

COMPARATIVE ANALYSIS OF ESSENTIAL OIL COMPOSITIONS FROM *Phyllanthus niruru*, *P. urinaria*, AND *P. arenarius*

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UDC 547.913

Plants of the genus *Phyllanthus* (Euphorbiaceae) are widely distributed in most tropical and subtropical countries. They have been used as folk medicine in some countries for thousands of years in the treatment of many diseases, such as disturbances of the kidney and urinary bladder, intestinal infections, diabetes, and the hepatitis B virus [1, 2]. The water extract of *Phyllanthus niruru* Linn possesses many bioactivities such as stomachic, aperitive, antispasmodic, laxative, diuretic, and carminative properties, and against constipation, fever, malaria, hepatitis B, dysentery, gonorrhea, syphilis, tuberculosis, cough, diarrhea, and vaginitis [3-7]. *Phyllanthus urinaria* Linn (*P. urinaria*) is particularly used as a diuretic and for liver protection, diabetes, hepatitis, jaundice, dropsy, and dysentery [8-10]. The bioactivity and chemical composition of *Phyllanthus arenarius* beille have not yet been reported. All of these plants are distributed in Guangxi and other provinces in China [11].

In past decades, due to interest in the bioactivities of genus *Phyllanthus*, many investigations on the chemical composition of *P. niruru* and *P. urinaria* have been reported. Many compounds, such as flavonoids, lignans, alkaloids, and tannins, have been isolated from *P. urinaria* [12-14], and alkaloids, flavonoids, lignans, tannins, phenols, and terpenes from *P. niruru* [15-19]. The essential oil composition of the three plants has not been reported. We wish to report the composition of the essential oils from *P. niruru*, *P. urinaria*, and *P. arenarius* in this paper. The essential oils of these plants were extracted by steam distillation, and then their compositions were analyzed by gas chromatography-mass spectrometry.

The composition of the essential oils from the three plants is shown in Table 1. Forty-three compounds were detected in the oil sample obtained from *P. arenarius*, 44 compounds from *P. urinaria*, and 50 from *P. niruri*.

TABLE 1. Content of Essential Oil Components Relative to Total Ion Current

Compound	<i>P. arenarius</i>	<i>P. urinaria</i>	<i>P. niruru</i>
Ethyl acetate	1.16	2.61	4.36
(3-Methyl-oxiran-2-yl)-methanol	0.51		
1,1-Diethoxyethane	0.86	1.81	0.89
2-Ethoxypropane	0.60		3.71
Benzaldehyde	0.88	2.93	1.82
(<i>E</i>)-1-(1-Ethoxyethoxy)-2-hexene	0.48		
Benzeneacetaldehyde	1.86		
<i>cis</i> - α , α ,5-Trimethyl-5-ethenyltetrahydro-2-furanmethanol	0.39		
3,7-Dimethyl-1,6-octadien-3-ol	2.74	1.00	10.17
Undecane	0.36		0.90
α -Terpineol	0.80		3.35
Tridecane	0.97		0.35
2-Methylnaphthalene	0.21		
Butanedioic acid, bis(2-methylpropyl) ester	2.19		
Eudesma-4(14),11-diene	0.31		
5,6,7,7-Tetrahydro-4,4,7-trimethyl-2(4H)-benzofuranone	1.02		
3-Methyl butanedioic acid bis(1-methylpropyl)ester	4.74		
Dodecanoic acid	1.84		1.70
α , α ,4 α -Trimethyl-8-methylene-decahydro-2-naphthalenemethanol	1.15		

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TABLE 1 (continued)

Compound	<i>P. arenarius</i>	<i>P. urinaria</i>	<i>P. niriru</i>
$\alpha,\alpha,4\alpha,8$ -Tetramethyl-1,2,3,4,4 α ,6,8 α -octahydro-2-naphthalene methanol	0.70		
Exeandioic acid bis(2-methylpropyl) ester	4.05		
Tetradecanoic acid	1.44	0.44	0.68
1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester	14.84		
Pentadecanoic acid	0.32		
1,2-Benzendicarboxylic acid, butyl octyl ester	0.45		
Hexadecanoic acid, methyl ester	0.47		
Dibutyl phthalate	1.61	1.04	0.47
<i>n</i> -Hexadecanoic acid	14.00	12.38	5.43
(<i>E</i>)-11-Hexadecenal	0.62		0.68
Nonadecane	0.41		
Octadecanoic acid, methyl ester	0.17		
9,12,15-Octadecatrienoic acid, methyl ester	8.95		
Hexadecanamide	0.96		
Octadecanoic acid	1.18		
Octacosane	0.60	0.46	
Docosane	1.06	0.35	
(<i>Z</i>)-9-Octadecanamide	3.29		
Diisooctyl adipate	4.00		
1-Heotadecene	0.40		
Eicosane	0.57	0.39	0.25
Di- <i>n</i> -octyl phthalate	10.26		2.76
Nonadecane	0.25		
2-Furanmethanol		4.45	
1-(1-Methylethoxy)-propane		0.23	
2-Ethoxypropane		1.88	
Phenol		6.57	7.30
3,3,5-Trimethylcyclohexanone		17.22	12.41
<i>trans</i> - $\alpha,\alpha,5$ -Trimethyl-5-ethenyltetrahydro-2-furanmethanol		0.73	1.82
Nonanal		0.57	
Methyl salicylate		2.29	
Benzothiazole		5.12	5.09
Dodecane		0.58	0.90
(<i>E</i>)-Cinnamaldehyde		1.29	
Nonanoic acid		0.38	
Heptedecane		0.45	
1 $\alpha,2,3,4,4\alpha,5,7\beta$ -Octahydro-1,1,4,7-tetramethyl-1H-cycloprop[e]azulene	0.45		
2,3,4,4 $\alpha,5,6$ -Hexahydro-1,4-dimethyl-7-(1-methylethyl)-naphthalene	1.09		
(-)- α -Panasinsen		1.13	
Lauric anhydride		1.15	
Hexadecane		0.41	0.33
Decahydro-1,4-dimethyl-7-(1-methylethylidene)-1-naphthalenol		7.78	
1-Octadecene		0.24	0.19
1,2-Benzenedicarboxylic acid, bis (2-methylpropyl) ester		1.34	
Dibutyl phthalate		1.04	
Tricosane		0.35	
Stearolic acid		5.95	
Octadecanoic acid, 2-(2-hydroxyethoxy)ethyl ester		2.35	
Acetic acid, octadecyl ester		0.48	0.44
2-Propenoic acid, 3-(4-methoxyphenyl)-2-ethylhexyl ester		0.61	
10-Methyl-eicosane		0.78	
Pentatriacontane		0.74	
1,19-Eicosadiene		1.14	

TABLE 1 (continued)

Compound	<i>P. arenarius</i>	<i>P. urinaria</i>	<i>P. niriru</i>
Heptacosane		0.93	
Di- <i>n</i> -octyl phthalate		2.03	
<i>n</i> -Hexatriacontane		0.61	
7-Hexyl-eicosane		0.45	
(<i>Z</i>)-9-Octadecenamide		1.76	1.23
(<i>Z</i>)-3-Hexen-1-ol			1.18
3-Methylbutanoic acid			1.48
Hexanoic acid			2.46
2-Methylbutanoic acid			0.65
3,5,5-Trimethyl-1-hexene			0.23
6-Methyl-5-hepten-2-one			1.04
Isocyanato-cyclohexane			0.48
5-Ethyl-2(5H)-furanone			0.52
Dodecanal			0.74
<i>a,a</i> ,4-Trimethyl-3-cyclohexene-1-methanol			1.2
(<i>E</i>)-Cinnamaldehyde			0.60
3,7-Dimethyl-2,6-octadien-1-ol acetate			0.28
(<i>E</i>)-3,7-Dimethyl-2,6-octadien-1-ol acetate			0.27
(<i>Z</i>)-6,10-Dimethyl-5,9-undecadien-2-one			0.59
Butanedioic acid, bis(2-methylpropyl)ester			0.34
Eudesme-4(14),11-diene			0.44
5,6,7,7 α -Tetrahydro-4,4,7 α -trimethyl-2(4H)-benzofuranone			3.08
Methylbutanedioic acid, bis(1-methylpropyl)ester			
Decahydro- α,α ,4-trimethyl-8-methylene-2-naphthalenemethanol		0.31	
Hexanedioic acid, bis(2-methylpropyl)ester			0.88
1,2-Benzendicarboxylic acid, bis(2-methylpropyl)ester			4.25
7,9-Di-tert-butyl-1-oxaspiro(4,5)deca-6,9-diene-2,8-dione			0.44
Nonadecanoic acid ethyl ester			0.18
(<i>Z,Z,Z</i>)-8,11,14-Eicosatrienoic acid			3.37
Octadecanoic acid 2-(2-hydroxyethoxy)ethyl ester			1.42
Hexanedioic acid, dioctyl ester			0.67
15-Tetracosenoic acid, methyl ester			0.22

ACKNOWLEDGMENT

Financial support by the National Natural Science Foundation (30660216) is gratefully acknowledged.

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