflammatory, a liver protector (Eidi *et al.*, 2015) activity.

The plant also effective against the intestinal worm useful as a wound healing (Rashed *et al.*, 2003) vermifuge activity and also useful for contraceptive effects (Hanumantapa *et al.*, 2014). Additionally, it helps as a booster for the immune system and also in controlling heart attack, (Hozayen *et al.*, 2011); the plant possesses blood purification activity (Amiri and Joharchi, 2013). Cario and Wallis (2012) reported from eastern Mallorca, it is used to regulate blood pressure The plant is also tested by various scientists for therapeutic application in rectal and mouth ulcers such as hemorrhoids and constipation (Kumar *et al.*, 2008). *Portulaca oleracea* is a highly medicinal plant due to its phytochemicals rich content. It is a proved to have many positive activities and found essential drug among herb and family portulacaceae. This family contents near about 120 species. In this paper we are focusing over phytochemical, bioactivities and pharmacological potential of this plant.



Figure of Habit of *Portulaca oleracea* Herb
(Source: https://florafinder.org/Species/Portulaca_oleracea.php)

II. Botanical Description

Portulaca oleracea L. (purslane) is a worldwide species, and the genus *Portulaca* belongs to the Portulacaceae family with 21 genera and 580 species. It is reported that Purslane exists about 4000 years ago. It has a cosmopolitan range, with some species found in Arabia (Uddin *et al.*, 2014). Purslane is a succulent annual herbaceous plant that grows up to 30 cm tall and is erect or decumbent. The stems are cylindrical, with the

longest reaching 30 cm in length and a diameter of 1-2 mm. The surface is yellowish-brown in colour and features a longitudinal furrow. The leaves are arranged in opposite or alternate directions and are readily damaged. The entire leaf is obovate in shape, measuring 1 -2.5 cm long and 0.5 -1.5 cm wide. The leaves are a greenish-brown colour. The leaves are greenish-brown in colour. At the tip and throughout the entire border, the leaf form is obtuse or slightly notched. The flowers are tiny and clustered in groups of three to five at the branchlet terminals. The flowers are golden in colour and have five petals. The fruit is conical in shape and about 5 mm long, with many tiny seeds inside. It has a faint odour and a slightly sour flavour (Chen *et al.*, 2014).

Kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Caryophyllidae
Order	Caryophyllales
Family	Portulacaceae
Genus	Portulaca
Species	Oleracea Linn.

Table of Scientific Classification of *Portulaca oleracea* L. (Okafor *et al.*, 2014)

III. Habitat

Purslane can be found in fields, vineyards, lawns, driveways, dunes, beaches, salt marshes, waste areas, eroded slopes, bluffs, and riverbanks, among other places (Chug *et al.*, 2019)

Vernacular Names of *Portulaca Oleracea* LINN. (Kirtikar *et al.*, 2003)

- **English:** Common purslane, garden purslane, purslane
- **Greek:** Andrachni, andrakala, antrakala
- **Hindi:** Baralunia, chhotalunia, lonia, khurfa, khursa
- **Bengali:** Baraloniya, chotaluniya, kulfi, munya
- **Kannada:** Doddagonisoppu, gonisoppu;

- **Persian:** Cholza, khurfah, kurfah, lonika
- **Sanskrit:** Brihalloni, lonika, lonamla, gholika
- **Tamil:** Karikkirai, parapukkiray, pullikirai

IV. Phytoconstituents Reported

It has been reported that the water, crude protein, crude fat, total sugar, dietary fibre and ash contents in fresh purslane were 88.9, 2.8, 0.6, 3.2, 5.6 and 1.4 g/100 g, respectively (Zhao *et al.*, 2016). Research has been shown that *P. oleracea* contains 10 to 20 times more melatonin, a cancer-fighting antioxidant, than any other fruit or vegetable studied. Its leaves contain up to 300 mg of vitamin C, vitamins B, E, PP, carotene, iron, magnesium, phosphorus, calcium, potassium, selenium, manganese, and a high content of Omega 3 and fatty acids (Zheng *et al.*, 2017).

Analysis of edible leaves and stems of *Portulaca oleracea* Linn. demonstrated the presence of bioactive compounds like flavonoids, coumarins, monoterpene glycoside (Yue *et al.*, 2015)), phenolic compounds (Li *et al.*, 2006), fatty acids as well as alpha- linolenic acid (Omega-3), alkaloids (Askari *et al.*, 2016), vitamins, and minerals. Flavonoids like Kaempferol and apigenin have been mainly isolated from leaf and stem of Purslane. Several alkaloids like Dopamine, noradrenalin and DOPA found in stem, leaf and seeds of Purslane. It is reported that Purslane also contains various vitamins including vitamin A, riboflavin, niacin, pyridoxine, vitamin C, folates, pantothenic acid and thiamine as well as hesperidin and α -tocopherol (Palaniswamy *et al.*, 2001).

Different researchers analysed bioactive ingredients in Purslane and revealed that it contains flavone like quercetin (Wang and Kong, 2016), portulacanone (Yan *et al.*, 2012), polysaccharides (Yuan, 2016), fatty acids like α -Linolenic acids, coumarin (Seo *et al.*, 2003) and other phenolic compounds, alkaloids like dopamine, terpenes like friedelin (Yao *et al.*, 2007), and steroid ingredients like β -sitosterol and β -sitosterylglucoside (Rasheed *et al.*, 2004).

V. Pharmacological Properties

According to the literature *Portulaca oleracea* has been reported to possess Antioxidant activity, Immuno-modulatory Activity, Antitumor Activity, Antimicrobial effect, Nephroprotective activity, Skeletal muscle relaxant activity, Antiulcer activity, Antidiabetic activity, Hepatoprotective activity, Anti-arthritic activity, Neuroprotective effects, Anti-inflammatory effect, Anti-fungal activity, Anti-fertility effect, Wound Healing Properties, Gastroprotective effects and many other biological activities. Further pharmacological studies regarding these activities have been undertaken by various workers which are given below-

1. Antioxidant Activity

Antioxidants are the substances that remove potentially damaging oxidizing agents in a living organism. Vafa Baradaran Rahimi, *et al.* (2019) reviewed on *Portulaca oleracea* L. and reported various anti-inflammatory, anti-oxidant, immuno-modulatory and antitumor activities. Mulry *et al.* assessed antioxidant activity of Purslane in different extracts. Study revealed that proline and betalain pigments found in Purslane protect plant and showed antioxidant activity (Mulry *et al.*, 2015). Ahangarpour, (2016) investigated that ethanolic extract decrease LH and FSH levels well as increases estrogen and progesterone levels. Behravan *et al.* (2011) studied that aqueous extract of *Portulaca* inhibited DNA damage by comet assay.

2. Immuno-Modulatory Activity

Several studies showed immuno modulatory properties of *Portulaca*. Georgiev *et al.* (2017) reported that polysaccharide complexes isolated from aerial parts of Purslane activated phagocytes, enhanced immuno-modulatory activities by interacting with immune cells in Peyer's patch cells. Li Y *et al.* (2014) investigated that Purslane polysaccharides raised the body weight, lymphocyte proliferation, and WBC count and splenocytes proliferation. Barakat LA reported that Pumpkin-Purslane seed mixture improved IgG and IgM levels (Barakat *et al.*, 2011).

3. Antitumor Activity

Study has been shown that *Portulaca* acts as potential anticancer drug. Shen *et al.* (2013) reported that Polysaccharides in Purslane enhanced the amount of T lymphocytes and decreased tumour growth. You *et al.* (2009) revealed that Purslane polysaccharids prevented the RBC hemolysis and scavenge DPPH, NO and hydroxyl radicals.

4. Antimicrobial Effect

Bae (2004) evaluated the antimicrobial activity of *P. oleracea* extracts on food-borne pathogens. In compared to petroleum ether, chloroform, and methanol extracts, he discovered that ethyl acetate extract had the most antimicrobial efficacy against *Staphylococcus aureus* and *Shigella dysenterica*. At 4000 ppm, the ethyl acetate extract of *P. oleracea* demonstrated excellent antibacterial activity against *Staphylococcus* (Bae, 2004).

5. Nephroprotective Activity

Karimi G *et al.* (2010) studied nephroprotective activity of *P. oleracea* against cisplatin induced acute renal toxicity in rats. This study revealed that rats treated with aqueous and ethanolic extract, 6 and 12 hr after cisplatin injection had blood urea nitrogen and serum creatinine levels significantly lower than those receiving cisplatin alone but mild to moderate cell injury was observed. This finding revealed some nephroprotective potential of *Portulaca oleracea* L

6. Skeletal Muscle Relaxant Activity

The skeletal muscle relaxant activity of aqueous extract of the stems and leaves of *P. oleracea* was examined by Parry *et al.* (1993) They noted that extract of Purslane abolishes the twitch contraction of the directly stimulated rat hemidiaphragm preparation. Further they found that the extract's effects on the diaphragm are qualitatively similar to potassium oxalate (a recognised ingredient of *P. oleracea*). The relaxing action reported on the isolated rat diaphragm is thought to be at least partly due to the K⁺ ion concentration of *P. oleracea*

7. Antiulcer Activity

Tahereh (2018) reviewed some therapeutic effects of *Portulaca oleracea* L. in hepatogastric disorders. Karimi *et al.* (2004) assessed some antiulcer activities and found that in mice, ethanol-induced stomach lesions were reduced by aqueous and ethanolic extracts of *P. oleracea* L. (0.8—1.77 g/kg). They also discovered that giving extracts to pylorus-ligated animals lowered stomach acidity (Karimi *et al.*, 2004). In rats, the gastroprotective properties of *P. oleracea* L. were investigated by Kumar *et al.* (2010) in acute gastric ulcers caused by aspirin, ethanol, cold restraint stress, pyloric ligation, and chronic ulcers caused by acetic acid. According to the findings, *P. oleracea* L. protects the stomach mucosa from oxidative damage by enhancing superoxide dismutase (SOD) and catalase (CAT) activity and lowering lipid peroxidation. Furthermore, *P. oleracea* L. reduced acid and pepsin secretions while increasing mucus synthesis.

8. Antidiabetic Activity

Diabetes mellitus is a metabolic illness marked by high blood sugar, improper lipid and protein metabolism, and long-term consequences affecting the retina, kidneys, liver, and neurological system (Radhakrishnan *et al.*, 2001). Li (2009) investigated that polysaccharide extracted from *P. oleracea* L. can control blood glucose and modulate the metabolism of glucose and blood lipid in diabetes mellitus mice.

9. Hepatoprotective Activity

Purslane (*Portulaca oleracea* L, Portulacaceae) has long been used in folk medicine to protect against liver injury, while its effectiveness has been questioned (Vishal *et al.*, 2019). Purslane ethanol extract was examined by Eidi *et al.* (2015) for its hepatoprotective efficacy against carbon tetrachloride (CCl₄)-induced liver damage in rats. Increases in hepatic marker enzymes (ALT, AST, ALP, GGT, and SOD) as well as histological changes suggested liver injury. In CCl₄-treated rats, administration of purslane extract (0.01, 0.05, 0.1, and 0.15 g/kg b.w.) resulted in a substantial tendency toward normalisation of all evaluated biochemical parameters. Purslane protects the rat liver from CCl₄-induced damage, as seen by histopathological changes that corresponded to changes in liver function markers. This suggests that purslane could be

used as a therapeutic alternative for individuals with liver problems (Eidi *et al.*, 2015).

10. Anti- Arthritic Activity

The anti-arhtritic effect of petroleum-ether extract of *Portulaca oleracea* Linn via Fruends adjuvant arthritis model in male wistar rats was investigated by Jagan *et al.* (2014). The test extracts were given at doses of 100, 200, and 300 mg/kg/p.o., with Indomethacin at a dose of 100 mg/kg serving as the standard. On the 21st day, a maximum of 77.82 percent inhibition was observed. Similarly, treatment with petroleum ether extract reduced the increase in paw diameter caused by Fruends adjuvant delivery, with the effect being stronger at 300mg/kg of petroleum ether extract of *Portulaca oleracea*. This study revealed the anti-arthritic activity of aqueous extract of *Portulaca oleracea*. On the 21st day, a maximum of 75.69 percent inhibition was observed. This study revealed anti-arthritic potential of *Portulaca oleracea* L. (Jagan *et al.*, 2012)

11. Neuroprotective Effects

Portulaca extracts were studied in mice for their hypoxia neuroprotective properties by Wang *et al.* Mice were housed in a normobaric low oxygen environment (10 percent oxygen and 90 percent nitrogen) for various periods of time after oral administration of the extracts or distilled water for seven days, and then slaughtered. Histological examination was conducted on mouse cortices. These results showed that PO extracts had protective effects on hypoxic nerve tissue. (Wang *et al.*, 2007)

12. Anti-Inflammatory Effect

Purslane's anti-inflammatory properties were investigated in an animal study(Sepide Miraj,2016). The findings revealed that Oleracone, a new alkaloid with rapid distribution and high bioavailability, had a strong anti-inflammatory impact (Meng *et al.*, 2016).

13. Anti-Fungal Activity

Mizutani *et al.* (1998) assessed antifungal activity in Purslane. Purslane root extracts were found to reduce zoospore movement. Inhibited zoospores settled quickly to the bottom of the petri dishes, where they

encysted before germinating in 1-2 hours. This finding revealed that *Portulaca oleracea* L. has potent antifungal activity.

14. Anti-Fertility Effect

Antifertility activity means prevention of pregnancy. Many herbs are used for contraception purpose from ancient days. Asha et.al. (2013) reported that due to natural alternatives; contraception could bring more benefits to more people at less cost than any other single technology. Hanumanatappa *et al.* (2014) worked over albino rats to test antifertility effect of chloroform extract of aerial parts of Purslane. This finding reveals that *Portulaca* has very good anti-fertility activity. Verma *et al.* (1982) investigated the antifertility effects of alcoholic extract of *P. oleracea* seeds on the reproductive organs of male albino mice. They found that the administration (s. c.) of alcoholic extract of *P. oleracea* seed induced an effective impairment of spermatogenesis.

15. Wound Healing Properties

Rashed *et al.* (2003) studied that in *Mus musculus* JVI-1, the preliminary wound healing activity of *Portulaca oleracea* was assessed, and it was discovered that a fresh crude extract greatly accelerates wound healing by stimulating wound contraction and decreasing the surface area of the excision wound.

16. Gastro-protective Effects

Karimi *et al.* (2004) reported that extracts of *P. oleracea* L. in aqueous and ethanolic forms Gastric ulcers caused by ethanol in mice were reduced by (0.8-1.77 g/kg). Extracts lowered stomach acidity in pylorus-ligated mice.

Conclusion

This review is an attempt to compile the pharmacological and phytochemical literature on *Portulaca oleracea*, to highlight and critically assess the pharmaceutical potential of this plant. The extensive survey of literature revealed that *Portulaca oleracea*, is an important medicinal plant with diverse pharmacological spectrum. Due to its high content of nutrients, especially antioxidants (vitamins A and C) and omega-3 fatty

acids, and its wound healing and antimicrobial effects as well as its traditional use in the topical treatment of inflammatory conditions. Further evaluation needs to be carried out in order to explore the concealed areas and their practical clinical applications, which can be used for the welfare of the mankind.

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