



Pharmacognostical studies of *Portulaca oleracea* Linn.

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RESUMO: “Estudos farmacognósticos de *Portulaca oleracea* Linn”. *Portulaca oleracea* Linn, pertence à família Portulacaceae e é uma erva daninha amplamente distribuída. Ela tem sido utilizada como remédio popular em muitos países como diurético, febrífugo, anti-séptico, antiespasmódico e vermífugo. Este artigo aborda o estudo microscópico da folha, caule e raiz de *Portulaca oleracea*, juntamente com as análises físico-química e fitoquímica preliminar que foram também estudadas.

Unitermos: *Portulaca oleracea*, Portulacaceae, pedapailicura, microscopia.

ABSTRACT: *Portulaca oleracea* Linn, belongs to family Portulacaceae and is a widely distributed weed. It has been used as a folk medicine in many countries as diuretics, febrifuge, antiseptic, antispasmodic and vermifuge. This paper deals with the microscopic study of leaf, stem and root of *Portulaca oleracea*, along with the physico-chemical and preliminary phytochemical analyses that were also studied.

Keywords: *Portulaca oleracea*, Portulacaceae, peddapayilikura, microscopy.

INTRODUCTION

Portulaca oleracea L. (Portulacaceae) is a warm-climate annual, it is known as Lonika in Sanskrit, Peddapayilikura in Telugu. The plant is succulent, herbaceous, erect or decumbent growing up to 30 cm height with cylindrical stem of 2-3 mm in diameter. *Portulaca oleracea* used traditionally for alleviating pain and swelling (Okwuasaba et al., 1987). The plant is usually cut into small pieces and eaten with salt or leaves and seeds are eaten or applied topically to soothe skin (Ghazanfar, 1994). Is employed in Brazil against hemorrhoids and as vermifuge (Agra et al., 2007 and 2008). It also exhibits a wide range of pharmacological effects, including antibacterial (Zhang et al., 2002), analgesic, anti-inflammatory (Chan et al., 2000), skeletal muscle-relaxant (Parry et al., 1987 and 1993) and wound healing (Rashed et al., 2003) activities. It is also consumed as a vegetable, widely sold in shops in United Arab Emirates and Oman (Miller and Morris, 1988) and has been reported to be rich in α -linolenic acid and β -carotene (Liu et al., 2000; Barbosa-Filho et al., 2008). In addition to flavonoids, coumarins (Awad, 1994) and

monoterpene glycoside (Sakai et al., 1996), in particular, it contains *N-trans*-feruloyltyramine (Mizutani et al., 1998), dopamine, dopa, high concentration of noradrenaline (Feng et al., 1961), ferulic acid (Chen, 2000) and adenosine (Meng et al., 1981).

In spite of the numerous medicinal uses attributed to this plant, there is no pharmacognostical report on the anatomical and other physico-chemical standards required for the quality control of the crude drug. Hence the present investigation includes morphological and anatomical evaluation, determination of physico-chemical constants and preliminary phytochemical screening of the different extracts of *P. oleracea*.

MATERIAL AND METHODS

Plant material

The whole plant *P. oleracea* was collected from surrounding Tirumala hills, Tirupathi, Andhra Pradesh in the month of November. The plant was authenticated by comparison with the specimen by Dr. K. Madhava Setty, Department of Botany, Sri Venkateshwara University,

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Tirupathi, Andhra Pradesh. A voucher specimen (KVCP103) has been deposited in the herbarium of department of pharmacognosy, Sri K.V. College of Pharmacy, Chickballapur, India.

Chemicals and instruments

Toluidine blue, tertiary butyl alcohol, ethyl alcohol, acetic acid, formalin, chloral hydrate, ethanol, hexane, petroleum ether, sodium hydroxide, glycerin, Camera Lucida, drawing sheet, glass slides, cover slips, watch glass, rotary microtome. Photographic of different magnification were taken with Nikon Labhot 2 Microscopic unit.

Macroscopic and microscopic analysis

The macroscopy and microscopy of the plant studied were according to the method of Brain and Turner (1975). The cross sections were prepared and stained as per the procedure of Johansen (1940). Leaf constants viz. vein islet number, veinlet termination, and stomatal index were studied according to the method of Evans (2003).

Physico-chemical analysis

Physico-chemical values such as the percentage of ash values and extractive values were performed according to official methods prescribed (Indian Pharmacopoeia, 1996) and the WHO guidelines on quality control methods for medicinal plant materials (WHO/QCMMPM guidelines, 1992).

Preliminary phytochemical screening

Preliminary phytochemical screening was carried out by using standard procedure described by Kokate (1986) and Harborne (1998).

RESULTS AND DISCUSSION

Macroscopic characters

The plant is succulent, herbaceous, erect or decumbent growing up to 30 cm high, with a cylindrical stem of 2-3 mm in diameter, somewhat swollen at the nodes. The leaves are alternate and obovate to spatulate, fleshy, flobrous, base, alternate, margins entire; apex is obtuse. The flowers are in terminal cluster with 2-6 foliar involucre. Sepals two subequal lanceolate, petals are five and flowers are bright yellow in colour. Stamens 12, filaments unequal. Ovary enclosed by the calyx stigma 4 or 5 fid capsules. Fruits are ovoid, circumscissile capsules, seeds numerous, black, muriculate. (Figure 1).

Table 1. Preliminary phytochemical screening of *P. oleracea*.

S. No.	Test	Methanol extract
1	Alkaloids	+
2	Carbohydrates	+
3	Glycosides	-
4	Tannins and phenolic compounds	+
5	Flavonoids	+
6	Fixed oil	-
7	Saponins	+
8	Proteins and amino acids	+
9	Steroids	+

Table 2. Ash values of *P. oleracea*.

S. No.	Parameters	Values % (w/w)
1	Total ash	7.37
2	Acid insoluble ash	0.95
3	Water soluble ash	1.04
4	Sulphated ash	11.35

Table 3. Extractive values of *P. oleracea*.

S. No.	Parameters	Values % (w/w)
1	Alcohol soluble extractive	1.91
2	Water soluble extractive	5.16

Table 4. Leaf constants of *P. oleracea*.

S. No.	Parameters	Values % (w/w)
1	Vein islet number (1 mm ² leaf surface)	13
2	Vein termination number	18
3	Stomata index	3.6



Figure 1. Macroscopy of the aerial aspect of *Portulaca oleracea* Linn.

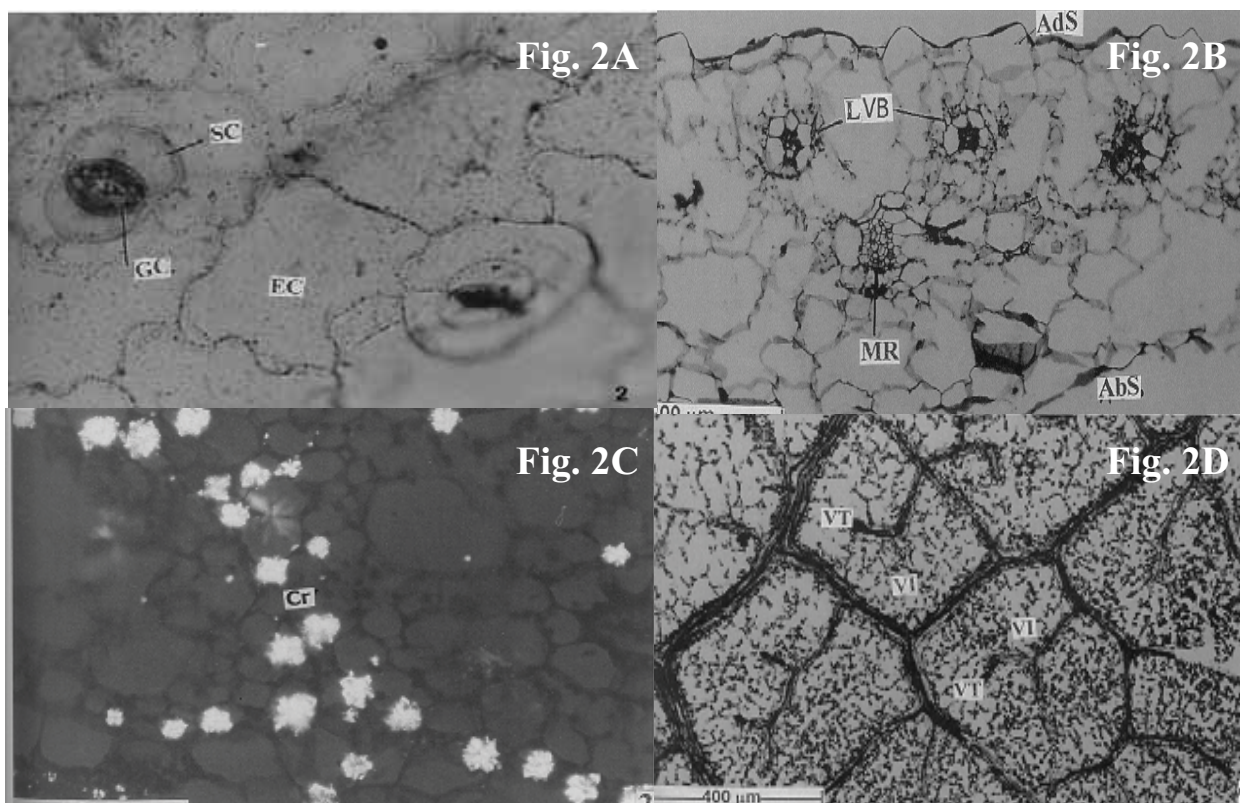


Figure 2. Microscopy of the leaf of *Portulaca oleracea* Linn.

Fig. 2A A portion of leaf showing stomata.

Fig. 2B Photomicrograph showing the transverse section of the midrib.

Fig. 2C Paradermal section showing crystals.

Fig. 2D A Portion of leaf showing the vein islets and termination.

Sc-Subsidiary cells, Gc-Ground cell, Ec-Epidermal cells, Abs- Abaxial side, ds-Adaxial side, VB- Median vascular bundle, Cr-Crystals, VT- Vein termination, VI- Vein islet.

Microscopic characters leaf

Transverse section of leaf shows broadly concave on the adaxial side and convex on the abaxial side. The ground tissue consists of large, thin walled compact parenchyma cells. The vascular stand has a central small segment and two larger lateral segments; three together arranged in shallow arc, the phloem cells occur on the abaxial convex part of xylem strand. Stomata occur on both adaxial and abaxial sides of the leaf. Stomata are paracytic in nature. The guard cells are 30 x 40 µm inside. The epidermal cells are rectangular to polygonal, slightly lobed; their antidual walls are thin and slightly wavy. The lamina is 600 µm thick along the midrib and 450 µm thick along the wings. The leaf is isobilateral and hydromorphic. The midrib region has small collateral vascular bundle placed in the median part of the leaf. The vascular bundle is 50 x 100 µm in size. Each bundle has a vertical file of xylem elements and small nest of phloem elements. 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 plants. Crystals of calcium oxalate are fairly

abundant in the mesophyll cells. The crystals are druses that are found in the ground cells as well as along the veins, mostly along the major veins. The crystals are 10-20 µm is surrounded by a ring of dilated. The lateral veins are thick and prominent. They form distinct vein-islets. The islets are wide, rectangular and mostly one vein termination in each islet. The terminations are long and thick. (Figure 2).

Stem

The stem is circular in with smooth and even surface. It consists of distinct epidermis, broad cortex and pith. Epidermis is thin with tangentially rectangular cells and distinct cuticle; epidermal layer is about 60 µm thick. The cortex is nearly 800 µm broad and consists of one or two layers of outer collenchyma layers and remaining portion being large, thin walled lest compact parenchyma cells. The bundles are collateral with radial xylem elements and phloem elements on the outer part. The pith is wide and consists of cells similar to cortical parenchyma. The xylem elements are thick walled and angular and possess dense calcium oxalate crystals. (Figure 3).

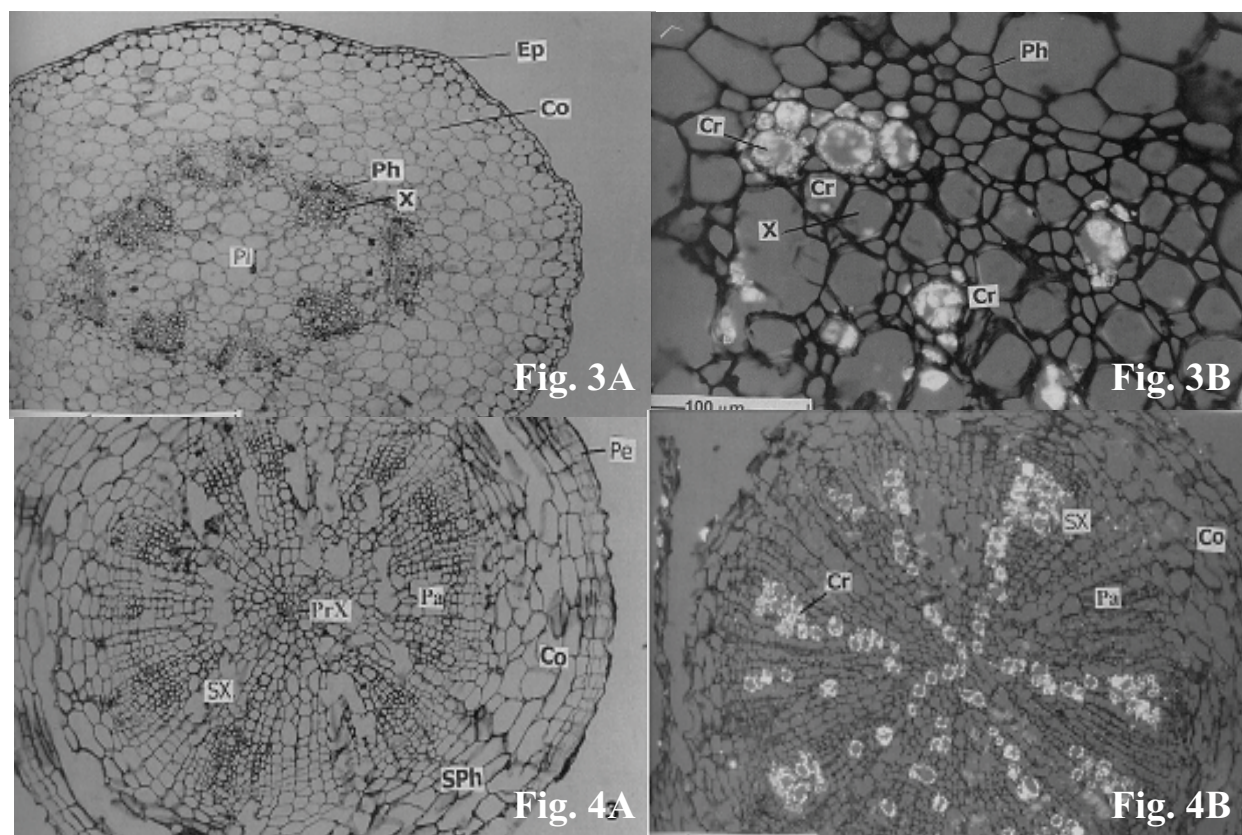


Figure 3A. Microscopy of the stem of *Portulaca Oleracea* Linn.

Figure 3B. Crystals occurring in the vessels.

Figure 4A. Photomicrograph showing the transverse section of taproot enlarged view.

Figure 4B. Secondary xylem in radial bands alternate with parenchymatous rays.

Ep- Epidermis, Ph- Phloem, X- Xylem, Co- Cortex, Pi- Pith, Cr-Crystals, Prx- Primary Xylem, Pa- Parenchyma, Sx- Secondary Xylem, SPh- Secondary Phloem, Pe-Periderm.

Root

The young roots show primary growth. It has diarch or triarch primary xylem and narrow cortex. The old root has a central core of primary xylem and wide secondary xylem. The periderm consists of two or three layers of phellem, a single layer of phelloderm and phellogen layer. The cortex consists of 4-6 layers of thin walled, tangentially stretched parenchyma cells. The vascular cylinder is wide and has 7 or 8 radial, fan shaped bands of xylem alternating with parenchymatous, wide bands. The xylem bands have narrow, thick walled elements; phloem occurs only along the xylem bands. Calcium oxalate crystals are fairly abundant in the xylem cells of old root. (Figure 4).

Preliminary phytochemical screening

Preliminary phytochemical screening mainly revealed the presence of alkaloids, carbohydrates, flavonoids, aminoacids, proteins, steroids, saponins, fixed oils, tannins and phenolic compounds (Table 1).

Physico-chemical constants

Ash values of a drug give an idea of the earthy matter or the inorganic composition and other impurities present along with the drug. The ash values (Table 2) of the completed plant of *P. oleracea* showed higher content of sulphated ash followed by total ash.

The extractive values are primarily useful for the determination of exhausted or adulterated drug. The water-soluble extractive was high (Table 3).

Leaf constants

Leaf constants viz. the vein islet number, vein termination number and stomatal index are present in (Table 4).

CONCLUSION

As there is no pharmacognostical work on record of this traditionally much valued drug, the present work was taken up with a view to lay down standards, which could be useful to detect the authenticity of this medicinally useful plant. Macro and micro morphological standards discussed here can be

considered as identifying parameters to authenticate the drug.

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