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REVIEW ARTICLE

PORTULACA OLERACEA (KHURFA)-WHOLE PLANT: AN UNDERUTILIZED MEDICINAL PLANT WITH PROMISING PHARMACOLOGICAL ACTIVITIES-A REVIEW

Sadaf[1], Tabassum Latafat[2], Mursaleen Naseer[1] and Jamal Azmat[1]
1. Assistant Professor, Department of Moalejat, Ajmal Khan Tibbiya College, AMU, Aligarh,UP,India.
2. Professor, Department of Moalejat, Ajmal Khan Tibbiya College, AMU, Aligarh,UP, India.

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Abstract

Portulaca oleracea L.,commonly known as purslane, is a widely distributed annual succulent plant traditionally used in various folk medicinal systems. Rich in bioactive compounds such as omega-3 fatty acids, flavonoids, alkaloids, vitamins, and minerals, P. oleracea has drawn significant scientific interest for its pharmacological potential. Numerous studies have highlighted its antioxidant, anti-inflammatory, antimicrobial, antidiabetic, neuroprotective, and hepatoprotective properties.Additionally, it has shown promising effects in cardiovascula r health and wound healing. This review provides a comprehensive overview of the ethnobotanical uses, phytochemical composition, and diverse therapeutic potentials of Portulacaoleracea, aiming to bridge traditional knowledge with modern pharmacological evidence. The plant's safety profile, potential applications in nutraceutical and pharmaceutical industries, and areas requiring further investigation are also discussed. This synthesis underscores P. oleracea as a valuable medicinal resource that merits more attention in clinical and experimental research.

Introduction:-

Portulacaoleracea, commonly known as purslane, is a herbaceous, succulent, annual weed widely distributed across warm regions of the world, including India, Europe, America, Canada, New Zealand, and Australia. In India, it grows abundantly—including in the Himalayas up to 170 m altitude—and is commonly found in flower beds, cornfields, and waste areas.[1,2]The genus name **Portulaca** is believed to be derived from the Latin words **porto** (to carry) and **lac** (milk), referencing the plant's milky sap. P. oleracea has been officially recognized in the French, Mexican, Spanish, and Venezuelan pharmacopoeias.[3]

Botanical Name: Portulacaoleracea[4,5,6,7,8]
Family: Portulaceae[4,5,6,7,8]
Vernacular names
Unani : Khurfaa[9,10],Kulfaa[9,10]
English : Purslain[4,11] · Garden Purslane[6]Common Purslane[5]

Corresponding Author:-Sadaf
Address**:-**Assistant Professor, Department of Moalejat, Ajmal Khan Tibbiya College, AMU, Aligarh,UP,India.

Hindi :Qalfa[11]Khalfa[11] , Kulfa[8,12]BadiLona[12]
Urdu : Qalfa[11],Khalfa[11]Khurfa[12] Khurfah[5,7]
Arabic :Baqlat-ul- humqa[4,11,12], BaqlatulMubarak[11],Baqlatul zahr[11]
Persian :Khurfa[11,12], Turuk[11]
Marathi :Kurfah,[12] Ghola[12]
Punjabi :Lonak,[12] Chhotalunia,[12] Khurfa,[12] Kufa[12]
Telugu :Pappukura,[12]Peddapavila Kura,[12] Payilidura,[12] Pavilikura[12]

Fig. 1:- Seedsof Khurfa.

Fig. 2:- Stems,Leaves and Flowers of Khurfa.

Material and Methods:-

This review was conducted through an extensive literature search using scientific databases such as PubMed, Scopus, Google Scholar, and Web of Science. Research articles, review papers, and ethnobotanical studies published in peer-reviewed journals were considered.

Description:-

Macroscopic:

Root – Cylindrical, small, oblique, surface smooth, brownish-grey; secondary roots less in number, roothairs abundant in upper region, fracture short.[12]

Stem – Almost cylindrical, swollen at the nodes, ribed, branched, 0.1 to 0.2 cm in diameter, fracture, short; odour, characteristic.[12]

Leaf – Simple, sub-sessile, cuneiform, rounded and truncate at the apex; 0.3 to 2.5 cm long and 0.1 to 0.6 cm wide, oblong, spathulate, smooth and greenish-brown.[12]

Flower – A few, bright yellow at terminal heads, sometimes in axillary clusters of 2-6, subtended by an involucre of 3-4 leaves; sepal 0.25-.04 cm long; petals obovate, 0.5 cm long, very delicate and soon falling off; stamens 8-12; style 5-6 fid, 0.35-0.4 cm long.[12]
Fruit – An ovoid capsule, 0.3 cm long, dehiscing above the base.[12]
Seed – Numerous, reniform, black, minute, 0.06-0.07 cm across, dark brown.[12]

Microscopic:

Root –The transverse section of the drug exhibits 5 to 15 layers of cork, with the inner layers filled with reddish-brown contents. This is followed by the secondary cortex, which is made up of thin-walled, oval cells possessing prominent intercellular spaces, contributing to the tissue's loose arrangement.Thepericycle is represented by fibres arranged in patches, indicating structural support. The secondary phloem comprises sieve tubes along with parenchymatous cells, serving in the conduction of nutrients and storage.The secondary xylem consists of vessels, tracheids, and parenchyma. The vessels are either solitary or occur in groups of 2 to 5, typically arranged in radial rows, and display simple pits and spiral thickening. The tracheids are thick-walled with a wide lumen, while xylem parenchyma is found to be abundant, likely functioning in storage and lateral conduction.Starch grains are found in various tissues including the secondary cortex, phloem, xylem parenchyma, and ray cells. These starch grains are both simple and compound, measuring 6–14 μm in diameter, and often consist of 2–3 components.

Stem –The transverse section is wavy in outline and shows 5 to 10 layers of thin-walled cork, with reddish-brown contents present in a few cells. Beneath the cork lies the secondary cortex, which consists of 2–3 layers of collenchymatous cells followed by 3–4 layers of parenchymatous cells with distinct intercellular spaces, contributing to flexibility and aeration.Thepericycle is represented by patches of pericyclic fibres, providing structural support. The secondary phloem is mainly composed of sieve tubes and parenchymatous cells, indicating its role in conduction and storage of nutrients.The secondary xylem consists of vessels, tracheids, and parenchyma. The vessels exhibit simple pits and spiral thickening, while the tracheids are thick-walled with a wide lumen. The xylem parenchyma is abundant and thick-walled, indicating its involvement in storage and lateral conduction.Rosette crystals of calcium oxalate and starch grains are present in the secondary cortex, phloem, xylem parenchyma, ray cells, and pith. The starch grains are a mix of simple and compound forms, signifying rich storage capacity within the tissue.[12]

Leaf -
Midrib – shows a collateral vascular bundle surrounded by a sheath of palisade cells; rest of the tissues between vascular bundle and epidermal cells composed of thin walled, oval, parenchymatous cells; stomata paracytic type; rosette crystals of calcium oxalate and starch grains simple, as well as compound, measuring 6-14 μ , present in mesophyll cells.[12]
Lamina– shows a single layered upper and lower epidermis, covered externally with a thick cuticle; paracytic stomata present on both surfaces; palisade single layered; spongy parenchyma cells more or less isodiametric and loosely arranged.[12]
Powder: Grayish-brown; shows groups of oval to polygonal, thin-walled, parenchymatous cells, pitted and spiral vessels, fragments of cork cells rosette crystals of calcium oxalate and starch grains, simple as well as compound, measuring 6-14 μ in diameter having 2-3 components.[12]

Identity, Purity And Strength
Foreign matter :Not more than 2 per cent, Appendix 2.2.2.
Total ash :Not more than 30 per cent, Appendix 2.2.3.
Acid-insoluble ash :Not more than 5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive : Not less than 3 per cent, Appendix 2.2.6.
Water-soluble extractive :Not more than 19 per cent, Appendix 2.2.7.[12]

Thin Layer Chromatography (T.L.C.)
T.L.C. of alcoholic extract of the drug on Silica gel 'G' plate using Toluene: Ethylacetate
(9 : 1) shows six spots at Rf. 0.08, 0.10 (both green) 0.41 0.52 (both faint green), 0.68 (yellow) and 0.76 (green) in visible light. Under UV (366 nm) six fluorescent zones are visible at Rf. 0.08, 0.10, 0.41, 0.52, 0.68, 0.76 (all pinkish red). On exposure to Iodine vapour six spots appear Rf. 0.10, 0.50, 0.61, 0.68, 0.76 and 0.98 (all yellow). Appendix 2.2.10[12]

Parts Used
1) Seeds[4,6,13,14]
2) Leaves[4,13,14]
3) Stems[13]
Temperament
Cold 3°[14] Moist 2°[4,14,] Cold Moist[12,13]
Dose
3-7g[12]
Badal (Substitute)
Kahu[5,14], Asapghol[15]
Muzir(Adverse Effects)
Muzir-e-Benai[13,14]Muzir-e-Tihal.[13]Muzir-e-meda[4,14]
Musleh (Corrective)
Mastagi[5,14] Podina[13,14]Qand Safaid[15]
Pharmacological Actions
Mudirr-i-Bawl (Diuretic)[5,7,15]
Mubarrid(Refrigerant)[5,13,14]
Musakkin-e-Safrawa Dam[12]
Mulayyin (Laxative)[11, 15]
Muaddil [5]
Mufattit-i-Hasah(Lithotropic)[15]
Therapeutic Uses
Shiddat-e-Atash,[12] Ghalayan-e-Dam,[12]Ziyadati-e-Safra, Sozishe- Meda,1[2]Amawa Baul.[12]
Important Formulations
Mufarreh Barid,1[2]
Banadiq-ul- Buzoor[12]

Chemical Constituents
OleracinsI(5-O-Beta-cellobiosidesof betanidin)18,[183,188],Oleracins II(5-O-Beta-cellobiosides of Isobetanidin)18,[183,188],acylated betacyanins isolated18[183],Portulic lactone16[173], 3-hydroxyportulol ether16[173], 5 hydroxyportula116[173],5hydroxyportulicacid16[173],Portulide16[173],Portulol16[173],Portula116[173]Portulicacid16[173],Portuleone16[173],Portulenol16[173],Portulene16[173],PilosanonesA&B16[173],Noradrenaline17[182,188]4-(2-aminoethyl),pyrocatechol17[182],3-(3,4-dihydroxyphenyl) alanine17[182,]catechol17[182]

Pharmacological Studies
Neuropharmacological-Effects
The ethanolic extract of P.oleracea var. sativa, upon intraperitoneal administration, demonstrated multiple neuropharmacological activities in experimental models. It significantly reduced locomotor activity in mice and exhibited antinociceptive effects in rats, as assessed by the tail flick method. The extract also delayed the onset of pentylenetetrazole-induced convulsions in mice, indicating anticonvulsant potential. Furthermore, both in vitro (rat hemidiaphragm) and in vivo (grip strength) studies revealed notable muscle relaxant properties. Importantly, the antinociceptive effect was attenuated by naloxone pre-treatment, suggesting the involvement of opioid receptors in mediating this response. These findings collectively indicate that P. oleracea var. sativa exerts diverse effects on both the central and peripheral nervous systems.[19]

Antihypertensive-Activity
The aqueous extract of P. oleracea stems and leaves has demonstrated significant relaxant and cardiovascular effects in various experimental models. In vitro, the extract abolished twitch contractions in the directly stimulated rat hemidiaphragm preparation, mimicking the action of potassium oxalate an identified constituent of P. oleracea. Removal of potassium ions (K^+) from the methanol extract using a cation exchange resin reduced its inhibitory effect, indicating a positive correlation between K^+ concentration and pharmacological response. The K^+ content was thus considered at least partially responsible for the observed relaxant effects on skeletal muscle tissue.[20]Aqueous extracts exhibited dose-dependent relaxation of smooth muscle preparations such as guinea pig fundus, taenia coli, and rabbit jejunum, alongside a dose-dependent contraction of rabbit aorta. On cardiac tissues, the extract produced dose-dependent negative inotropic and chronotropic effects on both spontaneously beating right atria and electrically

paced left atria in rabbits. In vivo studies showed that administration of the extract elicited dose-dependent pressor responses in rat blood pressure models.[21,22]

Anti-inflammatory-andAnalgesic-Effects

The ethanolic extract of the aerial parts (dried leaves and stems) of P.oleracea ssp. sativa has demonstrated significant anti-inflammatory and analgesic activities in experimental models. These effects were observed following both intraperitoneal and topical administration, but not through the oral route. When compared to diclofenac sodium, a standard synthetic anti-inflammatory drug used as an active control, the extract exhibited comparable efficacy in reducing inflammation and pain responses.[23,24] These findings suggest the potential of P. oleracea as a natural alternative for managing inflammation and pain, particularly through non-oral delivery routes.

Bronchodilatory-Effect

The bronchodilatory potential of the boiled extract of P. oleracea was evaluated in asthmatic patients. The extract produced significant improvements in all measured pulmonary function tests (PFTs), with statistical significance ranging from $P< 0.05$ to $P< 0.01$. Notably, the maximum increase in PFT values induced by the boiled extract was comparable to that produced by theophylline, a commonly used bronchodilator. However, the peak expiratory flow (PEF) and mid-expiratory flow ($MEF_{(25–75)}$) increases were significantly lower than those observed with salbutamol ($P< 0.05$ for both parameters). The onset of the bronchodilatory effect of P. oleracea was similar to that of theophylline, beginning at around 60 minutes post-administration, but its effects declined after 120 minutes. These findings suggest that P. oleracea exerts a relatively potent yet transient bronchodilatory effect, indicating its potential utility in managing asthma symptoms.[25]

Antimicrobial-Effects

P. oleracea exhibits antimicrobial activity against various bacterial and fungal species. Aqueous and ether extracts showed effectiveness against gram-negative bacteria, while ethanol and chloroform extracts inhibited Rhizobium leguminosarum**,** and ethanol extract also acted against Bacillus subtilis. No activity was noted against E. coli[26.]Hexane and aqueous extracts inhibited Fusarium spp., while ethanol and chloroform extracts were effective against Rhizopusartocarpi**,** as confirmed by agar cup and filter disc methods.[27]

Intestinal-Parasitic-Activity

In an ethnobotanical study using cognitive salience measures from free-listing tasks, P. oleracea was identified among five plants commonly used to treat intestinal worms. The other plants included Ambrosia hispida, Aristolochiatrilobata**,** Chenopodiumambrosioides, and Artemisia absinthium**.** The presence of bioactive compounds in these species supports their traditional use. The combination of cognitive prominence and biochemical evidence suggests that P. oleraceamay offer effective treatment for controlling intestinal parasitic infections.[28]

Use in Urinary Problems

Anethnobotanical study conducted in Trinidad and Tobago (1996–2000) involving 30 male and female respondents identified several plants traditionally used for urinary disorders and diabetes mellitus. A non-experimental validation of these plants was performed to assess their safety and potential efficacy. P. oleracea was among the plants with sufficient evidence supporting its traditional use for managing urinary problems. The findings aim to guide future clinical trials and inform healthcare providers to prevent counter-prescribing in the Caribbean context.[29]

Gastric-Antiulcerogenic-Activity

Aqueous and ethanolic extracts of P. oleracea were evaluated in mice for their antiulcer potential against gastric lesions induced by HCl and absolute ethanol. Both extracts demonstrated a dose-dependent reduction in ulcer severity, with the highest doses showing effects comparable to sucralfate. Additionally, oral and intraperitoneal administration of the extracts significantly reduced gastric acidity in pylorus-ligated mice. These findings suggest that P.oleracea possesses notable gastroprotective properties, supporting its traditional use in treating gastrointestinal disorders.[30]

Hepatoprotective-Activity

Administration of a 70% alcoholic extract of P. oleracea to rats with carbon tetrachloride (CCl_4)-induced liver injury significantly restored hepatic marker enzymes and total bilirubin levels to near-normal values. These results indicate that P. oleracea possesses hepatoprotective activity and may aid in liver function recovery.[31]

Hypocholesterolemic-Effects

Ahmed and colleagues investigated the effects of a hydroalcoholic extract of P. oleracea leaves on serum lipid levels in rabbits fed a hypercholesterolemic diet (0.5% cholesterol). The extract was administered orally at doses of 200, 400, and 800 mg/kg body weight for 12 weeks. Results showed a significant reduction in serum total cholesterol and atherogenic index in all treated groups compared to the positive control. These findings suggest that P. oleracea may be beneficial in the management of hypercholesterolemia.[32]

Anti-hyperglycemic-Activity

Oral administration ofP. oleracea homogenates significantly reduced blood glucose levels in alloxan-induced diabetic rabbits, restoring them to near-normal levels. This finding indicates the potential of P. oleracea as an effective agent for managing hyperglycemia.[33]

Toxicity-Studies

Dried powder of P. oleracea was extracted using various solvents, including methanol, ethanol, acetone, ethyl acetate, ether, trichloromethane, dichloromethane, benzene, and petroleum ether, and evaluated for bioactivity against Aphis gossypii Glover. Among the nine extracts, the methanol extract exhibited the highest contact toxicity, while the dichloromethane extract showed the strongest antifeeding toxicity. Although comprehensive toxicity data in humans is lacking, P. oleracea is known to contain cardiac glycosides and oxalic acid, which may pose potential toxic risks.[34]

Conclusion:-

Portulacaoleracea exhibits a wide range of pharmacological activities, including neuroprotective, antihypertensive, anti-inflammatory, bronchodilatory, antimicrobial, antiulcer, hepatoprotective, hypocholesterolemic, and antihyperglycemic effects. Its traditional use in treating various ailments is supported by both ethnobotanical evidence and experimental studies. Given its rich phytochemical profile and therapeutic potential, P. oleracea holds promise as a natural remedy in modern medicine. However, further clinical research is essential to establish its efficacy, safety, and mechanisms of action.

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Declaration of Competing Interest

None.

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