WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 5.990
Volume 4, Issue 5, 1573-1580. Research Article ISSN 2277– 7105

PHARMACOGNOSY AND NUTRACEUTICAL POTENTIAL OF *TRIANTHEMA PORTULACASTRUM* LINN.

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Article Received on
05 March 2015,

Revised on 28 March 2015,
Accepted on 18 April 2015

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ABSTRACT

Trianthema portulacastrum Linn. is a prostrate herb that belongs to family Aizoaceae. In India, it grows as post monsoon annual herb. The plant is reported to have anti-inflammatory, antipyretic, hepatoprotective activity. Besides, leaves of the plant are used as vegetable. Because of close morphological resemblance of the plant with crude drug 'Punarnava', it is usually mistaken for the same. Pharmacognosy is an indispensable aid in standardization of herbal crude drug. In the present work, pharmacognostical evaluation of the leaf of *Trianthema portulacastrum* was carried out in view to develop quality standards. It includes macroscopy, microscopy, powder study, phytochemistry and physicochemical analysis. The quantitative estimations of few important primary and secondary metabolites were carried out. It has put insight into nutraceutical potential of the plant.

KEYWORDS: Pharmacognosy, Phytochemistry, *Trianthema portulacastrum*, nutraceutical

INTRODUCTION

Trianthema portulacastrum Linn. (Family - Aizoaceae) is a prostrate branched annual herb with slightly fleshy leaves. It is known as "Swet Punarnava" in Marathi.[1] In India, it typically grows as post monsoon annual herb. It is common on waste places, among grasses, along roadsides and in fields. The plant is credited with anti-inflammatory, antipyretic and CNS depressant activity. The plant is bitter, alexiteric, analgesic, stomachic, laxative, alterative; cures "kapha", bronchitis, heart diseases, diseases of the blood, anaemia,

inflammations, piles, ascites and ulcer. Besides, leaves of the plant are traditionally used as leafy vegetable.[2,3,4,19] Taking into account the therapeutic and nutraceutical potential, it is utmost important to generate pharmacopoeial standards for the leaf of the plant.[5,15] The present investigation thus includes macroscopic and microscopical evaluation, determination of physicochemical constants and phytochemical screening of the *Trianthema portulacastrum* leaf. Recently there are strong recommendations for consumption of nutraceuticals to improve health, prevent and treat diseases. In this concern it is important to identify and quantify such phytochemicals in the drug plant.[22]

MATERIAL AND METHODS

Trianthema portulacastrum Linn. leaf material was collected from Mumbai, Maharashtra. It was collected in the month of September – October being luxurious in monsoon season. The material was authenticated from Blatter herbarium, St. Xavier's College, Mumbai with accession number *Trianthema portulacastrum* Linn. – 30065. To obtain powdered sample, material was dried at 37^0 C in Hot Air Oven and powder passing through mesh no. B. S. S. 22, with sieve size 0.710 mm. was stored in air tight container along with silica bags to prevent moistening of the samples.

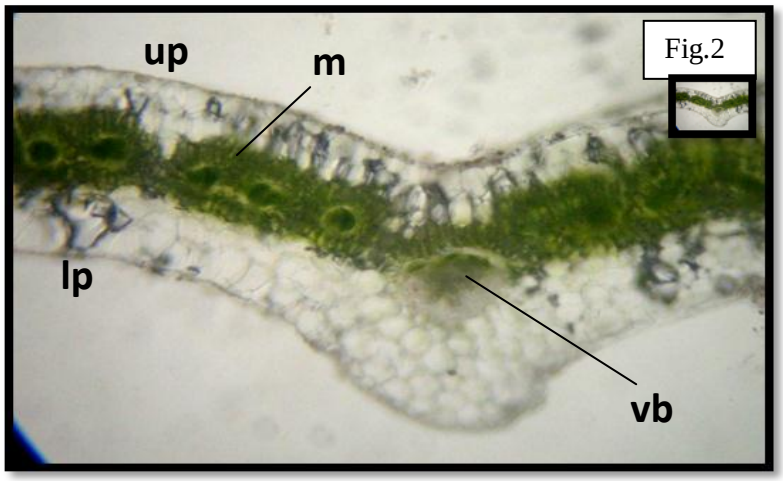
Macroscopy and microscopy of the leaf of *Trianthema portulacastrum* were studied. The standard staining methods were used on thin transverse sections to observe various types of cells.[6,11,12] The microscopic leaf constants like stomatal number, stomatal index, palisade ratio etc. were determined[10,11,12] [Table No. 1]. The powder study was carried out using camera lucida and stage micrometer.[8, 9,10,11,16]

Physicochemical studies included determination of moisture content, ash values and extractive values [Table No. 2]. The leaf powder subjected to various chemical reagents was exposed to UV light to analyze its fluorescence characters[9] [Table No. 3]. The water, alcohol and chloroform extracts of the material were screened for the phytochemical constituents[12,14,15][Table No. 4].

Quantitative estimation of protein content was carried out by Lowry's method. Total carbohydrate content was measured with Anthrone method. The anti oxidant vitamins C and E were quantified.[20] The important secondary metabolites like alkaloids and flavonoids were estimated by appropriate methods[17,21] [Table No. 5]. All the estimations were carried out on UV-VIS Spectrophotometer (Systronics).

RESULTS AND DISCUSSION

Macroscopy: *Trianthema portulacastrum* Linn. is an annual, prostrate somewhat succulent herb. It has simple leaf, 0.5 – 5cm× 0.4 – 4cm in size, green in colour with pink margin. The leaf is stipulate with truncate base, entire wavy margin and apiculate apex. It has glabrous surface, smooth slightly succulent texture. [Fig. 1]



Figures: 1. *Trianthema portulacastrum* Linn. Habit, 2. Transverse section of Leaf up-upper epidermis, lp-lowerepidermis, vb-vascular bundle, m-mesophyll

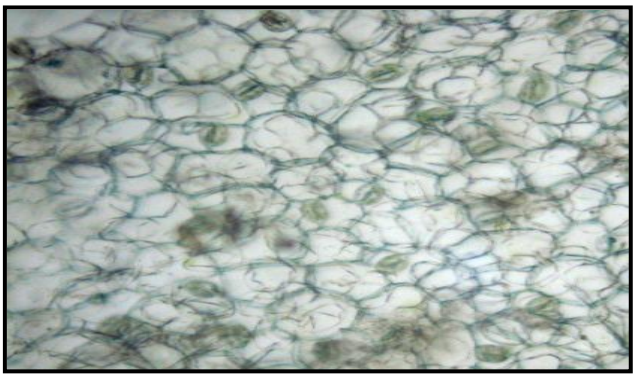
Microscopy: Trianthema portulacastrum Linn. leaf is anatomically isobilateral. It shows typical kranz anatomy. Upper epidermis is single layered made up of tangentially elongated cells [33.3 µm - 83.25 µm X 26.64 µm - 63.27 µm]. Epidermis is cuticularized, interrupted by sunken stomata. It has unicellular trichomes. Hypodermis is made up of water storage tissue. It includes 2 – 3 layers of thin walled parenchyma cells below upper epidermis and 3 – 4 layers above lower epidermis [33.3 µm - 123.21 µm X 33.3 µm - 63.27 µm]. Mesophyll is

confined at the centre made up of 3 – 4 layers of palisade like cells surrounding the vascular bundles. At the upper epidermal region these cells are more elongated and compactly arranged than towards the lower epidermis. Vascular bundles are surrounded by tangentially elongated bundle sheath cells with agranular chloroplast. Lower epidermis is uniseriate having tangentially elongated cells which are small in size compared to that of upper epidermis [16.65 µm - 69.93 µm X 9.99 µm – 66.6 µm]. The sunken stomata and unicellular trichomes are located intermittently in the epidermal layer. Midrib shows uniseriate upper epidermis. It is followed by 2 – 3 layers of water storage tissue. The vascular bundles are distinct. Mature leaf shows three vascular bundles arranged in an arch whereas in young leaves arch is incomplete. Below vascular bundles 3 – 4 layers of parenchyma cells are present. Few cells contain prismatic and sphaeraphide calcium oxalate crystals and starch grains. [Fig. 2]

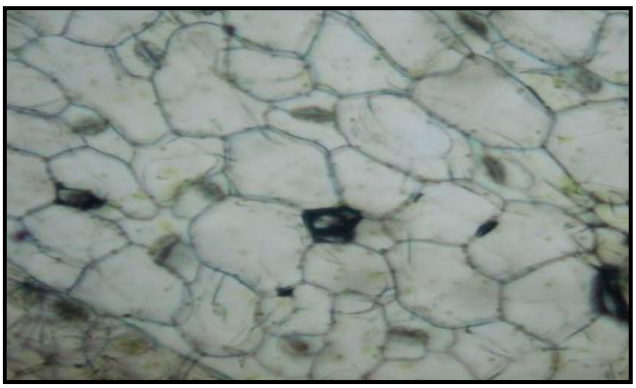
Leaf Constants: It showed the following parameters Table No. 1.

Table No. 1 Leaf constants of *Trianthema portulacastrum* Linn.

S.N.	Parameter	TP
1	Type of stomata	Anomocytic
2	Stomatal number Upper epidermis Lower epidermis	 19 - 22 - 25 25 - 29 – 31
3	Stomatal index Upper epidermis Lower epidermis	 09 - 14 - 20 18 - 19 – 24
4	Palisade ratio	2.25 - 3.0
5	Vein-islet number	7 – 13
6	Vein termination number	7 – 14



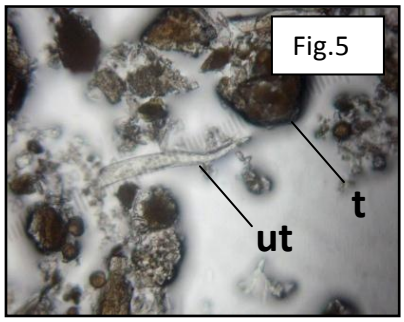
3. Upper epidermis of leaf with stomata

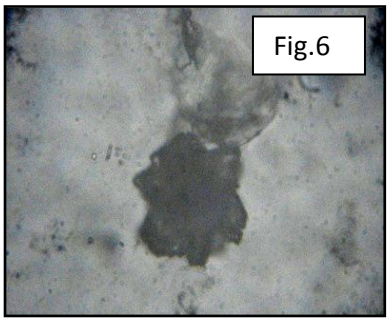


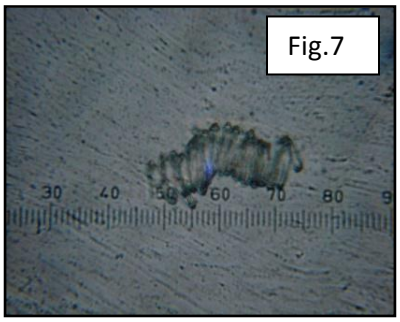
4. Lower epidermis of leaf with stomata

Powder study

The powder is green in colour with coarse texture. It shows stomata, tannin filled cells, unicellular trichomes, xylem vessels, sphaeraphide crystals and starch grains. Fig. 5, 6, 7.







Figs. 5-7 Powder study of leaf -5. t-tannin filled cells, ut-unicellular trichomes 6. Sphaeraphide, 7.annular vessel

Physicochemical studies: the results are given in Table No. 2

Fluorescence analysis: *Trianthema* leaf powder showed the following fluorescence indicated in Table No.3.

Phytochemical screening: The result is as observed in Table No. 4.

Quantitative phytochemistry: Table no. 5.

Table No. 2 Physicochemical Studies of *Trianthema portulacastrum* Linn. leaves

Moisture Content	84.4%
Total Ash w/w not >than	22%
Acid insoluble ash w/w not >than	2%
Water soluble ash w/w not >than	13%

Water Soluble Extractive w/w not<than	37.6%
Alcohol Soluble Extractive w/w not<than	8.8%
Chloroform Soluble Extractive w/w not<than	3.2%

Table No. 3 Fluorescence analysis of *Trianthema* leaf powder

Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Short UV	2IIIfP	2IIIfP	2IIIP	2IIIfP	2IIIfP	4IIIfP	2IIIfP	3IIIfP	3IIIfP
Long UV	3IIIG	2IIIyG	2IIIG	1IIIyG	2IyG	2IIyG	3IIyG	1IIIyG	1IIIyG

Key: 1-Very light, 2- Light, 3- Dark, 4- Very dark; II- Bright, III- Dull; f- Brownish, y- Yellowish; P- Purple, G- Green.

Table No. 4 Phytochemical screening

Sr. No.	**PhytoconstituentS**	***Trianthema portulacastrum* Linn. leaf**		
		WE	**AE**	**CE**
1	Test for Carbohydrates	+	--	+
2	Test for Proteins	+	+	--
3	Test for Steroids	+	+	+
4	Test for Glycosides	NA	+	NA
5	Test for Alkaloids	+	+	+
6	Test for Tannins	+	+	+
7	Test for Oxalic acid	+	+	+

WE- water extract, AE-alcohol extract, CE-chloroform extract, +-present,-- absent, NA-

Table No. 5 Quantitative phytochemistry of *Trianthema* leaf

Phytoconstituents	**Quantity**
Protein	3.0 %
Total carbohydrate	56.7 %
Vitamin C	2.6 mg/g
Vitamin E	5.2 µg/g
Alkaloids	0.19 %
Flavonoids	0.42%

CONCLUSION

The use of herbs to treat diseases is almost universal. Herbal drugs are popular for their safe action. However it may lead to adverse reactions at times. The major reason for this may be incorrect identification of the drug plant and adulteration due to it. So it is of paramount importance to establish quality control pharmacopoiel standards for every herbal drug.[18]

In the present study, pharmacognostic details for leaf of *Trianthema portulacastrum* Linn. are studied. Microscopically, it showed unicellular nonglandular trichomes, prismatic and

sphaeraphide crystals which will help in correct identification of the drug. Ash values and extractive values generated will be helpful in ascertaining quality of the material. Phytochemical screening and fluorescence analysis will aid in knowing genuity of the drug. The amount of protein and carbohydrate in the leaves of Swet-punarnava is significant for the use of this plant as leafy vegetable. The levels of anti oxidant vitamins C and E are significant. The drug action of the plant is mainly due to the secondary metabolites. The alkaloid and flavonoid content are noticeable in the leaves of this plant. Nutraceutical are the drugs that provide nutrients along with therapeutic action. *Trianthema portulacastrum* Linn. leaves hence have a large potential to be used as nutraceutical.

ACKNOWLEDGEMENT: The authors are immensely grateful to Dr. Shraddha Shimpi for her guidance.

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