7.4.7. ***Amaranthus palmeri*** S. Watson, Proc. Amer. Acad. Arts. 12:274 (1877); Boulos, Fl. Egypt 1: 135 (1999).

Pig weed, Careless weed

Lipids

Phytol and chondrillastrerol have been isolated from the aerial parts of *Amaranthus palmeri* (Fischer and Quijano, 1985). The nonpolar lipids of *Amaranthus palmeri*, a common agronomically weed (leaves and flowering parts) were studied by Dailey *et al*. (1989). The wax ester consisted of a series of C_{36} to C_{56} homologues, with the C_{40}, C_{42}, C_{44}, C_{46} and C_{48} homologues predominating. Data on the relative distribution of homologues of the free fatty alcohol fractions (I, J) obtained from chromatography and/or recrystallisation of the hexane extracts of leaves and thyrses, the bound fatty alcohols (L) and fatty acids are shown in Table 57. The major wax ester fatty acids were C_{16}, C_{18}, C_{20}, C_{22} and C_{24}. Similar trends were found between free and bound fatty alcohols, with the C_{22}, C_{24}, C_{26}, C_{28}, C_{30}, and C_{32} homologues predominating (Dailey *et al*. 1989). The compositions of the esters containing unsaturated acyl varieties (triglycerides, steryl esters, and terpenol esters) were determined by GC/MS analysis (Dailey *et al*. 1997). In addition, the free fatty acid, sterol, and triterpenol components were characterized. The triglycerides constituted the major class of esters. The major constituents were palmitic, linoleic, and oleic acids and the sterol chondrillasterol. The sterols campesterol, stigmasterol, ergost-7-en-3β-ol, chondrillast-7-enol, and 24-ethylidenecholest-7-en-3β-ol and the triterpenols α- and β-amyrin, lupeol, cycloartenol and

24-methylenecycloartenol were present in lesser quantities. The relative distributions of the nonpolar lipids of the leaves of *Amaranthus palmeri* for the original hexane extract A and derived fractions K-M (free alcohols and triterpenols) are given in Table 58 (Dailey *et al*., 1997).

Other Constituents

The carotene and ascorbic acid values of pigweed or careless weed (*Amaranthus palmeri*) used for food in New Mexico were 6.8-8.6 and 94-134 mg/100 g respectively (Lantz and Smith, 1944). Seed heads of *Amaranthus palmeri* are rich in 2-heptanone, which was consistently found, together with 2-heptanol, in all tissues (Connick *et al*., 1987). Nine volatile methyl ketones (2-heptanone, 2-octanone, 2-nonanone, 2-undecanone, 2-hexanone, 3-methyl-2-butanone, 2-pentanone, 3-hydroxy-2-butanone and 2- butanone) (Bradow and Connick, 1988a) and eight low molecular aliphatic alcohols and aldehydes (2-heptanol, 3-methyl-1-butanol, 1-hexanol, hexanal, 1-pentanol, acetaldehyde, ethanol and 2-methyl-1-

Table 57. Relative distribution of free fatty alcohols and bound fatty alcohols and acids from wax ester fraction of *Amarathus palmeri* *

Isomer (normal Cx)	Relative distribution (x100)[a]				
	Free fatty alcohols			Bound G[b]	
	Mother liquor[c] J	Recryst[c] I	Total[d] J + I	Alcohol[c] L	Acid[e] K
14	--[f]	--	--	--	2.2
15	--	--	--	--	1.1
16	--	--	--	--	100.0
17	--	--	--	--	3.3
18	7.0	--	4.2	5.5	43.9
19	7.3	--	4.4	0.1	9.0
20	11.4	--	6.9	12.4	44.6
21	7.3	--	4.4	0.9	2.0
22	94.6	0.3	57.3	41.9	44.1
23	13.8	0.1	8.2	4.4	3.5
24	355.0	22.3	224.0	105.0	28.8
25	14.0	2.1	17.0	6.1	1.6
26	15.1	28.3	20.9	52.0	6.1
27	6.7	3.2	7.4	3.9	0.3
28	100.0	100.0	100.0	100.0	3.4
29	6.6	8.9	15.0	7.0	0.1
30	66.4	87.9	77.0	61.6	1.0
31	1.0	4.1	2.2	2.9	--
32	29.8	41.6	36.9	26.0	--
33	--	0.5	0.2	2.1	--
34	--	1.7	0.7	1.8	--

[a]Relative to octacosanol or hexadecanoic acid. [b]After hydrolysis of wax ester isolate. [c]Analyzed as TMS derivatives. [d]Calculated from J and I fraction weights and GC data assuming 81% of fraction J was GC-volatile alcohols. [e]Analyzed as methyl esters. [f]Absent or less than 0.1.

* Dailey *et al*. (1989)

Table 58. Relative distributions of nonpolar lipids of *Amaranthus palmeri* for the original hexane extract A and derived fractions.

Compound	Original extract	Free alcoholas and triterpenols			Free fatty acids and sterols		Hydrolysis product from		
	A	K	L	M	O	P	F	E	D
Palmitic acid	76			55	47	42			
Phytol		100	66				56	90	100
Linoleic acid	100			4	54				
Oleic acid	96			8	44	100			
Stearic acid	12			12	12	8			
1-Eicosanol	< 1	3	3	2			1	4	4
Arachidic acid	4				3				
1-Docosanol	2	18	25	6			2	10	10
Docasanoic acid	5				5	2			
1-Tricosanol		3	7						
1-Tetracosanol	2	70	83	66			9	26	25
Lignoceric acid	1				7	3			
1-Pentacosanol		3	4	7					
n-Nonacosane	9								
1-Hexacosanol	2	24	43	36			4	10	10
1-Heptacosanol		2	4	4					
Hexacosanoic acid	8				2	< 1			8
n-Hentriacontane	11								
Heptacosanoic acid					1				
1-Octacosanol	8	56	100	100			3	23	22
1-Nonacosanol		4	7	10					
Octacosanoic acid and campesterol	2				8	3	10		
Stigmasterol	1				3		4		
Stigmasta-22-en-3β-ol	6				14	1	4		
Ergost-7-en-3β-ol	4				14	7	99		
β-Amyrin	8	49	63	81				100	23
1-Tricontanol		29	63	2				9	53
Chondrillasterol	52				100	57	100		
α-Amyrin	1	19	25					4	12
Lupeol	2	21	40					9	1
Cycloartenol		6	6					38	1
Chondrillast-7-enol	5				18	7	85		
24-Ethylidenecholest -7-en-3β-ol	< 1				3	2	44		
1-Hentriacontanol		3	4						
24-Methylenecycloartenol	2	38	25					10	< 1
1-Dotriacontanol	2	6	11	4				6	24

Dailey *et al.* (1997)
propanol) were identified in the mixture of volatiles released by *Amaranthus palmeri*. These

volatile compounds significantly inhibited the germination of carrot, tomato, onion and *Amaranthus palmeri* seeds (Bradow and Connick, 1988a,b). Tow betacyanins, amaranthine (major) and isoamaranthine (traces) were identified in the plant (Cai *et al*., 2001).

Palmer amaranth (*Amaranthus palmeri*) is a common agronomically significant weed whose soil have been observed to inhibit the growth of certain crop plants, most notably carrots and onion (Dailey *et al*., 1989). The weed residues are also autotoxic (Menges, 1987). Vanillin, 3-methoxy-4-hydoxynitrobenzene and 2,6-dimethoxybenzoquinone were isolated from the roots of *Amaranthus palmeri* (Fischer and Quijano, 1985).

The oxalate levels in some *Amaranthus* species (including *Amaranthus palmeri*) varied from 26.5 - 59.12% (Rodriguez *et al*., 1985).

Biological Activities

Four allergic proteins with molecular weights of 17.9, 20.1, 26.6 and 66.5 kDa have been identified from the pollen (Rosas Alvarado *et al*., 2008).

The most active allelochemicals from *Amaranthus palmeri* (AM) were volatile compounds. Volatiles emitted by soil containing AM residues and by dried and partially rehydrated leaf and flower residues themselves reduced carrot and tomato seed germination to < 7 %. Freshly harvested AM inhibited only carrot seed. Germination of AM and carrot seeds was retarded by exposure to volatiles from dried AM residues. Onion seeds were also inhibited by volatiles from AM (Bradow and Connick, 1987). The four compounds chondrillasterol, phtol, 2,6-dimethoxybenzoquinone and vanillin, showed biological activities, to varying degrees, in seed germination bioassays (Bradow, 1985). Laboratory seed germination bioassays of crude organic solvent extracts of *Amaranthus palmeri* parts indicated the presence of both promotive and inhibitory compounds. Aqueous extracts of the leaves and thyrses (flowering parts) had no significant effect on any of the seeds tested (Bradow, 1985).