The Aizoaceae is a large dicotyledon family with 114 genera and 2400 species (Boulos, 1999). The family Aizoaceae is inseparable in the mind from the names of *Mesembryanthemum*. According to Watt and Breyer-Brandwijk (1962), many of the familiar species of *Mesembryanthemum* have disappeared into other generic names, of which too many are unfamiliar.

Sterols and Terpenes

An analysis of 11 species in eight genera of the family indicates that Δ^5-sterols are dominant (Table 1), although *Drosenthemum hispidium* contains 57% of Δ^0 (Δ^0- sterols here refers to sterols with no nuclear double bond) (Patterson and Xu, 1990). The following sterol β-glucosides were identified from the aerial parts of *Tetragonia tetragonoides*: β-sitosterol β-D-glucoside, α-spinasterol β-D-glucoside, schottenol β-D-glucoside, Δ^{22}-stigmasterol β-D-glucoside, stigmasterol β-D-glucoside, stigmastanol β-D-glucoside and campesterol β-D-glucoside (Okuyami and Yamazaki, 1983).

Tetragonia tetragonoides has been reported to contain a cyclic diterpene (6,10,14-trimethyl-2-methylenepentadecanal), norditerpene aldehyde (2(*E*)-3,7,11,15-tetramethyl-hexadecenal, neophytadiens, phytol, methyl (2*E*)- and (2*Z*)-3-(4-hydroxy-3-methoxyphenyl-propanoate (plus its *cis* isomer) (Aoki *et al*., 1982).

Flavonoids and Other Phenolics

Richardson (1981) found that several members of the Molluginaceae contain *C*-glycosylflavones, confirming the use of this character in distinguishing the family from herbaceous members of Aizoaceae. *Glicrothamnus ulei*, a woody member of the Aizoaceae contains *C*-glycosylflavones, unlike all herbaceous members of the family previously investigated. This plant appears to be a chemical link between the Aizoaceae and Molluginaceae. Two flavanone glycosides, liquiritrin and naringenin and one flavonol glycoside, 3',4'-dihydroxy-7-methoxyflavonol 3-*O*-β-D-glucoside were identified from the aerial parts of *Aptenia cordifolia* (Elgindi *et al*., 1999). Luteolin, luteolin 7-*O*-glucoside, kaempferol 3-*O*-glucoside, quercetin 3-*O*-glucoside (Kolodziej, 1982), and a 4-arylflavan-3-ol (Kolodziej, 1983) were isolated from *Nelia meyeri*. Lee *et al*. (2008) identified the following three flavonol glycosides from the aerial parts of *Tetragonia tetragonoids*: 6-methylkaempferol-3-*O*-β-D-glucosyl(1'''→2'')-β-D-glucopyranosyl-(6'''-(*E*-caffeoyl)-7-*O*-β-D-glucopyranoside,6,4'-dimethoxykaempferol-3-*O*-*β*-D-glucosyl (1'''→2'')β-D-gluco-pyranosyl -(6'''-(*E*)-caffeoyl-7-*O*-β-D-glucopyranoside and 4'-methoxypatuletin-*O*-β-D-glucosyl (1'''→2'')β-D-derivatives of betanin and isobetanin were isolated from flowers of *Drosenthemum floribundum* (Haw.) Schwant. (Impellizzeri *et al*., 1973b).

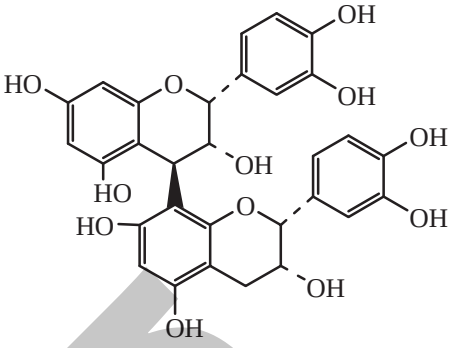
The occurrence and structural elucidation of three procyanidins *viz.* B-2 (**1**), B-5 (**2**) (dimers) and C-1 (**3**), a trimer) from *Nelia meyeri* have been reported (Kolodziej and Friedrich, 1979; Kolodziej, 1981, 1984). The anthocyanidin pelargonidin was detected in *Aptenia cordifolia* (Elgindi *et al*., 1999). Five bioactive compounds, individually or collectively responsible for the antibacterial property of *Carpobrotus edulis*, also known as Hotnotsfig or sourfig were identified as rutin, neohesperidin, hyperoside, catechin and ferulic acid (Van der Watt and Pretorius, 2001).

Six oxyneolignans *viz.* apteniols A-F (**4**-**9**) (Della Greca *et al*., 2005) and two lignamides (Della Greca *et al*., 2006) were isolated from the leaves of *Aptenia cordifolia*. Lignan amides have been also identified from *Tetragonia tetragonoids* (Lee *et al*., 2008).

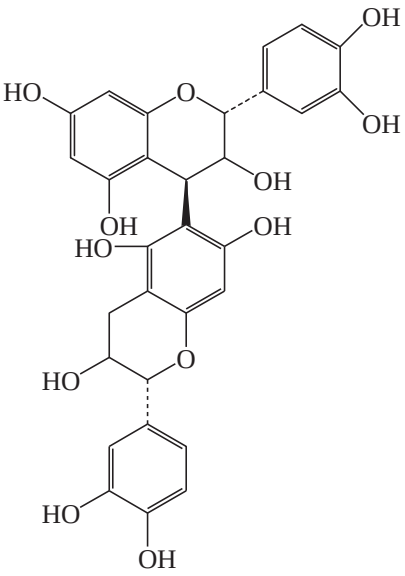
Table 1 – Desmethyl sterol composition of some species of the family Aizoaceae*

		Sterols (% total desmethylsterols)													
	Species	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1.	*Aptenia cordifolia*	—	1	15	15	32	—	—	17	3	—	2	—	14	—
2.	*Carpobrotus aequiliaterus*	7	—	12	24	49	—	—	6	2	—	—	—	—	—
3.	*Carpobrotus edulis*	—	—	9	2	59	—	—	16	1	—	1	—	12	—
4.	*Drosenthemum hispidium*	—	—	—	10	26	—	—	—	3	3	—	—	50	6
5.	*Eberlanzia hospitalis*	4	—	4	7	50	13	—	—	3	—	6	3	6	4
6.	*Gasoul crystallinum*	—	1	17	1	67	—	—	5	2	—	1	—	5	—
7.	*Gasoul nodiflorum*	—	3	4	9	27	—	—	15	11	—	2	1	23	4
8.	*Psilocaulon absmile*	6	4	5	7	35	2	1	2	3	—	—	3	28	4
9.	*Psilocaulon trothai*	4	2	3	6	29	3	—	—	17	—	1	2	29	2
10.	*Ruschia tumidula*	6	1	8	3	55	3	—	3	3	—	3	1	20	2
11.	*Tetragonia tetragonioides*	2	—	5	8	39	—	2	11	20	3	3	—	5	—

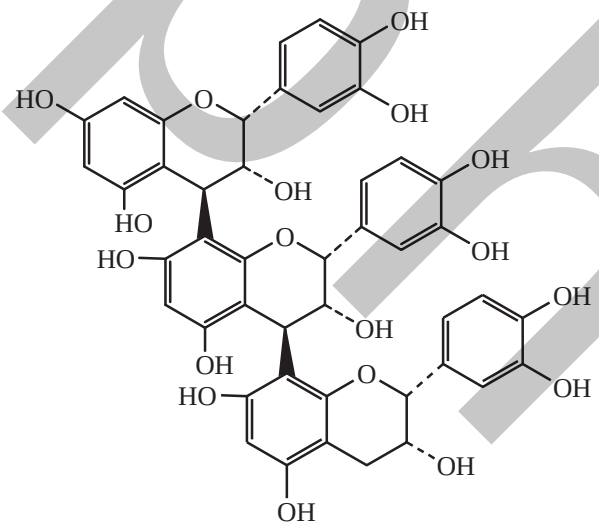
* Totals may not equal 100% due to rounding up or presence of desmethyl sterols not listed.
A = cholesterol, B = 24-methylenecholesterol, C = campesterol, D = stigmasterol, E = sitosterol, F = isofucosterol, G = 7-ergostenol, H = spinasterol, I = 7-stigmastenol, J = 7,25-stigmastadienol, K = 7,(*Z*)24(28)-stigmastadienol, L = campestanol, M = stigmastanol, N = 22-stigmastenol (Patterson and Xu, 1990)



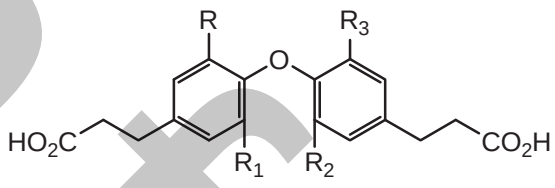
1 Procyanidin B-2



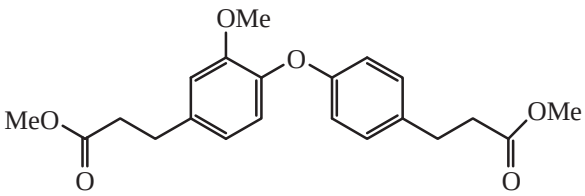
2 Procyanidin B-5



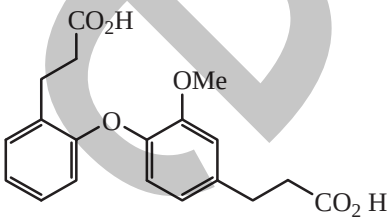
3 Procyanidin C-1



4 Apteniol A R=R_1=R_2=R_3=H
5 Apteniol B R=OMe, R_1=R_2=R_3=H
7 Apteniol D R=R_1=R_2=OMe, R_3 = H
8 Apteniol E R=R_1=R_2=R_3= OMe



6 Apteniol C

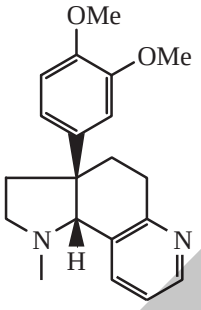


9 Apteniol F

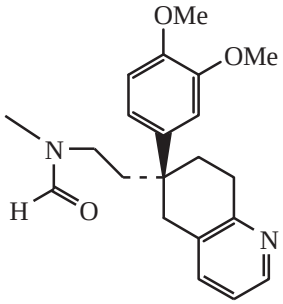
Alkaloids

The following alkaloids have been identified from *Sceletium namaquense*: alkaloid A_4 (**10**), *N*-formyltortuosamine (**11**), 4'-*O*-demethylmesembrenone (**12**), Δ^7 mesembrenone (**13**) (Jeffs *et al*., 1974), *N*-acetyltortuosamine, a dihydropyridone base (**14**) which is related to A_4 and the three joubertiamine type alkaloids 4- (3,4-dimethoxyphenyl)-4-[2-(acetylmethyl amino]cyclohexanone, 4-(3-methoxy-4 hydroxyphenyl) -4-[2-(acetylmethylamino)

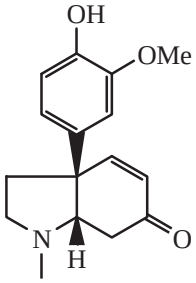
ethyl]cyclohexadienone, and (-)-3'-methoxy-4'-*O*-methyljoubertiaminol (Jeffs *et al*., 1982). Six mesembrine alkaloids together with *N*,*N*-dimethyltyramine were identified as constituents of *Sceletium subvelutinum* (Herbert and Kattah, 1989). The isolation of scleretenone from *Sceletium strictum* was also reported (Jeffs *et al*., 1974).



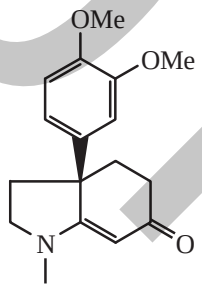
10 Alkaloid A_4



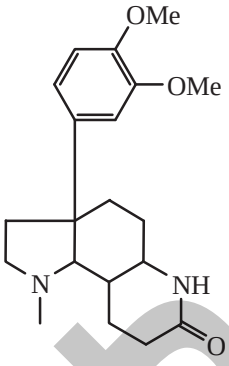
11 *N*-Formyltortuosamine



12 4'-*O*-Demethylmesembrenone



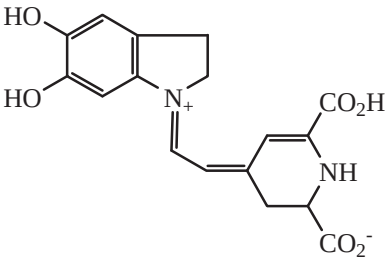
13 Δ^7-Mesembrenone



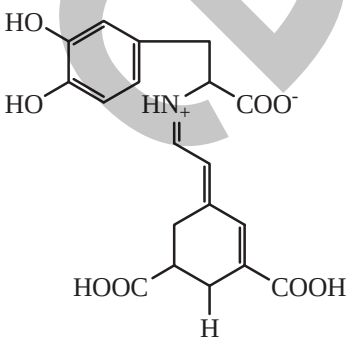
14 *N*-Acetyltortuosamine

Other Constituents

The flowers of *Carpobrotus acinaciformis* (L.) Bol. (syn. *Mesembryanthemum acinaciforme* L.) contained betanin, isobetanin, betanidin, isobetanidin, lampranthin-II, isolampranthin-II and 2-decarboxybetanidin (**15**) (Piatelli and Implizzeri, 1970). Dopaxanthin (**16**), a betaxanthin, was isolated from petals of *Glottiphyllum longum* (Haw.) N. E. Br. (Impellizzeri *et al*., 1973a).



15 2-Decarboxybetanidin



16 Dopaxanthin

The digestibility and nutritive value of *Tetragonia arbuscula* (a pasture plant in South Africa) have been early reported. The nutritive value of the plant compares very favorably with that of leucrne (Botha, 1938). The leaves of *Tetragonia tetragonoids* are used as a substitute for vegetables in a certain district in Japan (Aoki *et al*., 1982).

Table 2 – The proximate composition and minerals of *Mesembryanthemum* species growing in Egypt during flowering stage*

Species	Ash %	Minerals (mg/g dry wt.)				Total nitrogen	Crude protein	Total Carbohydrates	Total lipids
		Na^{+}	K^{+}	Ca^{++}	Mg^{++}				
Mesembryanthemum crystallinum	9.20	6.00	4.42	143.29	17.75	0.78	4.90	0.240	8.512
Mesembryanthemum forsskaolii	9.50	16.99	4.42	55.11	47.13	0.51	3.20	0.237	1.849
Mesembryanthemum nodiflorum	7.80	8.60	12.04	179.96	20.67	1.20	7.50	1.712	2.616

* El-Tantawy *et al*. (2004)

Table 3 – The total, soluble and insoluble carbohydrates of *Mesembryanthemum*, species growing in Egypt during flowering stage*

Species	Total carbohydrates	Soluble carbohydrates	Insoluble carbohydrates
Mesembryanthemum crystallinum	0.240	0.60	0.180
Mesembryanthemum forsskaolii	0.237	0.124	0.113
Mesembryanthemum nodiflorum	1.712	0.607	1.105

* El-Tantawy *et al*. (2004)

Tetragonia tetragonoids has been reported to contain polysaccharides which possess anti-inflammatory (Terumo Corp., 1984b; Kato *et al*., 1985) and antitumor effects (Terumo Corp., 1984a). The β-sterol glucosides from the plant also prevented ulcer formation in mice (Okuyama and Yamazaki, 1983).

Plants of the family Aizoaceae have been early reported to contain soluble oxalates (Molisch, 1918). Malic acid and citric acid have been detected in *Carpobrotus edulis* N. E. Br. (Stephen-Lewis, 1939). Soluble and total oxalate (as % oxalic acid on moisture-free basis of the pasture plant *Tetragonia expansa* are 1.5-12 and 2.9-13.4 respectively (Mathams and Sutherland, 1952). Tetragonin, a yeast growth-regulating substance was isolated from *Tetragonia expansa* (Schiffer and Kovács, 1959).

Folk Medicine, Pharmacological and Biological Activities

Although several members of the family are reported to be toxic, there are others which are known to be edible by human beings as well as animals. A list of the edible Aizoaceous plants has been reported (e.g. *Carpobrotus acinaciforme* (L.) Bol., *Carpobrotus deliciosus* (L.) Bol., *Carpobrotus edulis* (L.) Bol., *Caryophyllum crystallinum* N. E. Br., *Dactylopis digitata* N. E. Br., *Drosanthemum floribundum* Schw., *Eberlandzia spinosa* Schw., *Galenia africana* L., *Lithops hokeri* Schw., *Mesembryanthemum aloides* Haw., *Mestoklema tuberosum* N. E. Br., *Nanthus aloides* Schw., *Pleiospilos bolusii* N. E. Br., and *Tetragonia decumbens* Mill.) (Watt and Breyer-Brandwijk, 1962).

The boiled fruit of *Carpobrotus acinaciforme* (L.) Bol. is used in the treatment of pulmonary tuberculosis and other internal chest conditions, sore throats and sore mouths. The leaf juice has been used in dysenteries, as a diuretic, styptic and astringent. The fruit and leaf of *Carpobrotus edulis* (L.) Bol. have been widely used for various disease conditions. It is used as a gargle for all kinds of sore throat and for thrush, for digestive troubles and as a treatment for diarrhea and dysenteries. The juice of the plant diluted with water is used for catarrh of the bladder, gravel and other bladder ailments as well as for glandular swellings. In Europe both herb and seeds are said to be edible and the fresh herb is taken as a remedy for dropsy and dysentery, for affections of the liver and kidney and as a gargle. The plant is considered to be demulcent and diuretic and has been used in the treatment of inflammations of the pulmonary and genito-urinary mucosae (Watt and Breyer-Brandwijk, 1962).

A decoction of *Galenia africana* L. is used as a lotion for wounds in man and animal. The plant is also used in the treatment of veneral diseases. *Hymenocylus smithii* (L.) Bol. is toxic to the sheep. The root of *Khadia acutipetala* is used as a local application of sore eyes. An infusuin of *Pharnaceum lineare* L. f. is used in pulmonary conditions, for gout, rheumatism, sciatica and lumbago. *Psilocaulon absimile* N. E. Br. and *Tetragonia schenkii* Engl. are reported as poisonous plants. A decoction or a tincture of *Sceletium tortuosum* (L.) Bol. is used as a sedative. In Brazil, *Tetragonia expansa* Murr. is used as an antiscorbtic and as a remedy for pulmonary and intestinal affections (Watt and Breyer-Brandwijk, 1962).

The extract of *Carpobrotus edulis* showed antibactertial activity against *Enterococcus faecalis*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* (Chokoe *et al.*, 2008).

The family Aizoaceae is represented in Egypt by six genera and ten species (Boulos, 2009).