

VOLATILES IN *SARRACENIA FLAVA*

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Key Word Index—*Sarracenia flava*; Sarraceniaceae; pitcher plant; essential oils; caryophyllene; *p*-tolualdehyde; 2-phenylethanol; amines; insect attractants.

The genus, *Sarracenia*, one of the three genera in the Sarraceniaceae, has been the subject of many investigations since the mid-19th century. The insectivorous habit, the conspicuous leaves and flowers and the apparent ease of hybridization have led to interest [1-4] in the group by botanists, biochemists and horticulturists. There is no reference, however, to an examination of the volatile constituents of the genus which could possibly play a role in attracting insects.

Table 1. Analysis of the essential oil in *Sarracenia flava* (top)

Compound	I_{KOV-17}^*	%†	Compound	I_{KOV-17}	%
Aliphatic hydrocarbons			Alcoholic and phenolic compounds		
<i>n</i> -Undecane	1100	0.2	3-Hexene-1-ol	1095	0.2
β -Pinene	1265	0.1	Benzyl alcohol	1270	0.1
<i>n</i> -Tridecane	1300	0.2	<i>p</i> -Methoxyphenol	1282	0.2
<i>n</i> -Pentadecane	1500	0.6	<i>o</i> -Cresol	1308	1.0
Caryophyllene	1510	5.1	2-Phenylethanol	1380	3.4
Humulene	1545	0.4	Carvacrol	1560	4.1
<i>n</i> -Hexadecane	1600	1.8	Methyleugenol	1660	0.3
<i>n</i> -Heptadecane	1700	4.6	Hydroxyphenylbenzene	1795	0.1
Aromatic hydrocarbons			Miscellaneous		
<i>o</i> -Xylene	975	1.4	C ₈ H ₁₇ N	1435	1.9
<i>m</i> -Xylene	995	0.1	C ₅ H ₁₁ NO	1455	0.5
1-Methyl-2-ethylbenzene	1048	0.3	Benothiazole	1510	0.3
1-Methyl-3-ethylbenzene	1085	0.3	3,5-Dimethyl methylbenzoate	1640	0.3
1-Methyl-4-ethylbenzene	1125	0.1			
1,1,3-Trimethyl- <i>p</i> -3-phenylindan	1800	2.6			
Carbonyl compounds					
<i>n</i> -Nonanal	1120	0.2			
Methylcyclohexanone	1240	0.1			
Phenyl acetaldehyde	1305	1.7			
<i>p</i> -Tolualdehyde	1530	7.3			
Acetylnaphthalene	1690	0.7			
2,4-Dimethyl-2,4-heptadienal	1715	0.1			

* Kovats [5]. MS of the majority of compounds agreed with that in published compilations [6, 7]. That of acetylnaphthalene [8] and carvacrol [9] were identical with literature values. For the two unknown amines the five most intense fragment ion values (*m/e*) arranged in order of decreasing relative abundance with the proposed parent ion present sixth are: C₈H₁₇N; 59, 39, 41, 99, 126, 127 and C₅H₁₁NO; 55, 67, 82, 83, 39, 101.

† % Of total oil.

From the GC-MS analysis of the volatiles of *S. flava*, nearly 100 maxima were observed. Structural assignments were proposed for the 32 most abundant compounds which accounted for 40.3% of the total. The compounds include eight aliphatic hydrocarbons, six aromatic hydrocarbons, six carbonyl compounds, five alcohols, three phenols, two unknown amines and two miscellaneous compounds.

The aliphatic hydrocarbons (13.0% of the oil) consisted of five normal C₁₁-C₁₇, β -pinene, and two sesquiterpenes. Caryophyllene (5.1%) and *n*-heptadecane (4.6%) were the major hydrocarbon components. Six aromatic hydrocarbons which included three alkylated benzenes and 1,1,3-trimethyl-*p*-3-phenylindan accounted for 4.8% of the total oil.

Table 1 also lists 6 carbonyl compounds that accounted for 10.1% of the total oil. Phenyl acetaldehyde and *p*-tolualdehyde, are the major compounds in this class (9.1%). There were five alcoholic compounds and three phenolic compounds which accounted for 9.4% of the oil. The major component of these classes were 2-phenylethanol and carvacrol (4.1%). Also present were two unknown amines, whose structures are under investi-

gation. Thus, terpenes and amines appear to be the most significant volatile constituents of this plant, and one or more, may account for its attractiveness to insects.

EXPERIMENTAL

Isolation of the essential oil. Fresh *Sarracenia flava* tops (4.5 kg) were collected in the Okefenokee Swamp region of Southeastern Georgia, and stored at below 0° until they were chopped and steam distilled in an all glass system for about 3 hr. The distillate upon extraction with ether gave 0.8 g of oil (0.18% fr. wt). The oil was chromatographed and introduced into the GC-MS by procedures similar to those described in previous communications [8].

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