4.4. *SESUVIUM* L.

Sesuvium verrucosum possesses cytotoxic activity (Taha and Alsayed, 2000).

The genus *Sesuvium* is represented in Egypt by one species.

4.4.1. ***Sesuvium sesuvioides*** **(**Fenzl) Verdc., Kew Bull. 12: 349 (1957); Boulos, Fl. Egypt 1: 46 (1999).
Syn. *Diplochonium sesuvioides* Fenzl, Nov. Stirp. Dec. 7: 58 (1839).

Nothing has been reported about the constituents of this species.

4.5. *TRIANTHEMA* L.

Isoamericanin A, a neolignan, was isoloated from the seeds of *Trianthema turgidifolia* (Sarker *et al*., 1998a). The seeds of *Trianthema pilosa* and *Trianthema turgidifolia* yielded the following ecdysteroids: 20-hydroxyecdysone, ajugasterone C and polypodine B (Sarker *et al*., 1998b).

The genus *Trianthema* is represented in Egypt by two species.

4.5.1. ***Trianthema portulacastrum*** L., Sp. Pl., ed. 1, 223 (1753); Boulos, Fl. Egypt 1: 48 (1999).
Syn. *Sesuvium portulacastrum* L., Syst. Nat., ed. 10, 2: 1058 (1995);
Trianthema monogyna L., Mant. 69 (1767).

Carpet weed, Horse purslane

Constituents

Trianthema portulacastrum contains 21.5 – 29.4% protein similar to leucrne with relatively low structural carbohydrate (neutral detergent fiber: 43.6± 3.1%). (Garg *et al*.,1978; Bharathidhasan *et al*., 2007). The green leaves of the plant are good source of Fe, with moderate levels of Ca, P, Zn and carotenoids (Rao *et al*., 1980; Ragu and Kapoor, 1977; Bharathidhasan *et al*., 2007; Gooneratne and Kumarapperuma, 2007; Hussain *et al*., 2010).

The seeds of *Trianthema monogyna* contain oil (14.0%), protein (9.0 %) and moisture (9.0 %) the fatty acids were identified as $C_{16:0}$, 17.9; $C_{18:0}$, 2,5; $C_{18:1}$, 17.9 and $C_{18:2}$, 61.7% (Ahmad *et al*., 1979). Eight free amino acids were detected in the plant, including alanine and phenylalanine (Garg *et al*., 1978). The protein concentrate from the leaves of *Trianthema monogyna* L. had 44% protein, 37% carbohydrates and 14% ash (Mehrotra *et al*., 1978). The seeds of *Trianthema monogyna* contain 14.0% oil and 9.0% protein. The fatty acid composition of the oil is $C_{16:0}$ (17.9%), $C_{18:0}$ (2.5%), $C_{18:1}$ (17.9%) and $C_{18:2}$ (61.7%) (Ahmad *et al*., 1979).

Fifteen alkanes and 6 isoalkanes were detected in some Aizoaceae including *Trianthema portulacastrum* (Singh *et al*., 1982a). The seed oil (12.5 %) of *Trianthema portulacastrum*, growing in Pakistan, has been examined for its physicochemical. characteristics and fatty acid composition. TLC of the oil into lipid classes resulted into polar lipids (4.8%) and neutral lipids (95.2%). Fractionation of the neutral lipids provided hydrocarbons (0.3%), wax esters

(0.5%), sterol esters (4.0%), triglycerides (84.5%), free fatty acids (1.8%), diglycerides (2.5%), and monoglycereids (1.6%). The fatty acids which ranged from C_8 to C_{20} have also been (Ashraf and Riaz, 1996).

Soluble and total oxalate (as % oxalic acid on moisture-free basis) of *Trianthema portulacastrum* (a pasture plant in Queensland) are 7.7 and 9.6 respectively (Mathams and Sutherland, 1952). An average of 4.1% oxalic acid was extracted from soluble oxalates of leaves and 2.2% from the stems (Bharadwaj and Chandra, 1987). The stems and leaves are reported as good sources (≥ 1.0%) of oxalic acid (Bharadwaj, 1988). The macro- and microscopical characters of *Trianthema portulacastrum*, including physical constants and extractive values, have been reported (Prasad, 1984; Kumar *et al*., 2006).

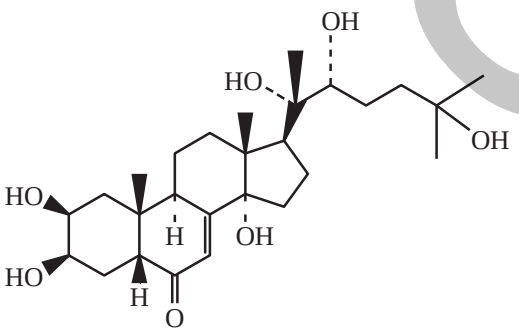
An antifungal tetraterpenoid named trianthenol has been isolated from the chloroform extract of *Trianthema portulacastrum*. Its structure was established as 15 - hydroxymethyl - 2,6,10,18,22,26,30-heptamethyl-14-methylene-17-hentriacontene benzaldehyde derivative, pentacyclic triterpenoid and benzoic acid derivatives were also reported from *Trainthema portulacastrum* (Nawaz *et al*., 2001).

Ecdysterone (Banerji *et al*., 1971), leptorumol (5,7-dihydroxy-6,8-dimethoxychromone) and 5,2'-dihydroxy-7-methoxy-6,8-dimethylflavone (Kokpol *et al*., 1997), 3,4-dimethoxy-cinnamic acid and betacyanin (Singh *et al*., 1982b) were isolated from *Trianthema portulacastrum*.

The white- and red-flowered varieties of *Trianthema portulacastrum* have been early reported to contain the alkaloid punarnavine (Chopra *et al*., 1940). Basu *et al*. (1947) isolated an alkaloid ($C_{32}H_{36}O_6N_2$, m.p. 127°C, picrate m.p. 112°C, platinichloride m.p. 121-122°C, oxalate m.p. 138°C, aurichloride m.p. 150-153°C, and sulphate m.p. 110-111°C) from *Trianthema monogyna*. The predominant alkane of the hydrocarbons from the surface wax of the fresh leaves of *Trianthema portulacastrum* was *n*-C_{27} (29.18%) (Laskar *et al*., 2003).

Quercetin and ferulic acid were synthesized in *Trinthema portulacastrum* due to fungal infection (Parikh and Daniel, 1992).

Both α- and β- ecdysones have been isolated from *Sesuvium portulacstrum* (Banerji and Chintalwar, 1971). This species was reported as one of the best sources of ecdysterone (Banerji *et al.*, 1971). 20-Hydroxyecdysone (**17**), an important insect moulting hormone was isolated from *Sesuvium portulacastrum* (Rele *et al*., 2003). α-Pinene, β-pinene, camphene, α-terpinene, cymene, limonene, 1,8-cineole, bornyl acetate, tridecane, *trans*-caryophyllene and α-humulene were identified in the essential oil (0.15%) of *Sesuvium portulacastrum* (Magwa *et al*., 2006). High concentration of betaine was found in the same species (Adrian-Romero *et al*., 1998).



17 20-Hydroxyecdysone

The following flavonoids were identified from *Sesuvium portulacastrum* : eupalitin, eupalitin 3-*O*-rutinoside, eupalitin 7-glucoside (Banerji and Chintalwar, 1971; Khajuria *et al*., 1982), and sesuviosides A-F (flavonol 3-*O*-robinobiosides and 3-*O*-(2''-*O*-α-L-

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, γ-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_4 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 analagesic, 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 antifertilty 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 (Vohora *etr al*., 1983).

Trianthema portulacastrum (carpet weed) possesses a potent hepatoprotective action against EtOH-, CCl_4- (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_4-induced chronic liver damage in mice. The elevated lipid peroxidation of the liver due to chronic CCl_4 treatment mormalized dose-dependently following treatment with ethanolic extract of the plant. The CCl_4-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 dismutane, 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-picryl hydrazyl and hydrogen peroxide radicals, and the IC_{50} 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 monoxygenase) and phase II