



# Phytochemical, Ethnobotanical and Phytopharmacological Discussions about *Trianthema portulacastrum* Linn. : A Brief Review

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## Abstract

*Trianthema portulacastrum* Linn. (Aizoaceae) is an important ethnomedicinal herb which is utilized for various traditional treatment purposes worldwide. It is found in India, Pakistan, Sri Lanka, Africa, West Asia and Tropical America. The plant species are endemic in South America. In Ayurveda, Sidhha and Homeopathy treatment system the plant is used widely for curing various diseases. It is a 30-70 cm long herbaceous plant which is branched, prostrate, and diffused in morphology. The leaves of the plants are fleshy in nature. According to the previously done phytochemical study the plant has found with various important bioactive compounds such as flavonoids, alkaloids, steroids, tannins, terpenoids, glycosides, phenolics, proteins, fats and carbohydrates. The plant is ascribed with different pharmacological properties like antioxidant, anti-fungal, analgesic, anti-pyretic, anti-inflammatory, and hepato-protective etc properties. It is also used in healing cuts and wounds, rheumatism, edema, asthma, bronchitis, jaundice, throat troubles as well as it is used as vermifuge agent in many parts of the world. The review was carried out to find out morphological, phytochemical, ethnomedicinal and pharmacological screening of *Trianthema portulacastrum* plant parts. This review can be helpful for identification and preparation of monograph of the plant for future research purposes.

**Keywords:** *Trianthema portulacastrum*, Ethnomedicine, Phytochemicals, Pharmacology.

## INTRODUCTION

Since the ancient time period the plant derived medicines are used by mankind widely. A huge number of traditional medicines are produced by the plants in the rural areas. India is one of the most resourceful countries for plant products. Due to its high resources a strong herbal treatment has been developed. In Ayurveda, Sidhha, Homeopathy and Folkloric medicine system beneficial weeds are very useful for healing human physiological disorders. According to World Health Organization (WHO) the traditional medicinal plants are used in protecting and curing from several types of critical diseases. Currently, in the world millions of people are using these medicinal plants for primary healthcare, cultural development and economic benefits. In some under development areas the medical facility is very poor, in that places the traditional medicinal plants play important and significant role in healthcare system. Huge amounts of literature and records of the theoretical concepts and practical skills support the traditional medicinal system. Some others carry this tradition through verbal learning by generation to generation. The plants are considered as one of the most important sources of medicinal materials for the search of better therapeutic activity<sup>[1]</sup>.

*Trianthema portulacastrum* Linn. locally known as Gadabani or Biskhapra. It is an annual or perennial herbaceous weedy plant which belongs to the family Aizoaceae. It is commonly known as Horse purslane or Carpet weed. It is found in the roadsides, wastelands, lawns, gardens and human settled areas. This weedy herb contains some important bioactive compounds such as alkaloids, volatile oils, tannins, carbohydrates, flavonoids, saponins, resins, pigments etc. The plant parts are widely

used in curing several physiological disorders of human being. *Trianthema portulacastrum* is ascribed with various biological properties which were studied earlier extensively by many researchers in the world<sup>[2,3]</sup>.

## TAXONOMICAL POSITION:

**Kingdom:** Plantae

**Phylum:** Tracheophyta

**Class:** Magnoliopsida

**Order:** Caryophyllales

**Family:** Aizoaceae

**Genus:** *Trianthema*

**Species:** *portulacastrum*

**Botanical Name:** *Trianthema portulacastrum* Linn.<sup>[4,5]</sup>

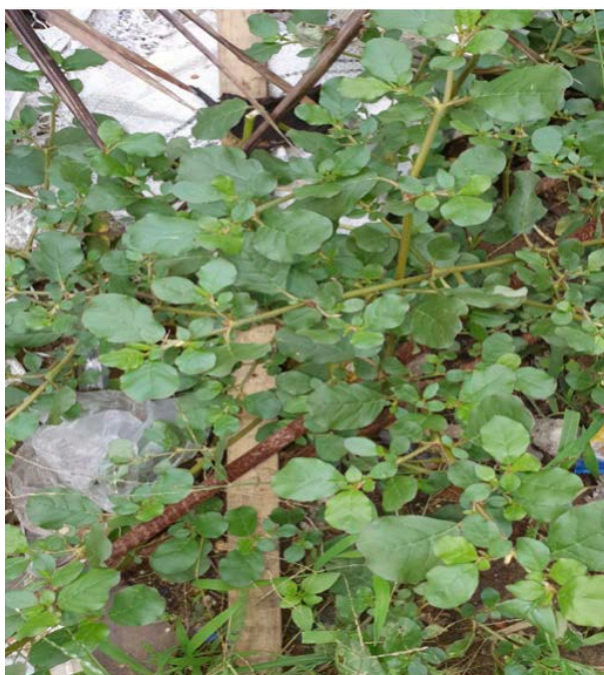
## VERNACULAR NAMES:

Bengali: Gadabani /Sabuni; Chinese: JiaHai Ma Chi; English: Horse Purslane/ Carpet weed/ Giant pig weed; Hindi: Sala sabuni/ Lal-sabuni Santhi/ Svet-sabuni/ Vishakhapara; Arabic: Hand Qooqi; Sindhi: Narmah; Spanish: Verdolaga; Tamil: Sharunnai; Telugu: Atikamamidi; Unani: Lotoos Aghryoos; Urdu: Biskhapra; Kannada: Pasalaesoppu; Malayalam: Pasalikeera; Marathi: Pundharighentulii; Oriya: Sweta Puruni; Persian: Dewasapt; Punjabi: Biskhapra; Sanskrit: Dhanpatra/ Chiratika / Shvetapunarnava/ Vishakha / Shvetamula.<sup>[4,5]</sup>

## BOTANICAL FEATURES

*Trianthema portulacastrum* Linn. (Figure 1) is an annual or perennial herbaceous medicinal weed which is found on the ground such as roadsides, wastelands, lawns, gardens and human settled areas. According to the morphological characteristics study there are two varieties of plant species are available i.e. white and red. This plant is a

prostrate, diffused, succulent or fleshy herb, branched; stems are thin, glabrous or pubescent. Leaves (Figure 2) are simple, fleshy or sub-fleshy. It has unequal, obovate or oblong leaf blade and it is opposite or alternate. The flowers (Figure 2) are small, hermaphrodite or polygamous, cymes, solitary and white or bright pink. Fruits are syncarpous, capsules are loculicidally. The seeds are glabrous; reniform, compressed, with epigeal germination and colors of the seeds are dull black. The plants nodes are thickened or flattened. Stems (Figure 2) are cylindrical, branched dichotomously, glabrous or pubescent, prostrate or trailing. It has tapering, slender, branched, fibrous root system and it is 5-20 cm in length, externally light yellow in color, and internally whitish or yellowish in color. Leaves of the plants are flat, simple, opposite, often fleshy; margin is entire or wavy, sub-succulent, unequal, obovate, cuneate base, apex obtuse, purplish. Bracts are membranous, short or long calyx tube, ovate and acute calyx lobes, sepals are free or adnate to the ovary, persistent, stamens are inserted near the top of the calyx tube, filaments are white and glabrous, free or connate; anthers oblong; Ovary free syncarpous or rarely apocarpous, sessile, truncate at apex, 1-2 celled, ovules many in each carpel, papillose, solitary basal or axile. Flowering time of the plant is from May to November. Fruiting time is end of July to December. After 20-30 days' germination of the seeds, the production of flowers and seeds are started. The mature seed are allowed to germinate immediately because of huge seeding capacity or very little dormancy for this in the same season multiple generations are produced with an optimum temperature at 35°C. Seeds can germinate between 20-48°C. After an incubation period 5-10 days, more than 50% of the fresh seeds can be able to germinate<sup>[6, 7]</sup>.



**Figure 1:** *Trianthema portulacastrum* Linn.



**Figure 2:** Stem, Leaves and Flower

#### PHYTOCHEMICAL COMPONENTS

Previously done phytochemical study of *Trianthema portulacastrum* revealed that the plant parts contains high amount of various bioactive compounds. These are flavonoids, alkaloids, steroids, tannins, terpenoids, glycosides, polyphenols, fats, proteins, carbohydrates, water soluble bases and potassium salts. The physicochemical and nutritional analysis of the leaves of the plants showed various parameters such as total moisture content 91.5%, protein 2.0%, fat 0.5%, carbohydrate 3.3%, crude fiber 0.8% and ash content is 2.4 g/100g; whereas the calcium 105 mg; phosphorous 31 mg; iron 38.6 mg and ascorbic acid contents are 72 mg/100 gm of the edible matter of the plant leaves. Carotene content has also found 2-3.5 mg/100g of edible parts of the leaves. Another study of the leaves in dry basis analysis showed that the ash content is 18.0%; total oxalate contents are 9.99%. The soluble portion of the leaves is 8.59%; whereas the calcium and phosphorus presence are 0.74% and 0.38%, respectively. The plant is also contains large amount of potassium nitrate. In white and red varieties the amount is 1.73% and 2.63%, respectively. The extractive values of the plant in successive soxhlet's extraction method showed range of variations in different solvents and it was such as petroleum ether, diethyl ether, chloroform, benzene, methyl alcohol and water extracts were found to be 1.77±0.009%, 1.38±0.018%, 1.15±0.006%, 0.42±0.001%, 12.83±0.093% and 18.06±0.069%, respectively. In an earlier study it was observed that the total ash, acid insoluble ash and water soluble ash content were 19.69±0.065%, 2.09±0.2% and 14.4±0.3%, respectively. The moisture content by loss on

drying method and by toluene distillation method was found to be  $5.66 \pm 0.06\%$  and  $6 \pm 0.01\%$ , respectively. The mean of the pH value of 1% and 10% (w/v) aqueous solution showed 5.07 and 5.06, respectively [8-10].

In a study, Karnick (1970) showed that the plant contains ecdysterone and an alkaloid Trianthemine which is a potential chemosterilant agent [11-13]. From the chloroform extract of the plant, a tetraterpenoid named trianthol-1, is isolated and showed prominent anti-fungal activity [14]. The plant also contains 3, 4-Dimethoxycinnamic acid and saponin,  $\beta$ -cyanine and alkaloid 'punarnavin' [15, 16]. The extracts of *Trianthema portulacastrum* contains different class of new flavonoids such as dichloromethane, 5, 2, dihydroxy -7-methoxy-6, 8-dimethylflavone, 5, 7-dihydroxy-6, 8-dimethylchromone (leptorumol) which is responsible for various biological properties [9, 17, 18].

### ETHNOMEDICINAL USES

*Trianthema portulacastrum* is a remarkable and important medicinal plant in ayurvedic, homeopathy, kabiraji, unani, sidhha and folkloric treatment system. This herbaceous plant is traditionally used for different treatment purposes in various parts of the world. Parts of the plant are used for healing several diseases such as analgesic, anemia, inflammation, stomachache, laxative and night blindness. The decoction of the plant is used to cure bronchitis, piles, ascites and heart diseases. The powder of the root is cathartic and abortifacient; it removes obstruction of the liver and used in amenorrhea and asthma. In rheumatoid arthritis decoction of the herb is useful and it is used as a vermifuge as well. The herb leaves are used for wound healing and to cure amenorrhea, beriberi, and edema. Its decoction also plays a huge role in relieving thoracic and stomach pain. The plant extracted oil is very useful in case of relieving the joint and muscle pain. All the parts of the plants are used as medicinal purposes but mainly the root and leaves are more beneficial in healthcare treatment system. Leaves have been reported to be diuretic property as well. The root is applicable to cures corneal ulcers, dimness of sight, itching and night blindness. The dust form of root is used as a cathartic in the Philippines with the combination of ginger [7, 19].

### PHARMACOLOGICAL ACTIVITIES

#### Antioxidant Activity

Previously the ethanol extract of the leaves of *Trianthema portulacastrum* reported to have the antioxidant property in relation to paracetamol, hepatotoxins, and thioacetamide in rat model [20, 21]. In toxicants-treated rats, the quantity of antioxidant enzymes such as glutathione reductase (GSH-R), glutathione peroxidase (GPX), superoxide dismutase (SOD), glutathione-S-transferase (GST), and catalase (CAT) were decreased in comparison with the control. The liver damage is occurred because the antioxidant capacity of the liver reduced due to the generation of lipid peroxides. But the activity of SOD and CAT increases by using the treatment with 100 mg/kg and 200 mg/kg ethanol leaves extracts of the plant. In that case the hepatic damage is reduced because the natural antioxidants can scavenge free radicals [6].

#### Antifungal Activity

In the previous study it was observed that chloroform and tetra terpenoid trianthenol extracts of the plant has the antifungal activity. In an *in vitro* fungicidal bioassay number of human and plant pathogens were subjected against these and compared with the respective standard drugs which showed that the percentage inhibition of the crude extract was found to be moderate [14].

#### Chemo-sterilant/ Molting Hormone Activity

The earlier study observed that the major chemical constituents such as phytoecdysterone are the plant derived ecdysterone, which is obtained from whole plant. These compounds and its analogs are widely used as chemo-sterilants because in case of insects and mammals they can be able to stimulate the protein synthesis mechanism [22, 23].

#### Analgesic and Antinociceptive Activity

To evaluate the analgesic activity of the whole plant the ethanolic decoction was used by hot plate and acetic acid induced writhing methods. The study showed that acetic acid induced inhibition on the writhing response was causing by the extract. The observation showed that a dose of 250 mg/kg plant extract and aspirin blocked the writhing response by 50.90% and 67.69%, respectively. In mice the extract showed significant antinociceptive properties, too [24].

#### Hypolipidemic Activity

The methanolic extracts of the whole plant showed the dose dependent hypolipidemic activity in animal model. In the study diabetes mellitus is regulated improperly. After 7 days of treatment the lipid profile test and it showed the beneficial impact in normal as well as alloxan-induced diabetic rats in the doses of 100, 200 and 300 mg/kg of body weight [25].

#### Anti-hyperglycemic Activity

In a study, the methanol extract of the whole plant produced serious anti-hyperglycemic activity against streptozotocin (STZ) induced diabetic rats, which are compared to standard oral hypoglycemic agent glibenclamide. In STZ-induced diabetic rats, a significant anti-hyperglycemic effect is produced by 100 mg/kg and 200 mg/kg suspension of methanolic extract after incubation. In the dose-dependent study 100, 200 and 300 mg/kg of dose was used for 7 days. The methanolic extract of the whole plant was supervised to normal and alloxan-induced diabetes rats. The extract produced significant effect comparing with the standard oral hypoglycemic agent in normal and diabetic rats [6, 26].

#### Hepato-protective Activity

In albino rats, the ethanolic leaves extract of the plant reported to have a major dose-dependent hepato-protective property against two widely used hepatotoxins such as thioacetamide and paracetamol which induced the hepato-toxic activity. The important parameters which were used in the biochemical study were total protein, serum glutamate oxaloacetate transaminase, alkaline

phosphatase, serum glutamate pyruvate transaminase and bilirubin. In the serum parameters study, the toxic effects of paracetamol and thioacetamide are totally prevented by the plant decoctions. The earlier study showed that the ethanolic leaf extract of the plant is dominant hepatoprotective effect. In animal model the ethanolic leaf extract showed the aflatoxin B1-induced hepatic damage by comparing with a standard silymarin. A study reported that the ethanolic leaf extracts of the plant showed the important role in case of mice to prevent acute and chronic CCl<sub>4</sub>-induced hepatocellular injury. In animal model the plant decoction suppressed the acute liver injury by alcohol and CCl<sub>4</sub>. During CCl<sub>4</sub> poisoning in animal model significant protection was shown by the ethanolic leaf extract in case of hematological, hematopoietic and plasma protein levels. According to the earlier study of Sarkar et al., the induction of chromosomal aberrations by the ethanol leaf extract gives strong protection. The liver was damaged by breaking DNA-chains and sugar bases. In the study to induce the damage, chronic or single acute dose of CCl<sub>4</sub> is used [3, 27-30].

#### Anti-carcinogenic Activity

Previous study showed that the plant has very promising anti-carcinogenic property on chloroform extracts in animal model. The study observed that the diethylnitrosoamine is a potent carcinogenic agent which induced the hepato-carcinogenesis in rats [28].

#### Anti-glomerulosclerosis Activity

In a study it was observed that in rats, the methanolic extract of *Trianthema portulacastrum* build huge protection against hepatic damage, atherosclerotic or CCT (1% cholic acid, and 4% cholesterol 0.5% thiouracil) diet induced glomerulosclerosis [30].

#### Anti-arthritis Activity

Earlier study showed that the plant parts possess potent anti-arthritis property in animal model. The study observed that the plant extract reduced the inflammation of experimental animal [31].

#### Anti-lithiatic Activity

According to a previous study the plant extract showed significant anti-lithiatic property in male wistar rats. It was concluded that this property may be due to presence of various phytochemicals such as alkaloids, flavonoids, phenols, tannins, saponins and triterpenes [32].

#### TOXICITY ASSESSMENT

The oral acute toxicity was studied in mice by using several doses of ethanolic or methanolic extract of the dried plant parts. The study concluded that the dose levels of 4000 mg/kg of body weight of the extracts were considered to be safe because up to that dose level no mortality was found. From a previous study it was observed that the albino rat's hepato-toxicity is induced by the significant protective effect of the ethanolic extract against thioacetamide and paracetamol in dose-dependent manner. The study showed that the toxic effects of

paracetamol (acetaminophen) and thioacetamide are prevented by the plant decoctions [3, 24].

#### CONCLUSIONS

The review highlighted that the *Trianthema portulacastrum* Linn. has the immense potentiality for morphological, phytochemical, nutritional, ethnobotanical parameters as well as biological activities. From the above explanation, it can be say that *Trianthema portulacastrum* Linn. has been used as an important remedial agent for several physiological disorders in different parts of the world which was mentioned in the review article. The review also cited the important biological or biochemical attributes of *Trianthema portulacastrum* Linn. as well as it highlights the researchers are actively working with this weed to know the ethnobiological potentiality of the plant. This review can be used for identification and preparation of monograph of the plant as well. The review found the loop holes or lacunae for future work, too [33].

#### Acknowledgment

The authors are thankful to Dr. Madhusudan Mondal, Former Additional Director, Botanical Survey of India, and Kolkata for identifying the plant and giving valuable taxonomical inputs.

#### Conflict Of Interest

The author declares no conflict of interest.

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