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A PHYTOPHARMACOLOGICAL REVIEW ON *TRIATHEMA PORTULACASTRUM* (BISKHAPRA)

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ABSTRACT
Trianthema portulacastrum L. (Biskhapra/ Horse purslane) is widely found in tropical and subtropical countries of the world. This weed automatically spread in cultivated fields. *Trianthema portulacastrum* L. (Aizoaceae) is an annual, branched, prostrate, slightly succulent, naturalized herb in India. The plant, historically valued as a green vegetable by poor people on the Indian sub-continent because of the high vitamin C content in the leaves, is medicinally known for treatment of edema. From the ancient time it is used for curative purposes. The plant pertains wide range of applicability and henceforth used as an Ayurvedic herb. The decoction of this herb is utilized as a vermifuge, antidote prepared from that helps in treating alcohol poisoning and leaves cure the wound. Biskhapra is a well notorious drug in Unani system of medicine for its extensive use in urinary system as diuretic (*Mudirre Baul)*, in ascites, anasarca, cystitis in case of dribbling of urine, in dropsy, edema and ascites. Major chemical constituents are alkaloids, trianthemine, punarnavin, ecdysterone, tetraterpenoid, 3, 4-Dimethoxycinnamic acid, β- cynin and saponins. Various pharmacological properties like antimicrobial properties, analgesic, antiinflammatory, antidiabetic, antihyperglycemic, hepatoprotective activity makes this plant very renowned amongst researchers as they utilized it somewhat like a panacea. This article compiles all updated information related to *T. portulacastrum Linn*. Scientifically proved activities are co-related with traditional concepts. Scientific evidence exists with respect to their major and minor constituents. The novelty and applicability of *T. portulacastrum* are hidden. Such things should be overcome through modern scientific concepts.

KEYWORDS: Biskhapra, Unani and traditional Medicine, Aizoaceae, Ethnopharmacology, Morphology, Phytochemistry.

INTRODUCTION
Ever since his existence on this planet, man has had to depend on nature for sustenance and survival. Plant-based medicines have been used by mankind since time immemorial. According to the report of World Health Organization (WHO), over 80% of the world population relies on the traditional system of medicine, largely plant based, to meet their primary health care.[1] India is one of the nations blessed with a rich heritage of traditional medical systems and rich biodiversity to complement the herbal needs of the treatment administered by these traditional medical systems. The recognized Indian systems of Medicine are Ayurveda, Siddha, and Unani which use herbs and minerals in the formulations,[2] but it is mandatory to prove traditional concepts scientifically in the laboratory. Over the last few years, researchers have aimed at identification and validating plant-derived substances for the treatment of various diseases. Interestingly, it is estimated that more than 25% of modern medicines are directly or indirectly derived from plants.[3] The global demand for herbal medicine is not only large, but also growing. Now a day, collection of medicinal plants from forest is very difficult due to government's forest policy, rapid loss of diversity of plants, natural habitats, traditional community life, cultural diversity and knowledge of medicinal plants. To solve this problem weeds may provide medicines with low cost, more potential and without adverse side effects.[4]

Trianthema portulacastrum L. (TP) is one of the most important members of Aizoaceae family.[5] Other than this, 20 more species are reported from the similar genus *Trianthema*, which is an annual or perennial plant and various researches reported about the therapeutic potential of this species. Various parts of this plant are used for the isolation of drugs and bioactive compounds.[6] *T. portulacastrum* is a flowering plant

commonly known as Horse purslane, Biskhapra and Giant pigweed.[7] It is broadly distributed in tropical countries and is native to continents Africa, South and North America Southeast Asia. This review shows the evaluation of occurrence, morphology, ethnopharmocology, ecological, biodiversity, phytochemistry, medicinal uses, toxicity and pharmacological activities about *T. portulacastrum*.

The Broad classification is as per follow.[8]

Taxonomical Classification
Domain: Eukaryota
Kingdom: Plantae (Plants)
Sub-kingdom: Tracheobionta (Vascular plants)
Division: Magnoliophyta (Flowering plants)
Superdivision: Spermatophyta (Seed plants)
Class: Magnoliopsida (Dicotyledons)
Subclass: Caryophyllidae
Order: Caryophyllales (Herbaceous and fleshy)
Family: Aizoaceae (Fig-marigold family)
Genus*: Trianthema* L.
Species*: Trianthema portulacastrum* L.

Occurrence and distribution
It is an exotic weed and a native of tropical America. It is growing throughout most tropical countries, such as Baluchistan, Ceylon and India.[4] It is now naturalized throughout India in cultivated fields, river beds, waste ground, etc.[2] Its infestation is very common in various agricultural and vegetable crops, such as mustard, maize, pigeon pea, mung bean, potato, onion, cotton, soybean, pearl millet and sugarcane, especially during the rainy seasons.[9,10]

Two forms are reported to occur in this species; *a red-colored form* known as Lal Sabuni, in which the stem, leaf-margin, and flours are red; a *green-colored form* known as Svet Sabuni, which has a green stem and white flowers.[11]

Propagation and cultivation
This is not cultivated commercially, but it is found throughout India as a tropical problematic terrestrial weed by virtue of its infestation in plains, river beds and in wastelands. It also grows automatically in cultivated fields with agriculture and vegetable crops, especially in the rainy seasons.

Macroscopic description
Root: Thin, slender, tapering, and tortuous, with lateral branching fibrous root, 5–15 cm in length; 0.3–2.5 cm in diameter, light yellow externally, creamish white internally, fractures fibrous.

Stem: Cylindrical, dichotomously branched, prostrate or trailing, somewhat glabrous, at places reddish tinted, nodes swollen, fresh stem succulent.

Flower: Small, Bisexual flower, solitary, sessile, pinkish, nearly concealed by the pouch of the petiole, calyx tube scarious, thin, stamens 10–15, ovary superior, sessile, style single papillose, shorter than the stamens.

Fruit: Fruit capsule is 3–5 mm long, almost concealed in the petiolar pouch, slightly concave, upper beak-like part at the time of dehiscence, carrying 2–3 seeds, lower cup-like part enclosing 2–5 or more seeds, fracture fibrous.

Seeds: are reniform, dull black, rough, muriculate.[1,4]

Leaves: are simple, fleshy, entire, broad, opposite, uneven, ovate, petiole dilated enclosing the stem, single midrib, dorsiventral, having two-layered palisade tissue, pinnately veined, green in colour and 2 cm long, 3 cm wide attached to the plant via 1 cm short petioles.[12]

Phytochemical parameters
A lot of data have been obtained by the phytochemical studies of the plant leaves *Trianthema portulacastrum* L. which is described below.[13]

Table 1: Physicochemical parameter of leaves.

Sr no	Parameter	Value
1	Total Ash	19.69±0.065%
2	Acid insoluble	2.05±0.2 %
3	Water soluble	14.4±0.3 %
4	Moisture content by loss on drying	5.56±0.06%
5	By toluene distillation	6±0.01%
6	pH 1% aqueous solution	5.02
7	pH 10% aqueous solution	5.04
	Extractive values by successive Soxhlet's extraction	
8	Petroleum ether	1.76±0.009 %
9	Diethyl ether	1.38±0.017 %
10	Chloroform	1.15±0.006 %
11	Benzene	0.43±0.001 %
12	Methyl alcohol	12.83±0.093 %
13	Water	18.07±0.069 %

Microscopic description

Root

The TS of root is almost circular in outline. The outer most layer of the cork is somewhat obliterated followed by 3–4 rows of closely arranged thin-walled cubical to tangentially elongated rectangular cells. Distinct cork is not evident. Underneath these lines a narrow zone of cortex, composed of fairly large, oblong or polygonal or tangentially elongated thin-walled parenchymatous cells. In TS of younger roots, 2 phloem bundles embedded in the central wood are seen, which gradually form a complete ring around the double-shaped xylem, 2–3 layers of parenchymatous cells are present in between each ring of xylem and phloem. Alternate zone of xylem and phloem are found due to anomalous secondary growth and their numbers vary according to the age of the plant. Xylem consists of vessels of various sizes, tracheids, and xylem parenchyma and phloem consists of sieve tubes, companion cells, and phloem parenchyma. Rosette and rhomboidal crystals of calcium oxalate are present in parenchyma of phloem and cortical region. Traces of lateral branches are also observed at some places.[1,14]

Stem

TS of stem is almost circular in outline, epidermis covered by thin cuticle, trichomes are usually unicellular but sometimes bicellular trichomes also present. Cortex collenchymatous, 8–10 cells broad. Endodermis well-developed pericycle distinct in the form of sclerenchymatous patches; phloem comprises sieve tubes, companion cells, and phloem parenchyma, cambium indistinct. Xylem consists of vessels, tracheids, fibers, and xylem parenchyma. Vessels are either solitary or in radial rows of 3–7. Pith is well developed and parenchymatous, starch grain and rosette crystals of calcium oxalate are present in cortical as well as in pith region.

Leaf

TS of the leaf passing through midrib shows slight depression on the upper side and broad elevation on the lower side, a layer of parenchymatous hypodermis, becoming two celled over the meristele lines underneath this, palisade continuous over the meristele. In midrib the number of vascular bundles varies from 1 to 3. The meristele consisting of xylem in row and inconspicuous phloem with arc of large parenchymatous cells toward the upper side and 2- to 4-celled pericyclic fibres toward the lower side. A single-layered upper and lower epidermis covered by thin slightly striated cuticle interrupted by uni- to multicellular, uniseriate trichomes and stomata. Some trichomes are balloon shaped mostly found on the margins. The epidermis consists of straight-walled cells with faint cuticular striation and anisocytic to paracytic stomata on both upper and lower surfaces.

TS passing through lamina show single-layered hypodermis, 2–3 layered palisade and 3–5 loosely arranged spongy parenchymatous cells. Vascular bundles abundant in palisade region surrounded by large parenchymatous sheath. Rosette crystals, idioblast with raphides of calcium oxalate and small oval-shaped starch grains are also found in mesophyll region.

Powder

Yellowish green. Shows starch grains, fragments of leaves with epidermal cells of paracytic and anisocytic stomata, unicellular balloon-shaped and multicellular, uniseriate trichomes, fibres, tracheids, vessels, with spiral scalariform and reticulate secondary wall thickenings. Idioblast with raphides of calcium oxalate of leaf, idioblast with single rosette crystal of calcium oxalate of stem, rosette, prismatic crystals of calcium oxalate, fragments of cork and pollen grains.[1]

Phytoconstituents

Photochemical screening has revealed the presence of steroids, flavonoid, fats, terpenes, carbohydrates, tannins and alkaloids. Phytochemical constituents in the various parts of the plant are very significant.[15] The methanolic extract was screened for the presence of various phytoconstituents, such as steroids, alkaloids, terpenoids, glycosides, flavonoids, phenolic compounds, and carbohydrates.[16]

Phytochemistry

Extraction of air-dried **plant** with **dichloromethane** has led to the isolation of a new flavonoid, 5,2′-dihydroxy-7-methoxy-6,8-dimethylfl avone (C-methylfl avone), along with 5,7-dihydroxy-6,8-dimethylchromone (leptorumol), which has been previously reported from a fern species.[17]

The red and white **flowers** contain an alkaloid trianthemine, also punarnavine.[11]

The **plant** contains nicotinic acid (Vitamin B3), ascorbic acid (Vitamin C).[18] The mineral profile of *T. portulacastrum* as calcium (0.3%), magnesium (0.2%), iron (50 ppm), copper (8 ppm), zinc (30.0 ppm), and manganese (50 ppm), whereas the phosphorus content at 0.13% ± 0.1% and crude protein 1.5% ± 1.2%.[19]

The plant is rich in phosphorous and iron but poor in calcium. The high content of oxalate affects the assimilation of calcium. Carotene (2.3 mg/100 g) has also been reported.[18]

Chromatography of dried plant with methylene chloride on silica yielded long chain esters; a mixture of C14, C16, C18, C20, and C22 long chain alcohols; β-sitosterol, stigmasterol, and their β-glucopyranosides.[17]

A tetraterpenoid named trianthenol has been isolated from the chloroform extract of the plant. Its structure was established as 15-hydroxymethyl-2,6,10,18,22,26,30-heptamethyl-14- methylene-17-hentriacontene on the basis of spectroscopic data, including high resolution

mass and two-dimensional Nuclear Magnetic Resonance (NMR) techniques.[17]

Ecdysterone has been isolated from the whole plant; yield in g/kg is 0.1. Ecdysterone is the most widely occurring phytoecdysone.[20] Phytoecdysteroids are a plant steroids related in structure to the invertebrate steroid hormone 20-hydroxyecdysone. Typically, they are C27, C28, or C29 compounds possessing a 14α-hydroxy-7-en- 6-one chromophore and A/B-*cis* ring fusion (5β-H).[21]

Ecdysterone biogenesis may be increased by the use of various phytohormones and different sucrose levels in seedling callus culture of *T. portulacastrum*.[22]

Hydrocarbons from the surface wax of the fresh leaves of plant have been isolated and characterized and their relative distribution determined through gas liquid chromatography studies. The considerable occurrence of branched chain hydrocarbons may be an indication of the characteristics of lower plants based on taxonomy.[21]

Beta-cyanin (colouring flavoind) and 3,4-dimethoxy cinnamic acid also have been reported from *T. portulacastrum* and other aizoaceae family.[23]

Four new compounds first time reported from *T. portulacastrum* as 5-hydroxy-2-methoxy benzaldehyde, 3-acetyl aleuritolic acid, p-methoxy benzoic acid, and p-propoxy benzoic acid.[17]

Traditional uses

The **plant** is alexiteric, analgesic, stomachic, laxative, alterative; cures "Kapha," bronchitis, heart diseases of the blood, anemia, inflammations, "Vata," piles and ascites.[4] The plant has been used in the indigenous system of medicine for the obstruction of the liver asthma, amenorrhea, dropsy, edema, ascites, and beri-beri. A decoction of the herb is used as a vermifuge and is useful in rheumatism; it is also an antidote to alcoholic person.[11]

Root*:* Antipyretic, analgesic, spasmolytic, deobstruent, and anti-inflammatory. The ayurvedic pharmacopoeia of India recommended in diseases of liver and spleen, anemia, and edema.[18] The root applied to the eye cures corneal ulcers, itching, dimness of sight, and night blindness.[4]

The root is cathartic and abortifacient with irritant properties.

An infusion of the roots is administered in jaundice, stranguary, and dropsy.[2,18]

The powdered bitter and nauseous root is given in combination with ginger as a cathartic.

In the Philippine Islands, the powdered root is given as a cathartic.[4]

Leaves: Used as diuretic in edema and dropsy. A decoction of the herb is used as an antidote to alcoholic poison.[18] Leaves have been reported to be diuretic, and therefore useful in the treatment of edema and ascites.[2,18]

Pharmacological activities

Hepatoprotective activity

The **ethanolic leaves extract** of *T. portulacastrum* L. (Aizoaceae) showed a significant dose-dependent (100 mg and 200 mg/ kg p.o.) hepatoprotective protective effect against two well known hepatotoxins, namely, paracetamol- and thioacetamide induced hepatotoxicity in albino rats. The degree of protection was measured by using biochemical parameters, such as serum glutamate oxaloacetate transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT), alkaline phosphatase (ALP), bilirubin (BRN), and total protein (TP). The plant extract completely prevented the toxic effects of paracetamol (acetaminophen) and thioacetamide on the above serum parameters.[24]

The studies also indicate that the ethanolic leaves extract of *T. portulacastrum* is a potent hepatoprotectant as silymarin. The hepatoprotective effect of ethanolic leaves extract of *T. portulacastrum* studied on afl atoxin B1 (AFB1)-induced hepatic damage in a rat model and compared with silymarin, a well-known standard hepatoprotectant. Pretreatment with *T. portulacastrum* (100 mg/kg/p.o.) and silymarin (100 mg/kg /p.o.) for 7 days reverted the condition to near normal.[25]

An ethanolic extract of *T. portulacastrum* (ETP) gives a significant protection against acute and chronic CCl4-induced hepatocellular injury in mice. ETP of the plant (excluding roots) protects against acute liver injury induced by alcohol and CCl4 in mice by modulating hepatic lipid peroxidation and glutathione (GSH) level,[26] and by restoration of enzymes of the plasma membrane, microsomal, lysosomal, and cytoplasmic fractions of hepatic tissue.[27] Moreover, CCl4-mediated hepatic lipid peroxidation and activities of the related antioxidative enzyme levels were significantly inhibited by ETP.[27] Marked protection was given by ETP as refl ected by the hematological status, hematopoietic system and plasma protein levels in mice during CCl_4 poisoning.[28]

A strong evidence that ETP can offer protection against the induction of chromosomal aberrations, DNA-chain break and sugar-base damage in liver, induced by either chronic or a single acute dose of CCl4. The biological and molecular response of ETP suggests the underlying molecular mechanisms of the promising antihepatotoxic activity of *T. portulacastrum*.[16]

Antihyperglycemic activity/hypoglycemic

The **methanolic extract** of *T. portulacastrum* **whole plant** produced significant antihyperglycemic activity against streptozotocin (STZ)-induced diabetic rats, which

are comparable to glibenclamide (a standard oral hypoglycemic agent). The 100 and 200 mg/kg suspension of methanolic extract produced a significant antihyperglycemic effect ($P < 0.05$) after 1 h following administration and this antihyperglycemic effect was more pronounced after 4 h of treatment in STZ-induced diabetic rats.[23]

The **methanolic extract** of **whole plant** was administered for 7 days to normal and alloxan-induced diabetes rats at a dose of 100, 200, and 300 mg/kg. The extract produced signifi cant reduction ($P < 0.001$) in blood glucose in normal and diabetic rats as compared with standard oral hypoglycemic agent, glibenclamide.[8]

Hypolipidemic activity

The **methanolic extract of whole plant** produced a dose dependent hypolipidemic activity in rats. Diabetes mellitus associated with lipid metabolism is improperly regulated. A dose of 100, 200, and 300 mg/kg showed beneficial effects on the lipid profile in normal as well as alloxan-induced diabetic rats at the end of the treatment period, that is, 7 days.[8] The hypolipidemic drugs have attended considerable attention because of their potential to prevent cardiovascular disease by retarding the accelerated atherosclerosis in hyperlipidemic individuals.[22]

Antifungal activity

It was reported that horse purslane extract against *F. chlamydosporum* found to be very effective which causes leaf-spot disease in the plants.[29] Tetraterpenoid trianthenol and **chloroform extract of plant** both showed antifungal activity. When these were subjected to in vitro fungicidal bioassay against a number of human and plant pathogens, the percentage inhibition of the crude extract and trianthenol was found to be moderate in comparison to respective standard drugs.[30]

Analgesic activity/antinociceptive activity

The **ethanol** extract of *T. portulacastrum* (**whole plant**) was evaluated by acetic acid-induced writhing and hot plate methods to assess analgesic activity. It was found that the extract caused an inhibition on the writhing response induced by acetic acid in a dose-dependent manner. A dose of 250 mg/kg extract and Aspirin could block the writhing response by 50.92% and 67.68% ($P < 0.001$), respectively. It was also indicated that the extract showed significant antinociceptive action in hot plate reaction time method in mice. This effect was comparable to that of standard drug Aspirin-treated controls, suggesting the central activity of extract.[15, 31]

Chemosterilant/molting hormone activity

Ecdysterone is the most widely occurring phytoecdysone, is also obtained from **whole plant** of *T. portulacastrum* as a major chemical constituent. The compound and its analogs have potential use as chemosterilants and because they stimulate protein synthesis not only in insects but also in mammals. The bioassay for the molting hormone activity was carried out by modifying the "Chilo dipping" technique. In the present work, *Musca domestica* (housefly) larvae were used, which give quicker response compared with *Chile*. The isolated abdomens of housefly larvae were dipped in the crude extracts of the plants. The molting hormone activity was shown by the formation of a pupanum. For quantitative experiments, the test solutions were injected into the isolated larval abdomens. A dose of 0.01 μg of ecdysterone gave a full pupation response.[32] There are possibilities of utilizing insect molting hormone as third-generation insecticide.[33]

Antioxidant activity

The **ethanolic leaves extract** of *T. portulacastrum* L. showed the antioxidant activity in relation to hepatotoxins, paracetamol, and thioacetamide in rats. The levels of antioxidant enzymes, namely glutathione reductase (GSH-R), glutathione-S-transferase (GST), glutathione peroxidase (GPX), superoxide dismutrase (SOD), and catalase (CAT), were decreased significantly in toxicantstreated rats when compared with those of normal control animals. Thus antioxidant capacity of the liver decreased leading to the generation of lipid peroxides resulting in liver damage. But treatment with 100 mg and 200 mg/kg p.o. ethanolic leaves extract of the plant increases the activity of SOD and CAT and it scavenges free radicals and reduces hepatic damage. So it might be concluded that the hepatoprotective action of extract is due to its antioxidant activity.[16,34]

Glomerulosclerosis

The methanolic extract of *T. portulacastrum* L. with 100 and 200 mg/kg, b.w. produced a protection against atherosclerotic diet or CCT (4% cholesterol, 1% cholic acid, and 0.5% thiouracil) diet-induced glomerulosclerosis and hepatic damage by reducing serum lipid levels, AST, ALT (aspartate and alanine transaminases), and creatinine levels in rats.[35]

Diuretic Properties

In India *T. portulacastrum* is commonly been used for ethnomedicinal purposes because of its diuretic activity. When diuretic activity of plant extract compared with standard diuretic that is furosamide than it gave 79% result in response to the plant dose of concentration 50 mg/kg and also produces kaliuretic and natiuretic effects.[36]

Antilithiatic activity

The present study was focused on evaluation of *ethanolic extract of leaves* of *Trianthema portulacastrum* Linn. (EETP) on experimentally induced urolithiasis. Parameters like urinary volume, urine analysis (calcium, oxalate, phosphate, magnesium, and phosphate), serum analysis (calcium, creatinine, uric acid, BUN) and antioxidant studies (SOD, CAT, MDA) were performed to access the activity. Treatment with ethanolic extract of *Trianthema portulacastrum* at both the doses showed a significant restoration of urinary and serum parameters

on Eethylene Glycol &Ammonium chloride induction. The extracts at both doses showed significant increase in antioxidant enzymes activity &decrease in MDA levels.[37]

Antimicrobial properties

Some reports depicted that *T. portulacastrum* possessed antimicrobial properties and found to be effective against both gram positive and gramnegative bacteria, fungi and helminthes because of the presence of photochemical available in plant.[38] Plant extract prepared from roots showed antimicrobial property against bacteria *Bacillus subtilis*, *Escherichia coli*, *Proteus vulgaris* and *Staphylococcus aureus*. Phytochemical screening confirmed the presence of alkaloid, flavonoid, sterols and phenolic compounds in the plant. Further attribution to the research explored that fraction of flavonoid of plant *T. portulacastrum* performed better antimicrobial and antifungal propertied, based on zone of inhibition than that of phenolic and alkaloid fractions in the methanolic extract.[39]

Anthelmintic activity

Evaluation of anthelmintic effects of *Trianthema portulacastrum* L. (Aizoaceae) whole plant against prevalent gastrointestinal worms of sheep was done that may justify their traditional use in veterinary clinical medicine. *In vitro* anthelmintic activity of the crude aqueous methanolic extract (CAME) of the plant was determined using mature female Haemonchus (H.) contortus and their eggs in adult motility assay (AMA) and egg hatch test (EHT), respectively. In vivo anthelmintic activity of crude powder (CP) and CAME in increasing doses (1.0-8.0 g kg(-1)) was determined in sheep naturally infected with mixed species of nematodes using fecal egg count reduction test (FECRT) and larval counts. Fecal egg count reduction and larval counts from coprocultures were performed pre- and post-treatments to assess the anthelmintic activity of the plants. CAME of *T. portulacastrum* showed a strong in vitro anthelmintic activity and pronounced inhibitory effects on H. contortus egg hatching as observed through AMA and EHT, respectively. It exhibited dose and time dependent anthelmintic effects on live worms as well as egg hatching. All the species of gastrointestinal nematodes (GINs), i.e. Haemonchus contortus, Trichostronglyus spp., Oesophagostomum columbianum and Trichuris ovis which were prevalent, found susceptible ($P<0.01$) to the different doses of CP and CAME of plant. The data showed that *T. portulacastrum* possess strong anthelmintic activity *in vitro* and in vivo, thus, justifying their use in the traditional medicine system of Pakistan.[40]

Nephroprotective effects

To evaluate the nephro protective effect of **ethanolic extract** of *Trianthema portulacastrum* **leaves** in gentamicin induced renal damage in rats. The protective effect was further studied from analyzing the potential of the extract to scavenge the free radicals. I.p administration of ethanolic extract of *T.portulacastrum* restored the levels of the biochemical factors determined significantly and exhibited a significant potential to scavenge free radicals with respect to control. The ethanolic extract of *T.portulacastrum* exhibited significant nephroprotective activity.[41]

Antiinflammatory activity

Trianthema portulacastrum is being used in Ayurveda for its anti - inflammatory activity in chronic models of inflammation. Wistar albino rats were treated with **whole plant ethanolic** extract of *Trianthema portulacastrum* 100mg \ kg orally with 2% gum acacia , as suspending agent and indomethacin 20mg \ kg as standard. And the effects were observed in chronic model of inflammation namely, rexin pellet induced granuloma model. This study demonstrated that *Trianthema portulacastrum* reduced significantly the dry weight of granuloma that was formed after rexin pellet implantation. It has got significant anti - inflammatory activity in chronic models of inflammation.[42]

Mosquito larvicidal activity

Crude **aqueous and acetone extracts of leaf** of *Trianthema portulacastrum* was evaluated for its mosquito larvicidal properties against the larvae of four vector species of mosquito under laboratory conditions. These extracts showed good larvicidal properties, 100% mortality in the third instar larvae was observed in the larval bioassay test with Anopheles culicifacies, Anopheles stephensi, Culex quinquefasciatus and Aedes aegypti at a concentration of 1.0, 0.75, 0.75 and 1.0% respectively. It was observed that the acetone extract is more effective as compared to aqueous extract. *Trianthema portulacastrum* can be considered as a probable source of photochemical used for the development of larvicide against disease vectors.[43]

Antifertility activity

T. portulacastrum has been well known for its antifertility properties because of the presence of phytochemical like steroid and ecdysterone that has been naturally present. Hence, it is employed as a contraceptive and abortifacient by some rural peoples and tribal communities of India. This tendency was studied in aqueous, chloroform and alcoholic extracts of plant, to exhibit antifertility activity. It was found that alcoholic, chloroform and aqueous extract perform 94%, 73% and 64% abortifacient activity. From this, it was clearly depicted that alcoholic extract is most potential as antifertility agent.[44]

Anticarcinogenic activity

The study clearly demonstrates that the anticarcinogenic property of *T. portulacastrum* L. is very promising. The chloroform fraction of overground part of *T. portulacastrum* has emerged as the most active fraction inhibiting chemically induced rat hepatocarcinogenesis. Hepatocarcinogenesis was induced by the potent carcinogen diethylnitrosoamine (DENA). The

chloroform extract of *T. portulacastrum* has proved significant in reducing nodule incidence by as much as 25% as compared to 100% in the DENA-treated group. Most of the antineoplastic agents available in the market produce many toxic side effects, such as nephrotoxicity, cirrhosis, and so on, but since the control as well as the experimental animals indulged in normal food and water intake; the extract may be taken to be nontoxic.[45]

CONCLUSION

Natural and herbal drugs are recognized as safe but can also lead to adverse reactions, therefore correct identification and adulteration can help to validate it as potential drug candidate. Different polyphenolics isolated from the extract prepared in different solvents which seems to persist number of pharmacological properties such as antimicrobial, analgesic, anti-inflammatory, antidiabetic, anti-hyperglycemic, hepato-protective activity and help in curing many disorders. This review is an effort to bring all the properties of this plant together that was reported at times. This report explored important therapeutical properties of this herb and its curative nature which converge the interest of researchers towards this plant. This study finally concludes that *T. portulacastrum* L. is an unusual and unbelievable source with so much to offer the world of medicine. As it is a weed, widely available in all the seasons, drastic conditions and ease of collection in low cost, the plant could serve as a "lead" for the development of novel agents having good efficacy in various disorders in the future. Moreover, there are possibilities of utilizing insect molting hormone, Ecdysterone as third-generation insecticide.

REFERENCE

1. Anonymous. Quality Standards of Indian Medicinal Plants. Vol.1. New Delhi: Indian Council of Medical Research, 2003; 261- 70.
2. Kumar A, Saluja AK, Shah UD, Mayavanshi AV, Pharmacological potential of Albizzia lebbneck: A review. Pharmacognosy Review, 2007; 1: 171-4.
3. Cragg GM, Newman DJ, Snader KM. Natural products in drug discovery and development. Journal of Natural Product, 1997; 60: 52-60.
4. Kirtikar KR, Basu BD. Indian Medicinal Plants. Vol. 2. Allabahad: Lalit Mohen Basu, 1975: 1180-1.
5. Yaqoob S, Sultana B, Mushtaq M. *In vitro* antioxidant activities of *Trianthema portulacastrum* L. Hydrolysates. Preventive Nutrition and Food Science, 2014; 19(1): 27-33.
6. Yamaki J, Venkata KC, Mandal A, Bhattacharyya P, Bishayee A. Health-promoting and disease-preventive potential of *Trianthema portulacastrum* Linn. (Gadabani)- An Indian medicinal and dietary plant. Journal of Integrative Medicine. 2016; 14(2): 84-99.
7. Gaddeyya G, Kumar PR. A Comprehensive review on ethnobotany and photochemistry of a herbal weed *Trianthema portulacastrum* L. Journal of Pharmacognosy and Phytochemistry, 2015; 4(4): 25-31.
8. Anreddy RNR, Porika M, Yellu NR, Devarakonda K. Hypoglycemic and hypolipidemic activities of *Trianthema portucastrum* Linn. Plants in normal and alloxan induced diabetic rats. Int J Pharmacol, 2010; 6(2): 129-33.
9. Balyan RS. Bhan VM. Emergence, growth and reproduction of horse purslane (*Trianthema portulacastrum*) as infl uenced by environmental conditions. Weed Science, 1986; 34: 516-9.
10. Randhawa MA, Khan MA, Khan NH. Infl uence of *Trianthema portulacastrum* infestation and plant spacing on the yield and quality of maize grain. Int J Agric Biol, 2009; 11: 225-7.
11. Wealth of India (Raw Materials). Vol.10. New Delhi: Council of Industrial and Scientific Rearch, 1976; 281.
12. Bruckmann C, Gerbaulet M, Hammer SA, Hansen B, Hartmann HE, Ihlenfeldt HD, et al. Illustrated Handbook of Succulent Plants: Aizoaceae AE. Springer Science and Business Media, 2001.
13. Karim S, Jahan N, Jafri MA, Physico-chemical studies of Biskhapra (*Trianthema portulacastrum* Linn.) leaves. Indian Journal of Unani Research, 2011; 11(11): 52-60.
14. Anonymous. The Ayurvedic Pharmacopoeia of India. Govt of India, Ministry of Health and Family Welfare, Dept of Ayush. Part-1st; vol-4th : 209.
15. Shanmugam SK, Bama S, Kiruthiga N, Kumar RS, Sivakumar T, Dhanabal P. Investigation of analgesic activity of leaves part of the *Trianthema portulacastrum* (L) in standard experimental animal models. Interational Journal of Green Pharmcy, 2007; 1: 39-41.
16. Sarkar A, Pradhan S, Mukhopadhyay I, Bose SK, Roy S, Chatterjee M. Inhibition of early DNA-damage and chromosomal aberrations by *Trianthema portulacastrum* L. in carbon tetrachloride-induced mouse liver damage. Cell Biology International, 1999; 23: 703-800.
17. Udom K, Nattapol W-I, Santi TP, Warinthorn C, Gysorn V, Jim S, *et al*. A C-methylflavone from *Trianthema portulacastrum*. Phytochemistry, 1997; 44: 719-22.
18. Khare CP. Indian Medicinal Plants, an Illustrated Dictionary, Berlin/Heidelberg: Springer-Verlag, 2006; 96: 668.
19. Bharathidhasan S, Ganesh Babu NS, Balakrishnan V. In vitro Evaluation of the Nutritive Value of *Trianthema portulacastrum* as a Source of Fodder for Ruminants. Malaysian Journal of Nutrition, 2007; 13: 179- 87.
20. Banerji A, Chintalwar GJ, Joshi NK, Chadha MS. Isolation of ecdysterone from Indian plants. Phytochemistry, 1971; 10: 2225- 6.
21. Singh BP, Singh RP, Jha OP. Flavonoids of some Aizoaceae and Molluginaceae of Bhagalpur. Biology Bulletin India, 1982; 4: 157-63.

22. Tripathi KD. Essentials of Medical Pharmacology. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd, 2004; 575.
23. Sundera A, Shyam RG, Bharath A, Rajeshwara Y. Antihyperglycemic Activity of *Trianthema Portulacastrum* Plant in Streptozotocin Induced Diabetic Rats. Pharmacologyonline, 2009; 1: 1006-11.
24. Kumar G, Banu GS, Pappa PV, Sundararajan M, Pandian MR. Hepatoprotective activity of *Trianthema portulacastrum* L. against paracetamol and thioacetamide intoxication in albino rats. Journal of Ethnopharmacology, 2004; 92: 37-40.
25. Banu GS, Kumar G, Murugesan AG. Ethanolic leaves extract of *Trianthema portulacastrum* L. Ameliorates aflatoxin b1 induced hepatic damage in rats. Indian Journal of Clinical Biochemistry, 2009; 24: 250-6.
26. Mandal A, Bishayee A, Chatterjee M. *Trianthema portulacastrum* affords antihepatotoxic activity against carbon tetrachloride induced chronic liver damage in mice: Reflection in subcellular levels. Phytotherapy Research, 1997; 11: 216-21.
27. Mandal A, Bandyopadhyay S, Chatterjee M. *Trianthema portulacastrum* L. reverses hepatic lipid peroxidation, glutathione status and activities of related antioxidant enzymes in carbon tetrachloride-induced chronic liver damage in mice. Phytomedicine, 1997; 4: 239-44.
28. Mandal A, Karmakar R, Bandyopadhyay S, Chatterjee M. Antihepatotoxic potential of *Trianthema portulacastrum* against carbon tetrachloride-induced chronic hepatocellular injury in mice: Reflection in hematological, histological and biochemical characteristics. Archives of pharmacal Research, 1998; 21: 223-30.
29. Aneja KR, Kumar V, Sharma C. Leaf-spot disease of *Trianthema portulacastrum* – a new record from world. Journal of Innovations in pharmaceutical and Biological science, 2014; 1(2): 112-16.
30. Nawaz HR, Malik A, Ali MS. Trianthenol: An antifungal tetrapenoid from *Trianthema portulacastrum* (Aizoaceae). Phytochemistry, 2001; 56: 99-102.
31. Umesh GW. Analgesis activity of ethanolic extract of the plant *Trianthema portulacastrum* in experimental model. Journal of Evolution of Medical and Dental Science, 2015; 4(34): 5867-71.
32. Dinan L. Phytoecdysteroids: Biological aspects. Phytochemistry, 2001; 57: 325-39.
33. Ravishankar GA, Mehta AR. Control of ecdysterone biogenesis in tissue culture of *Trianthem portulactrum*. Journal of Natural Product, 1979; 42: 152-8.
34. Liou GY, Storz P. Reactive oxygen species in cancer. Free Radical Research, 2010; 44(5): 479-96.
35. Shyam Sunder A, Reddy RN, Rajeshwar Y, Kiran G, Devkota KP, Baburao B. Protective effect of methanolic extract of *Trianthema portulacastrum* in atherosclerotic diet induced renal and hepatic changes in rats. Der Pharmacia Lettre, 2010; 2: 540-5.
36. Asif M, Atif M, Malik ASA, Dan ZC, Ahmad I, Ahmad A. Diuretic activity of *Trianthema portulacastrum* crude extract in albino rats. Tropical Journal of Pharmaceutical Research, 2013; 12(6): 967–72.
37. Sree lakshmi K, Prabhakaran V, Mallikarjuna G, Gowthami A. Antilithiatic Activity of *Trianthema portulacastrum* l. and *Gymnema sylvestre* R.Br against Ethylene Glycol induced Urolithiasis. Interational Journal of Pharmaceutical Science Review and Research, 2014; 25(1): 16-22.
38. Obeidat M, Shatnawi M, Al-alawi M, Al-Zu 'bi E, Al-Dmoor H, Al-qudah M, et al. Antimicrobial activity of crude extract of some plant leaves. Research Journal of microbiology, 2012; 7(1): 59-67.
39. Kavitha D, Parvatham R, Padma PR. Assessment of *Trianthema portulacastrum* for its antimicrobial potential and investigation of their phytochemicals using HPTLC,GC-MS, and IR. International Journal of Pharmacy and Pharmaceutical Sciences, 2013; 6(1): 675-86.
40. Hussain A, Khan MN, Iqbal Z, Sajid MS, Khan MK. Anthelmintic activity of *Trianthema portulacastrum* L. and *Musa paradisiaca* L. against gastrointestinal nematodes of sheep. Veterinary Parasitology, 2011; 179(1-3): 92-99.
41. Balamurugan G, Jagan Mohan CM, Muthusamy P. Protective effect of *Trianthema portulacastrum* Linn leaves on gentamicin induced nephrotoxicity in rats. Journal of Natural Remedies, 2009; 9(2): 165–169.
42. Suresh. S Kendri. A Study Of Anti - Inflammatory Activity of Plant "*Trianthema Portulacastrum*" In Chronic Models of Inflammation. Journal of Evolution Of Medical and Dental Sciences, 2015; 4(45): 7793-7796.
43. Singh SP**,** Raghavendra Kamaraju**,** Thomas TG**.** Mosquito larvicidal properties of aqueous and acetone extracts of *Trianthema portulacastrum* Linn. (Family: Aizoaceae) against vector species of mosquitoes. The Journal of communicable diseases, 2011; 43(4): 237-41.
44. Parveena Devi, Pradeep Kumar, Nidhi and Isha Dhamija. Antifertility Activity of Medicinal Plants On Male And Female Reproduction. International Journal of Pharmaceutical Science and Research, 2015; 6(3): 988-1001.
45. Bhattacharya S, Chatterjee M. Protective role of *Trianthema portulacastrum* against diethylnitrosamine induced experimental hepatocarcinogenesis. Cancer Lett, 1998; 129: 7-13.