

# A REVIEW ON PHYTOCHEMICAL AND PHARMACOLOGICAL EFFECT OF *PORTULACA OLERACEA* L. STEM

<sup>1</sup>Sourabh Atak, <sup>2</sup>Pratiksha Alabade

Department of Pharmacology,  
Nanded Pharmacy College,  
Nanded, Maharashtra, India.

**Abstract:** The plant *Portulacaoleracea* is used as medicinal herb atleast 2000 years ago and it is also used as food before this period. *Portulacaoleracea* belongs to the family *Portulacaceae*, which is an annual herb. Its origin is unsure but archeobotanical findings are very common at many prehistoric sites. The plant approximately contains 30 different biological activities and over 60 medicinal indications. *Portulacaoleracea* is mentioned as alternative system of medicine because all parts of plant such as roots, stem, leaves, seeds possess the medicinal properties. It is a common herb used as vegetable. Its vernacular name is Purslane, Hog weed, Kurfa, Andrachni, Baralunia etc. It has round, smooth, procumbent succulent stem, growing about 6 inches high with small oblong, wedge shaped dark green leaves, thick stalked and clustered together, flowers bloom in June and July which are yellow in colour. *Portulacaoleracea* is distributed all over the world and native of many parts of Europe, India, China, Japan etc. The plant is rich in Flavanoids, Alkaloids, Terpenoids, Organic acids, Vitamins, Minerals which are present in different parts of the plant such as stem, leaves, roots, seeds it is proved by qualitative phytochemical extract of plant by using different solvents. The plant *Portulacaoleracea* is reported to possess the multifaceted biological activities such as anti-ulcerogenic activity, antimicrobial activity, antioxidant activity, antidiabetic activity, anticonvulsant activity, antitussive effect, hepatoprotective activity, anti-inflammatory activity etc., It also possess the antiimplantation and abortifacient properties, bronchodilator property etc. The plant *Portulacaoleracea* is used since antiquity in Unani medicines for treating various ailments such as skin diseases, fever, dysentery, bleeding piles, spleen diseases etc. Moreover now-a-days *Portulacaoleracea* is used in cosmetics. The present review is an attempt to outline the recent knowledge of significant traditional uses, pharmacological activities, pharmacognostic and phytochemical study of plant *Portulacaoleracea*.

**Keywords:** Scientific Classification, Phytochemical constituents, Pharmacological Activities.

## 1. Introduction

Purslane, *Portulaca oleracea* Linn. belongs to family *Portulacaceae*. It is green vegetable which resembles methi (Fenugreek) leaves but are slightly thicker & has no bitterness. It has thick & succulent reddish green stem & this vegetable has a nice earthy flavor.

It reflects that it may have originated & adapted to desert climates of the Middle East & India. It has reddish-brown stem, alternate wedge-shaped leaves, cluster of yellow flowers containing 4 to 6 petals that bloom in summer & numerous black shiny & rough seeds.

Purslane is easy to cultivate. The plants grow best in a nutritious well-drained soil in sunny areas. It is important to keep the soil evenly moist to ensure that the plants become fertile. The seed is sown directly into final growing places in the spring, and often multiple times throughout the summer in order to have a steady supply of healthy plants over a longer period. The leaves can be picked from the plants six to eight weeks after sowing. Commonly found in *Portulacaoleracea* citric acids, dopa, coumarins, flavonoids, alkaloids, urea monoterpene glucoside, portuloside A, was isolated from the Methanolic extract of aerial parts of *P. oleracea*. pectin, glutathione and coenzyme this palatable vegetable is very well endowed with nutrients and ranks in the top percentile of recommended dietary intake for alpha-linolenic acid, beta-carotene, tocopherol, magnesium and potassium. It has laxative effect prevent the blood pressure & high cholesterol as it contains high amount of omega-3 fatty acids. It inhibits inflammation on body, maintains normal functioning of immune system.

Purslane fights & eliminates carcinogens from body. It prevents cardiovascular disease, used in antiasthmatic, antioxidant and diuretics. The herb has also been used to treat mastitis (inflammation of the mammary gland), haemorrhoids and bleeding after childbirth. The seeds have been used against intestinal worms. Purslane is used as a remedy for diarrhea, bacterial dysentery, fever and urinary tract infections and sometimes for appendicitis. The seeds, bruised and boiled in wine, were given to children as a vermifuge.



### ***Portulaca Oleracea L. Plant***

#### **2. Scientific classification *portulaca oleracea L.stem***

- Kingdom-Plantae
- Subkingdom-Tracheobionta
- Superdivision-Spermatophyta
- Division-Magnoliophyta
- Class-Magnoliopsida
- Subclass-Caryophyllidae
- Order-Caryophyllales
- Family-Portulacacea
- Genus-*Portulaca L.*
- Species-*PortulacaOleracea L.*

#### **3. Vernacular Names**

**Table 1: Vernacular names of *Portulaca oleracea***

- ❖ **Marathi:**Ghol
- ❖ **Hindi:**Kulfa
- ❖ **English:**Purslane
- ❖ **Gujrati:**Nunia
- ❖ **Bengali:**Nunia Sag
- ❖ **Tamil:**Pachiri
- ❖ **Malayalam:**Koluppa

#### **4. Characteristics of *Portulacaoleracea***

##### **Microscopy of stem**

- Transverse section of the stem is circular in outline. Epidermal cells polygonal in shape and are surrounded externally by thick striated cuticle. Next to epidermis 2- 3layers of collenchymas cells, it is followed by isodimetricparenchymatous cells which are densely filled with starch grains.

#### **5. Propagation of *Portulacaoleracea***

It germinates on the surface of soil after an irrigation orrain. The seeds grow rapidlyinto plant and produces flowers in a few weeks. The plant requires moist light with well-drained soil in a sunny position. It does not produce any leaves if it grows in dry condition. The plant takes 40-56 days to produce crop from seed and can then be harvested by cutting the stem. The fleshy stem remains moist

after harvesting and viable for several days and reroot to develop a new plant when it is re-irrigated.

## 6. Distribution

It is distributed all over world. It is native of many parts of Europe, India, China, Japan and a scention Island. It is also found in British Isles, America and Australia. It is distributed all over India, up to 170 m in the Himalaya and in all warm countries.

## 7. Habitat

It grows well in orchards, vineyards, crop fields, landscaped areas, gardens, roadsides, other disturbed sites.

## 8. Phytochemical Constituents of stem

Some researchers have reported the following chemical components such as flavonoids, alkaloids, terpenoids, organic acids, vitamins, and minerals present in stem of the plant *Portulacaoleracea*.

### 8.1 Flavonoids present in stem part of the plant

Kaempferol, Apigenin, Luteolin, Myricetin, Quercetin, Genistein, Genistin, Portulacanones A, Portulacanones B, Portulacanones C, Portulacanones D, 2,2'-Dihydroxy-4',6'- dimethoxychalcone.

### 8.2 Alkaloids present in stem part of the plant

Dopamine, Noradrenalin, Oleraceins A, Oleraceins B, Oleraceins C, Oleraceins D, Oleraceins E, Adenosine, Oleracins I, Oleracins II, N-trans-Feruloyltyramine, (7'R)- N-Feruloylnormetanephine, 1,5-Dimethyl-6-phenyl-1,2-dihydro-1,2,4-triazin-3(2H)-one, (3R)-3,5-Bis(3-methoxyhydroxyphenyl)-2,3-dihydro-2(1H)-pyridinone, Thymine, N- trans-Feruloyltyramine, (7'R)-N-Feruloylnormetanephine.

### 8.3 Terpenoids present in stem part of the plant

Portuloside A, Portuloside B, (3S)-3-O-( $\beta$ -D-Glucopyranosyl)-3,7- dimethylocta-1,6-dien-3- ol, (3S)-3-O-( $\beta$ -D-Glucopyranosyl)-3,7-dimethylocta-1,5-dien-3,7- diol, Portulene, Lupeol, (2a,3a)-3-[[4-O-( $\beta$ -D-Glucopyranosyl)- $\beta$ -D-xylopyranosyl]oxy]-2,2,3-dihydroxy-30- methoxy-30-oxoolean-12-en-28-oic acid.

### 8.4 Organic acids present in stem part of the plant.

3-Quinolincarboxylic acid, Indole-3-carboxylic acid, Catechol, Caffeic acid,  $\alpha$ -Linolenic acid, Linoleic acid, Palmitic acid, Stearic acid, Oleic acid, p-Coumaric acid, Ferulic acid, Docosapentaenoic acid, Eicosapentaenoic acid, Docosahexaenoic.

### 8.5 Vitamins

Vitamin A, Riboflavin, Niacin, Pyridoxine, Vitamin C, Folates, Pantothenic acid, Thiamin,  $\alpha$ - Tocopherol, Hesperidin.

### 8.6 Minerals

Minerals such as phosphorus, manganese, iron, and calcium, copper are present in stem

### 8.7 Other compounds

Portulacerebroside,  $\beta$ -Sitosterol, Daucosterol, Glutathione, Proline, Melatonin, Chlorophyll, Tannin, Isopimpinellin, Robustin, Bergapten are present in the (stem) part of *Portulaca oleracea*.

## 9. Quantitative phytochemical analysis

### 9.1 Alkaloid:

Method given by Harborne (1973) was followed. Five gm of dry powdered sample was soaked in 200 ml of 10% acetic acid in ethanol and left undisturbed for 4 hours.

Solution was filtered and the extract was reduced to one fourth by heating in the water bath. To this concentrate, ammonium hydroxide was added till the complete precipitation. Precipitate was washed with dilute ammonium hydroxide and filtered. Filtrate, the total alkaloid was dried and weight was recorded.

## 9.2 Flavonoid:

Procedure given by Bohrn and Kocipal-abyazan (1994) was followed. Ten gm of dry powdered sample was soaked in 100ml of 80% aqueous methanol for 5 hours to extract flavonoid. The procedure was repeated thrice for complete extraction. Solution was filtered using whatman filter paper No 42 and the filtrate containing flavonoid was dried in water bath and the weight was recorded.

## 9.3 Tannin:

Procedure given by Van- burden and Robinson (1981) was followed. Half gm of the plant sample was shaken in 50 ml of distilled water over the shaker. It was filtered using whatman paper, and the filtrate was diluted to a final volume of 50 ml. To 5 ml of this filtrate, 0.1 N HCL and 0.008M potassium ferrocyanide (2ml) was added. Optical density was measured at 605 nm, and total tannins were calculated as per the formula given by Van- burden and Robinson (1981)

## 9.4 Saponin:

Method given by Obadoni and Ochuko (2001) was adopted. Twenty ml of the sample was heated for 4 hrs in 20% aqueous ethanol over water bath with stirring at 55°C. Solution was filtered and the residue was again subjected to extraction and filtered. Both the filtrates combined together were reduced to 40 ml over water bath at 90°C. The concentrate was taken in a separating funnel, to this, 20ml diethyl ether was added. It was shaken vigorously. Upper aqueous layer was separated, lower ether layer was discarded. Saponin content was collected after repeated purification.

## 9.5 Protein:

Fresh plant material was used for total protein estimation, using bovine serum solution as standard, as per Lowry et al. (1951) procedure. The absorbance was measured at 660 nm and the standard graph was plotted. Protein present in the fresh sample was estimated using the standard graph

## 10. PHARMACOLOGICAL ACTIVITIES

According to the literature *Portulaca oleracea* has been reported to possess hepatoprotective, analgesic and anti-inflammatory, antioxidant, anticancer, wound healing, bronchodilator, neuroprotective, hypochlolesterolemic and many other biological activities. Further pharmacological studies regarding these activities have been undertaken by various workers which are given below:

### 10.1 Antimicrobial effect

The antimicrobial activity against two gram positive bacteria (*Bacillus subtilis*, *Staphylococcus aureus*) and one gram negative bacteria (*Pseudomonas aeruginosa*) by using the aqueous and ethanolic extracts of root and leaves of *Portulaca oleracea*. The highest antibacterial and antifungal activity was observed at the concentration of 750µg/ml. Ethanolic root extract was more potent to inhibit the growth of *Pseudomonas aeruginosa* while aqueous extract was comparatively more potent for *Bacillus subtilis*, *Staphylococcus aureus*. Dhole et al.

### 10.2 Antioxidant effect

Vincenzo Sicari et al. reported the antioxidant effect of *Portulaca oleracea* Linn. In his study two different solvents MeOH/H<sub>2</sub>O and EtOH were applied to fresh and dried leaves. The extracts were analysed using HPLC-DAD phenolic acids and flavonoids were identified in all samples. Total antioxidant activity was measured by using the albino rats (ABTS) and 1,1-diphenyl-2-picrylhydrazyl (DPPH) and ferric reducing antioxidant power (FRAP) assay. Fresh hydroalcoholic purslane exhibited a promising radical scavenging activity. Sanja et al.

### 10.3 Anticonvulsant effect

The aqueous extract of the *Portulaca oleracea* leaves showed the anticonvulsant effect in healthy albino mice. The purslane extract significantly reduced the duration of tonic hind limb extension in maximal electroshock. Convulsion was induced by pentylenetetrazole in a dose dependent manner, the aqueous extract delayed the onset and decreased the duration of clonic convulsions.

### 10.4 Bronchodilator effect

Boiled and aqueous extract of *Portulaca oleracea* showed a relatively potent relaxant effect in concentration dependent manner on guinea pigs tracheal chain which was compared with theophylline. These results were also comparable to greater than theophylline at different concentrations. This was reported by Boskabady et al.

### 10.5 Hepatoprotective activity

Prabhakaran v et al. evaluated that the suspension of methanol and petroleum ether extracts of *Portulaca oleracea* in methyl cellulose for hepatoprotective activity in wister albino rats by inducing hepatic injury with D-galactosamine (400mg/kg). Altered biochemical parameters were significantly restored at the dose levels of 200mg/kg and 400mg/kg. When compared to D-galactosamine and silymarin treated groups. Histology of the liver section of albino rats also showed to significantly prevent D-galactosamine toxicity as revealed by the hepatic cells with well-preserved cellular architecture. Biochemical and histological data confirmed significant hepatoprotective activity of these extracts.

### 10.6 Neuroprotective effect

Hingxing et al. investigated the neuroprotective effects and mechanism of aqueous extract of *Portulaca oleracea* at the doses of 2.5, 5 and 10 mg/kg per day on SD mice injected daily with d-gal (50mg/kg/day) by behavioral tests. When compared to d-gal treated mice, the extract treated mice showed higher activity upon induction by new environmental stimuli, lower anxiety and higher novelty-seeking behaviour in the open field tasks and significantly improved learning and memory ability, when compared with d-gal-treated mice.

### 10.7 Nephroprotective activity

Aqueous and ethanolic extract of *Portulaca oleracea* against cisplatin induced acute renal toxicity was studied in rats. Treatment with aqueous and ethanolic extracts in the highest dose (0.8 and 2 g/kg), 6 and 12 hour before cisplatin injection reduced blood urea nitrogen and serum creatinine. Tubular necrotic damage was also not observed. In another group rats treated with aqueous and ethanolic extract, 6 and 12 hr after cisplatin injection also had blood urea nitrogen and serum creatinine levels significantly lower than those receiving cisplatin alone but mild to moderate cell injury was observed.

### 10.8 Skeletal muscle relaxant activity

Okwuasaba et al. investigated the skeletal muscle relaxant properties of an aqueous extract of this plant on the twitch and tetanus tension evoked by electrical stimulation using the rat phrenic nerve hemidiaphragm and frog sciatic nervesartorius muscle preparations and on contractures induced by nicotinic agonists using the rat rectus abdominis muscle preparation. Their observations indicate that the aqueous extract possesses unique skeletal muscle relaxant properties which do not appear to involve interference with cholinceptor mechanism(s). They concluded that the mechanism of action of the extract may involve interference with Ca<sup>2+</sup> mobilization in skeletal muscle.

### 10.9 Analgesic activity

Heng-zhi wang, Chuan-jin wang evaluated the analgesic activity of natural Allantoin from *Portulaca oleracea* seed. Allantoin was isolated from *Portulaca oleracea* seed for first time and analgesic effect was evaluated in acetic acid-induced abdominal constriction tests in mice with i. p injection. The result indicated that the analgesic effect of allantoin was almost as strong as aspirin. Allatoin was observed to be analgesic with dose dependence proliferation and the tested mice did not exhibit a tendency to be addicted to allatoin. These results suggested that allatoin could be a promising candidate as novel analgesic agent.

### 10.10 Wound healing activity

The preliminary wound healing activity of *Portulaca oleracea* was studied using *Musculus svi-1*. Fresh homogenized crude aerial part of *Portulaca oleracea* were applied topically on the excision wound surface as single dose in different amounts. The results suggested that *Portulaca oleracea* accelerates the wound healing process by decreasing the surface area of the wound and increasing the tensile strength. The greatest contraction was obtained at a single dose of 50mg and second greatest by two doses of 25mg. Measurement of tensile strength healed area were in agreement.

### 10.11 Anti-tumor activity

Shiva khatibi et al investigated the cytotoxic an antiproliferative effect of *Portulaca oleracea* ethanolic extraction on Helacell line. In this study, Hela cells were cultured and exposed to various concentration of *Portulaca oleracea* ethanolic extract for 24 and 48 hours. Cytotoxicity and cell viability were evaluated, usin MTT (3-(4,5-dimethylthiazole-2yl)-2,5- diphenyltetrazolium bromide) and trypan blue respectively. However the results suggested that ethanolic extract of *Portulaca oleracea* effectively decreased proliferation of Hela cell (P<0. 001). It also decreased the viability of the cells after treatment with extract (P<0. 001) and it exerts its time and dose dependent effect.

### 10.12 Antihypertensive activity:

An aqueous extract of the stems and leaves of *P. oleracea*abolished the twitch contraction of the directly stimulated rat hemidiaphragm preparation. The effects of the extract mimic qualitatively the action of potassium oxalate-a known constituent of *P. oleracea*on the diaphragm. Removal of K<sup>+</sup> ions from the methanol extract by passing it through a cation exchange resin reduced

the inhibitory effect of the extract. There was a positive correlation between the concentration of K<sup>+</sup> ions in the extract and the effects of potassium chloride of similar molarity. It was concluded that the K<sup>+</sup> ion content of *P. Oleracea* is at least partly responsible for the relaxant effect observed on the isolated rat diaphragm. An aqueous extract of *P. oleracea* leaves and stems produced a dose dependent relaxation of guinea pig fundus, taenia coli and rabbit jejunum and a dose dependent contraction of the rabbit aorta. On spontaneously beating rabbit right atria and electrically paced left atria, the extract produced a dose dependent negative inotropic and chronotropic effects. On rat blood pressure, the extract produced dose dependent pressor responses.

### 10.13 Anti-fertility effect:

The antifertility effects of alcoholic extract of *P. oleracea* seeds were observed on the reproductive organs of male albino mice after s.c. administrations of 15, 20 and 30 doses (1 dose=50 mg/mouse per alternate day). The treatment produced mass atrophy of spermatogenic elements. Epididymal lumina were devoid of spermatozoa or contained debris. Treatment led to significant decrease in absolute weights of testes, epididymides, vas deferens and seminal vesicles. Administration of 30 doses produced a significant decrease in protein content and sialic acid of testes, epididymides and seminal vesicles remained unaltered after 30 doses while it was drastically reduced in testes. The administration (s.c.) of alcoholic extract of *P. oleracea* seed induced an effective impairment of spermatogenesis.

### CONCLUSION

*Portulaca oleracea* is a unique traditional herb which is used by ancient Romans to treat dysentery, intestinal worms, headache, stomach aches. The plant itself possesses approximately 30 different biological activities and over 60 medicinal indications. Extensive survey of literature reported that the *Portulaca oleracea* possesses different phytochemical constituents such as alkaloids, flavanoids, terpenoids, organic acids, vitamins, minerals and high content of nutrients. As a matter of fact that it possesses a wide range of pharmacological activities like anti-ulcerogenic effect, anti-diabetic effect, anti-microbial activity, neuroprotective effect, antioxidant property, antitussive effect, analgesic effect etc, with less side effects when compared to synthetic drugs. *Portulaca oleracea* is in use since antiquity in Unani medicines for treating various ailments such as skin diseases, fever, dysentery, bleeding piles, spleen diseases etc. Moreover now-a-days it is useful in cosmetics the plant which is rich in omega-3 fatty acids which helps the skin cells flexible. This review concludes that *Portulaca oleracea* may have a significant role in health care.

### SUMMARY

The plant *Portulaca oleracea* were in use at least 2000 years ago. Plants consist of different Vernacular names and has specific characteristics. The *Portulaca oleracea* itself possesses the various phytochemical constituents in different parts of the plant and pharmacological activities. It is abundant in nutritious value. *Portulaca oleracea* is often used in cosmetics and Unani.

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