

rhamnopyranosyl)-robinobiosides (Discadee *et al.*, 2011).

Joshi (1961) studied the changes in free amino acids and mineral constituents of *Sesuvium portulacastrum* L., a salt marsh halophyte over two seasons *i.e.* winter and summer. Proline, aspartic acid, glutamic acid, alanine, serine and glycine were found in considerable quantities, while threonine, valine, methionine,  $\gamma$ -aminobutyric acid and phenylalanine were present to a lesser extent. Leucine and isoleucine were present as traces. Na and Cl were the main inorganic ions, while K, Ca, Mg and SO<sub>4</sub> were also absorbed in substantial amounts in spite of the saline condition.

### **Folk Medicine, Pharmacological and Biological Activities**

*Trianthema portulacastrum* is an important medicinal plant used in Ayurvedic and Unani systems of medicine. It is attributed with analgesic, stomachic, alterative, anti-inflammatory and abortifacient properties and is claimed to be of value in asthma, bronchitis, ascites, orchitis, cardiovascular disorders and migraine. It is also used as a laxative and alterative. The root is applied to the eye cures, corneal ulcers, itching, dimness of sight and night blindness (Vohra *et al.*, 1983; Kirtikar and Basu. 1984).

Crude extracts from the roots and leaves of the plant have been investigated for their general pharmacodynamics (e.g. blood pressure, respiration, smooth and skeletal muscles, isolated from heart preparations etc.) (Gupta *et al.*, 1976), and antifertility effects (Jamwal and Anand, 1962; Garg, 1976). Ethanolic extract of the whole plant of *Trianthema portulacastrum* showed the following activities: antipyretic (against yeast pyrexia in rats), analgesic (against chemical and electrical stimuli), anti-inflammatory (30.43% inhibition of formaldehyde induced arthritis in rats), *in vitro* antibacterial and also CNS depressant properties (Vohra *et al.*, 1983).

*Trianthema portulacastrum* (carpet weed) possesses a potent hepatoprotective action against EtOH-, CCl<sub>4</sub>- (Bishayee *et al.*, 1996; Mandal *et al.*, 1998), paracetamol- and thioacetamide - induced hepatocellular injury (Kumar *et al.*, 2004) and a strong anthelmintic activity (Hussain *et al.*, 2011). The chemo-preventive efficacy of the plant against diethylnitrosoamine-induced experimental hepatocarcinogenesis was also reported. The plant reverses hepatic lipid peroxidation, glutathione status, and activities of related enzymes in CCl<sub>4</sub>-induced chronic liver damage in mice. The elevated lipid peroxidation of the liver due to chronic CCl<sub>4</sub> treatment normalized dose-dependently following treatment with ethanolic extract of the plant. The CCl<sub>4</sub>-treated mice showed both decrease in their hepatic-reduced glutathione (GSH) level and an increase in their oxidized glutathione (GSSG) level, meanwhile their GSH/GSSG ratio decreased. The extract increased dose-dependently the activity of glutathione reductase and decreased those of catalase, glutathione peroxidase and glutathione S-transferase in the liver (Mandal *et al.*, 1997). The ethanolic extract of *Trianthema portulacastrum* caused a significant reduction in the lipid levels in hyperlipidemic rats and is comparable with the standard anti-hyperlipidemic drug atorvastatin. The plant extract also increases the liver antioxidant enzyme (catalase superoxide dismutase, glutathione) levels while reducing the lipid peroxide (malondialdehyde) levels (Sunder *et al.*, 2010a). The methanolic extract showed a concentration dependent free radical scavenging activity against 1,1-diphenyl-2-picrylhydrazyl and hydrogen peroxide radicals, and the IC<sub>50</sub> values were found to be 4.5 ± 0.6 and 3.7 ± 0.5 mg/ml, which were comparable with standard ascorbic acid (Sunder *et al.*, 2010b).

A decrease in the parenchyma occupied by foci seems to suggest the anticarcinogenic potential of the plant in DENA-induced hepatocarcinogenesis (Bhattacharya and Chatterjee, 1998a). The chloroform fraction of the plant has been found to be very effective in restoring glutathione levels and the levels of phase I (cytochrome P450 monooxygenase) and phase II

(UDPGT) enzymes which undergo substantial changes during chemical rat hepatocarcinogenesis (Bhattacharya and Chatterjee, 1998b).

The tetraterpenoid, trianthenol, exhibited antifungal activity (Nawaz *et al.*, 2001). The root extract showed antibacterial activity against *Bacillus subtilis*, *Escherichia coli*, *Proteus vulgaris*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*. The antibacterial activity was comparable to cortimoxazole (Kumar *et al.*, 2006). The methanolic extract of *Trianthema portulacastrum* produced a dose dependent hypoglycemic, and hypolipidemic activity in rats and were comparable with standard oral hypoglycemic agent, glibenclamide (Anreddy *et al.*, 2010). Banerjee *et al.* (2006) reviewed the therapeutic values of 16 chemical substances characteristic of the plant which have in indigenous system of medicine several applications either with its different parts or as entire herb.

*Sesuvium portulacastrum* is used as remedy of fever and scurvy (Magwa *et al.*, 2006). The antioxidant activity of the same plant (Agoramoorthy *et al.*, 2008; Thirunavukkarasu *et al.*, 2010), as well as the antibacterial and antifungal activities of its essential oil (Magwa *et al.*, 2006) have been reported. The plant has been used as a replacement of salt in the curing process of goatskins (Kanth *et al.*, 2009).

4.5.2. ***Trianthema triquetra*** Willd., Ges. Naturf. Freunde Berlin Neue Schriften 4: 181 (1803); Boulos, Fl. Egypt 1: 48 (1999).

Syn. *Trianthema salsoloides*, sensu Täckh., Stud. Fl. Egypt, ed. 2: 75 (1974).

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Fifteen alkanes and 6 isoalkanes were detected in some Aizoaceae including *Trianthema triquetra* (Singh *et al.*, 1982a). Temporal variations in osmoregulatory solutes with reference to saline habitat and habits in two species of *Trianthema* have been studied by Joshi *et al.* (2007). Highly significant temporal variations of salinity, Na<sup>+</sup> and Cl<sup>-</sup> content were observed in the habitat. Although quantity of major amino acids was significantly different in leaves, stems and roots of *Trianthema monogyna* L. and *Trianthema triquetra* Rott. ex Willd., their concentrations did not reflect any temporal effects. Accumulation of sugar in vegetative organs and their fluctuations were not significant for thin leaved species *Trianthema monogyna*, but their content in *Trianthema triquetra* was affected by temporal changes. Amounts of Na<sup>+</sup>, Cl<sup>-</sup>, Ca<sup>2+</sup> and K<sup>+</sup> in plant organs were positive related with changes in salinity and mineral ion composition of the habitat.

The antihepatotoxic effect of *Trianthema triquetra* root has been reported. The activity of the antioxidant enzymes such as GPx, CAT, SOD and vitamin E is significantly recovered towards an almost normal level in rats treated with the plant. The maximum protection against CCl<sub>4</sub> induced hepatic injury was afforded by the dose of 200 mg/kg body weight of the plant (Chitra and Nithyanandhi, 2007).

## 4.6. ZALEYA Burm.f.

The genus *Zaleya* is represented in Egypt by two species (Boulos, 1999).

4.6.1. ***Zaleya decandra*** (L.) Burm. f., Fl. Ind. 110, t. 31, f. 3 (1768); Boulos, Fl. Egypt 1: 49 (1999).

Syn. *Trianthema decandra* L., Mant. 70 (1767).

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