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MORPHOLOGICAL AND ANATOMICAL STUDIES OF PURSLANE (PORTULACA OLERACEA) WEED-AN ETHNO MEDICINAL PLANT

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ABSTRACT

Portulaca oleracea which is widely distributed in various habitats of Himalayan region was investigated morphologically and anatomically during present study. Anatomical and morphological features of different vegetative organs (leaf, stem and root) and reproductive organs (flower, fruit and seed) were studied along with medicinal importance of the plant. Portulaca oleracea is an annual succulent herb belongs to the family Portulacaceae. In the morphological study it was observed that the plant have sessile (stalk less) leaves which were ovate, smooth, succulent, arranged in opposite manner, stem was aerial, weak and cylindrical, root consists of a long thick taproot as well as many fibrous lateral roots, flowers were single in leaf axils, fruit consists of round to egg-shaped capsules with glossy brown and black seeds. In anatomical studies, cross sections of the leaf, stem and root were examined. From the earlier research work on this plant, it has been reported that it is an important medicinal plant; with a good source of alpha-linolenic acid which is an omega-3 fatty acid that is useful for human growth, development and in prevention of various diseases. Purslane has better nutritional quality than the major cultivated vegetables with higher beta-carotene, ascorbic acid, and alpha-linolenic acid (omega-3 fatty acid) along with high nutritive and antioxidant properties.

KEY WORDS

Morphological, anatomical, Portulaca oleracea, medicinal plants, omega-3 fatty acid

INTRODUCTION

Weed species (which grow on their own, without human efforts) have certain effects in agriculture, which are mostly in the form of different harmful results but somehow there are also some beneficial effects. Purslane (*Portulaca oleracea*) has been used historically as a remedy for arthritis and inflammation in Chinese medicine and Indian Ayurveda. In India it is known by the name 'Rudravanti' in Hindi; 'Lonika' in Sanskrit, 'Nuner' in Kashmiri and 'Luniya' in Garhwali Language. Purslane (*Portulaca oleracea*) is an annual succulent herbaceous weed from the family Portulacaceae and a common weed in turf grass as well as in the field crops ^[1-3]. It has smooth, reddish, mostly prostrate stem and

the leaves, which may be alternate or opposite, are clustered at stem joints and end ^[4].

Purslane is common weed plant and found all over the world. But this plant has enormous ability for infestation mainly due to the large number of seeds produced by plant. It has particular ability to re-root after cultivation because the fleshy stem remains moist and viable for several days and have a great potential to form roots ^[5]. This plant is mostly known as halophytic plant species for desalinating saline soil and for drainage water reuse system ^[6]. Purslane has a slightly sour and salty taste ^[7]. This weed plant deserves special attention from agriculturalists as well as nutritionists, because of its high nutritional quality, beta-carotene, ascorbic acid and alpha-linolenic acid ^[8]. It has extremely high levels of omega-3 fatty acids for a land vegetable as well as



significant amount of fiber, vitamin A, vitamin C, Bfamily vitamins, iron, magnesium, manganese, potassium, calcium, and copper. Whole plant (leaves, stem, flowers, and seeds) is edible and has been used for thousands of years in different variations. The Purslane plant (*Portulaca oleracea* L.) is a very good source of alpha-linolenic acid ^[9-10] Alpha-linolenic acid is an omega-3 fatty acid plays an important role in human growth, development and in the preventing many diseases.

MATERIALS AND METHODS

Study area

Present research work was carried out in the Botany Department of Uttaranchal college of Science & Technology (P.G.) Dehradun, Uttarakhand (India), which located in the Doon valleys (on the foothills of the Garhwal Himalayas) between two of India's greatest rivers Ganges and Yamuna. For the investigation Purslane (Luniya) was procured from the Sahastradhara region of the Dehradun.

Climatic condition of the study area

The climate of Dehradun is the same as of a North-Indian city i.e., cool winters, warm summers, rainy monsoons and a balmy spring also depends upon the altitude, the higher you go the colder you will feel. During the summers, the temperature ranges between 36°C and 16.7°C. In winters, the temperature lies in between 23.4°C and 5.2°C and gets an average rainfall of 2073.3 mm annually.

General experimental Design

- 1. Morphological study of vegetative parts root, stem and leaf and reproductive parts flower, fruit and seed.
- 2. Anatomical study of root, stem and leaf.
- 3. Assessment of the medicinal importance of plant.

RESULTS AND DISCUSSION

1-Morphological study

The Purslane weed which is an angiospermic plant was collected from sahastradhara region and identified with the help of Garhwal Flora of Babu ^[11]. Fresh samples were used for morphological measurements. Samples were fixed in 70% alcohol for anatomical studies.

HABIT: The plant is herb.

STEM (Fig.2)

Purslane has reddish green, herbaceous stem which was aerial, weak and cylindrical, up to 30 cm long, 2-3 mm in diameter, swollen at the nodes, smooth, glabrous (not hairy) apart from the leaf axils, diffusely branched and the internodes are 1.5-3.5 cm in length, similar observation was earlier reported by some researchers ^[9].



Fig. 2. Morphology of *Portulaca oleracea* Linn. LEAVES (Fig.3)

Leaves were sessile (stalk less), ovate, smooth, succulent (fleshy and juicy leaf), shiny and vary from 0.5 to 2 inches in length. The leaves were generally arranged in the opposite manner, short petiolated, stipular appendages present were minute or absent and taste sour.



Fig.3. Leaves and Flowers of *Portulaca oleracea* Linn. The petiole was short about 1-1.5 mm long and 0.5 mm thick with greenish upper surface and reddish lower surface of leaves. Present results are in conformity with other researchers ^[6].

FLOWER (Fig.3)

Flowers initiation occurs during May to September, originates as single or clusters of 2-5 at the tips of stems. Flowers usually borne single in leaf axils and open during the sunshine. Flowers were bisexual, regular; 2 sepals, ovate, triangular and 3-5 mm long; 5-petals, adnate at base to sepals, broadly obovate, 3-8 mm long, yellow, emarginated; stamens 7-12, half inferior ovary; one celled style with 3-6 arms. Flowers opened only on hot and sunny day from mid-morning to early afternoon. Similar findings were also noted by Riccieri et al. (2000) ^[12].



ROOT:

Root consists of a long thick taproot as well as many fibrous lateral roots.

FRUIT (Fig. 4.)

Fruit consists of almost round to egg-shaped capsules, usually about 4 to 8 mm long that open around the middle to release the seeds. Similar observations were noted by other researchers ^[1].



Fig. 4. Fruit of Portulaca oleracea Linn.

SEEDS (Fig. 5.)

Seeds were reddish brown to black, oval and tiny (0.02-0.03 inches in diameter). They were glossy, brownish and black when mature. Cotyledons were egg-shaped to oblong, hairless and succulent. A single plant may produce 240,000 seeds which may germinate even after 5-40 years. Present results are in conformity with Vidyullatha et al. (2013) ^[13].



Fig. 5. Seeds of *Portulaca oleracea* Linn. 2. Anatomical study

LEAF (Fig.6.)

T. S. of leaf showed that ground tissue consists of large, thin walled compact parenchymatous cells. Vascular stand has a central small segment and two larger lateral segments; three together arranged in shallow arc and the phloem cells occur on the abaxial convex part of xylem strand. Stomata occur on both adaxial and abaxial sides of the leaf. Stomata were paracytic. The epidermal cells were rectangular to polygonal, slightly lobed; their antidinal walls were thin and slightly wavy. Leaf was isobilateral. A ring of dilated bundle sheath cells surrounds the bundle; these bundle sheath cells are called Kranz-tissue, which are characteristic C₄ -type of photosynthesis of some selected plant species. Similar observations were also seen by Bagepalli et al. (2008); and Kirtikar et al. (2000) ^[9, 14].



Fig.6. T.S. leaf of *Portulaca oleracea* Linn. STEM (Fig. 7.)

T.S. of stem was almost circular in outline; epidermal cells were polygonal in shape and externally surrounded by thick cuticle. Epidermis was followed by 2-3 layers of collenchymatous cells. Cortex was surrounded by thick epidermal layer and endodermis was very well developed. Vascular bundles were lying along the endodermis forming a ring like structure on which the bundles were arranged. The centre consists of large parenchymatous pith resembling to cortex by the shape of cells. The similar results are with the conformity of others Bagepalli et al. (2008)^[9].



Fig. 7. T.S. of the stem of *Portulaca Oleracea* Linn. ROOT (Fig. 8.)

T. S. of root revealed that epidermis was composed of several layers. Large cortex was present (composed of thick parenchymatous cells). Endodermis was clearly separating the cortex from vascular region.



Fig. 8. T. S. of the root of *Portulaca oleracea* Linn.



The central zone of root was covered by large amount of vascular bundles. Big wood vessels or tracheae were apparent which confirm its special role with reference to rapid absorption, Netala et al. (2014)^[15] also reported similar findings.

3-Ethnomedicinal value of Portulaca oleracea

Liu et al. 2000 ^[16] reported that Purslane has superior nutritional quality than the major cultivated vegetables, with higher beta-carotene, ascorbic acid and alphalinolenic acid (Omega-3 fatty acids). Purslane has been described as a power food because of its high nutritive and antioxidant values^[17]. It has been shown to contain five times higher omega-3 fatty acids than spinach [1]. Omega-3 fatty acids belong to a group of polyunsaturated fatty acids which are essential for the human growth, development, prevention of numerous cardiovascular diseases and maintenance of a healthy immune system. Purslane has recently been identified as the richest vegetable source of alpha-linolenic acid, which has resulted in a growing level of interest to introduce purslane as a new cultivated vegetable. Consuming foods that are high in omega-3 fatty acids has been shown to significantly reduce cardiovascular disease as well as atherosclerosis, thereby preventing heart attacks and strokes. Furthermore, the potassium found in Purslane can reduce blood pressure due to its behaviour as a vasodilator, meaning that it relaxes blood vessel and reduces strain on the heart.

Purslane is very low in calories, but it is nutrient rich and packed with dietary fibre, which means that people can feel full after a meal of purslane, but they won't necessarily up there calorie intake by very much, thereby helping people who are struggling to lose weight or maintain their diets. In traditional Chinese medicine, it was widely used to treat diarrhoea, intestinal bleeding, haemorrhoids and dysentery Along with gastrointestinal issues; it can also treat a wide variety of skin conditions as well. The high levels of vitamin A combined with the cocktail of compounds found in this "weed" mean that it can help to reduce inflammation on bee stings and snake bites. It can also boost the healthy appearance of the skin, reduce wrinkles and stimulate healing of skin cells to remove scars and blemishes when consumed. One of the most widespread and tragic diseases in the world today is cancer, so any anti-carcinogenic food item is highly praised. Purslane has significant levels of vitamin C and vitamin A, both of which act as antioxidants to prevent

certain cancers, specifically lung and oral cancers. However, Purslane also contains Betalain pigment compounds, which give the plant its distinctive red and directly connected yellow colouring. Beta-cyanins and beta-xanthins have been with anti-mutagenic effects in the body, that they prevent free radicals from causing mutation in healthy cells, thereby helping to prevent the development of cancer.

Purslane can help to prevent macular degeneration and cataracts by eliminating free radicals that attack the cells of the eye and cause these commonly age-related diseases. The researchers have found that purslane contains relatively high content of oxalic acid, which can be exacerbating the formation of oxalates in the body. Boiling the purslane causes a great deal of oxalic acid to be eliminated, without losing many of the other beneficial nutrients. The range of minerals present in this makes it a healthy choice for people, who want to protect their bones. Calcium, magnesium, iron and manganese are all elements required to develop bone tissue and speed the healing process of the bones in our body. The higher content of iron and copper in purslane means that it will stimulate the production of red blood cells. Both of these minerals are essential for boosting circulation, which means more oxygen being delivered to essential parts of the body, increased healing speed of the cell and organs, increased hair growth and a general improvement of metabolic efficiency as observed by Proctor (2013) ^[18]. Earlier purslane was supposed to protect from evil spirits and if carried was supposed to attract love and luck. It was carried by soldiers to protect them in battle.

CONCLUSION

In the present work morphology, anatomy and the economic benefits of *Portulaca oleracea* were studied. It is a unique herb, which is richest vegetable source of omega-3 fatty acids and protein than all other vegetables. This herb is in use since antiquity in unani and ayurvedic medicines for various ailments such as skin diseases, fever, spleen diseases etc. Purslane plays important role in human growth and development.

We have concluded that the importance of purslane was well known by researchers and its versatile biological activities have been proved on scientific parameters, but at the local level people only known, it as a weed plant. So, we should aware people by conducting seminars, conferences, researches, short-term training



and advertisements, by Government and Nongovernment agencies at the national and international level and we should take steps to cultivate it as a vegetable and conserved for the future benefits.

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