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SHORT COMMUNICATION

The Oils from Stems, Leaves and Roots of *Elephantopus scaber* Linn.

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ABSTRACT

The oil from stems, leaves and roots of *Elephantopus scaber* Linn. were extracted by solvent maceration technique. The percentage yield oil from stems, leaves and roots are 0.001%, 0.003% and 0.04%, respectively. The stem oil gives major constituents of pentacosane (12.3%), lupenyl acetate (11.7%) and fern-7-en-3*β*-ol (11.0%), while the leaf oil contains isooctyl phthalate (19.2%), hexadecanoic acid (15.0%) and α-linolenic acid (5.0%) as the major components. The major constituents identified in the root oil are hemellitol (11.6%), octyl phthalate (6.0%), 1-nonadecanol (5.6%) and 1-octadecanol (5.5%). There were only three compounds detected and identified in all three parts of the plant, namely decanedioic acid, bis-(2-ethylhexyl)ester, dotriacontane and pentacosane. The oils were analysed by gas chromatography-mass spectrometer and the compounds were identified by comparison with the mass spectral fragmentation pattern database.

Keywords: Compositae, *Elephantopus scaber,* essential oil, herbs, GC-MS

E. scaber is a small herb plant which belongs to the Compositae family (Ho *et al*., 2012). This plant can be found in the Neotropics, Europe, Asia, Africa and Australia (Hiradeve & Rangari, 2014). In Malaysia, it is known as *Tapak Liman* or *Tutup Bumi*. There are about 30 species of *Elephantopus* species have been identified (Wang *et al*., 2004). *E. scaber* is one of herbal plant that is used traditionally as medicine to treat many types of diseases. Its parts are boiled with water to cure diseases such as fever. It can be found at road sides, grass fields and forest border. This herbal plant can grow and reach the height of 50 cm. It has been used as traditional medicines in many countries to treat various diseases such as fever, edema, stomach-ache and used as an antidote for snake bites.

There are a lot of compounds had been isolated and identified from this species. Studies done by Geetha *et al*. (2012) had successfully isolated isodeoxyelephantopin and deoxyelephantopin from the chloroform crude extract of *E. scaber*. The extensive studies on this plant also had shown numerous biological activities. The crude extracts of *E. scaber* shows its potential as hepatoprotective, anti diarrhea, cardiotonic, antihyperglycemic and many more (Daisy *et al*., 2009; Ho *et al*., 2012; Muthumani *et al*., 2010). Besides the studies on the extracts of the plant, the essential oil also had been extracted and studied by Wang *et al*. (2004). The group reported the chemical constituents of *E. scaber* essential oil consists of few major components identified as hexadecanoic acid, isopropyl dimethyl tetrahydronaphthalenol, ß-sesquiphellanndrene, octadecadienoic acid and phytol with content percentage of 42.3%, 14.1%, 8.3%, 5.5% and 5.2%, respectively. However, the report only referred to the essential oil of the whole plant and the sample was taken from Southern China. In this study, it focused on the essential oil constituents of the leaves, stems and root oils of *E. scaber* which was collected from Sarawak, Malaysia.

The sample *E. scaber* was collected from the area around Kuching, Sarawak, Malaysia. The fresh samples were separated into leaves, stems and roots, and were cut into smaller size (~5 mm) prior to extraction. Rotary evaporator BUCHI model R-II was used in order to remove solvent from all extracts. Mass spectra were recorded on gas chromatography–mass spectrometer using Shimadzu QP GC-2010 plus.

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The stems (40 g), leaves (100 g) and roots (18 g) of *E. scaber* were extracted separately using 1500 mL of *n*-hexane. The soaked samples were left for 30 minutes at room temperature and then evaporated using rotary evaporator yielded the crude oil. The crude oil was dissolved in 50 mL of absolute ethanol and filtered. The filtrates were evaporated to give the oils from stems, leaves and roots of *E. scaber* (Ahmad & Raji, 1993). The oils obtained were analysed by GC-MS.

Gas chromatography – mass spectrometer (Shimadzu QP GC-2010 Plus) analysis was performed using a non-polar column, cross-linked BPX-5 (30 m long × 0.25 mm ID × 0.25 μm film thickness composed of non-polar 5% phenyl methyl siloxane). The initial temperature was programmed at 50°C. After 2 minutes, the temperature was increased to 300°C with the rate of 10°C min^{-1} and maintained for 10 minutes. The temperature of the injector and detector was set at 280°C and 300°C, respectively, while the interface temperature was set at 320°C. Helium was used as the carrier gas. Exactly 1 μL of the sample was diluted using dichloromethane and injected into GC-MS. The compounds detected from the samples were identified using the mass spectral fragmentation pattern database. The essential oils obtained from the leaves, stems and roots of *E. scaber* give golden yellow, pale yellow and yellow oil, respectively.

There were about 0.001% of stem oil obtained from 40 g of sample. Meanwhile for the leaf oil, the yield is slightly higher than the stem oil which is about 0.003%. Root oil gives the highest yield between the three parts of the plant with the percentage yield of 0.04%. Table 1 shows the chemical constituents identified from stems, leaves and roots oil of *E. scaber*. There were 16 compounds identified from the stem oil of the plant with the percentage of 60.2%. The two major constituents in the stem oil were unable to be identified which gives the percentage of 31.8%. However, three other major compounds were identified as pentacosane (12.3%), lupenyl acetate (11.7%) and fern-7-en-3*β*-ol (11.0%).

Thirty-four compounds were identified from the leaf oil of the plant with 86.7% of the oil. There were three major components identified which are isooctyl phthalate (19.2%), hexadecanoic acid (15.0%) and α-linolenic acid (5.0%). 96.2% of the root oil chemical constituents with 47 compounds were identified. The major constituents are hemellitol (11.6%), octyl phthalate (6.0%), 1-nonadecanol (5.6%) and 1-octadecanol (5.5%). There were only three compounds detected from all parts of the plant that are decanedioic acid, bis-(2-ethylhexyl) ester, dotriacontane and pentacosane. Meanwhile, there were 10 compounds identified in any two parts of the plants which are 1-nonadecene, *E*-9-eicosene, diisobutyl phthalate, docosane, heneicosane, hexadecanoic acid, 1-nonadecanol, tetracontane, tetracosane, tetratetracontane and tricosane.

Comparison with the chemical constituents of the whole plant essential oil extracted by Wang *et al*. (2004), only three of the major components were found in the current study, namely hexadecanoic acid, *β*-sesquiphellandrene and octadecadienoic acid. Hexadecanoic acid was found in stem and leaf oil with the percentage of 0.90% and 15.0%, respectively. *β*-Sesquiphellandrene was found in root oil and octadecadienoic acid was found in leaf oil with the percentage of 3.8% and 2.7%, respectively. The differences in the chemical constituents of the oil in the present study with study carried out by Wang *et al*., (2004) might be due to the different sampling areas of the samples and the method that were used to obtained the essential oil of *E. scaber*.

In conclusion, the essential oil from the stems, leaves and roots of *E. scaber* were extracted and the chemical constituents were identified. The major constituents identified in stem oil are pentacosane (12.3%), lupenyl acetate (11.7%) and fern-7-en-3*β*-ol (11.0%). The leaf oil contains isooctyl phthalate (19.2%), hexadecanoic acid (15.0%) and *α*-linolenic acid (5.0%) as the major components, while, the roots oil contains major components of hemellitol (11.6%), octyl phthalate (6.0%), 1-nonadecanol (5.6%) and 1-octadecanol (5.5%).

Table 1. Chemical constituent of *Elephantopus scaber* stem, leaf and root oils.

Compound	Percentage of compounds (%)		
	Stem	Leaf	Root
1,3-Dimethylbenzene	5.9	-	-
1-Docosanol	-	1.1	-
1-Heneicosanol	-	-	0.5
1-Heptacosanol	-	-	3.7
1-Isopropyl-1-methyl-2-nonylcyclopropane	-	-	1.1
1-Nonadecene	-	1.1	4.4
1-Nonadecanol	-	1.1	5.6
1-Octadecanol	-	-	5.5
1-Pentyl-2-propylcyclopentane	-	-	0.7
1-Tetracosanol	-	0.5	-
1-Tricosanol	-	0.5	-
2-Hexyl-1-decanol	-	-	0.5
2-Methylpentadec-1-ene	-	-	0.6
1,2,3,4,4a,5,6,8a-Octahydro-*α*,*α*,4a,8-tetramethyl-[2R-(2α.,4a*α*,8a*β*)]-2-naphthalenemethanol	0.6	-	-
4,8,12,16-Tetramethylheptadecan-4-olide	-	0.9	-
E-5-Eicosene	-	-	0.6
7,9-Di-*tert*-butyl-1-oxaspiro(4,5)deca-6,9-diene-2,8-dione	-	0.7	-
Z-7-Hexadecene	-	-	0.9
Z,*Z*-9,12-Octadecadienoic acid	-	2.7	-
E-9-Eicosene	-	0.6	1.2
2,6-Dimethyl-6-(4-methyl-3-pentenyl)-bicyclo[3.1.1]hept-2-ene	-	-	0.6
Caprylic acid	-	1.0	-
Caryophyllene	-	-	0.6
Cinnamyl tiglate	-	-	0.9
cis-9-Hexadecenoic acid	-	0.6	-
Ethyl-cyclodocosane	-	-	1.0
Cyclohexadecane	-	-	0.7
Cyclotetracosane	-	-	0.6
Decanedioic acid, bis(2-ethylhexyl) ester	1.3	4.2	4.4
Diisobutyl phthalate	-	1.0	0.9
Diketone alcohol	-	0.6	-
Docosane	-	1.5	1.0
Docosyl alcohol	-	-	4.9
Docosyl pentafluoropropionate	-	-	0.8
Dotriacontane	0.5	0.5	2.2
E-5-Octadecene	-	-	0.6
E-9-Octadecene	-	-	1.3
Ethylbenzene	3.8	-	-
Fern-7-en-3*β*-ol	11.0	-	-
Hemellitol	-	-	11.6
Heneicosane	-	0.6	0.5
Tritetracontane	-	-	0.7
Heneicosane	0.5	-	-
Heptanoic anhydride	-	2.5	-
Hexacosane	-	0.8	-
Hexacosyl heptafluorobutyrate	-	-	0.6
Hexadecane	-	-	0.9
2,6,10,14-Tetramethylhexadecane	-	0.6	-
Hexadecanoic acid	0.9	15.0	-
Hexatriacontane	1.3	0.8	3.7
Hydrocinnamoyl bromide	1.4	-	-
Isooctyl phthalate	-	19.2	-
Lupenyl acetate	11.7	-	-
Mesitylene	-	-	4.6
Naphthene	-	-	0.7
Nonacosane	-	-	1.2
Octacosane	-	0.7	-
Octyl phthalate	-	-	6.0
Oleic Acid	-	3.1	-
Pentacosane	12.3	4.1	2.4
2,4-Di-*tert*-butyl-phenol	-	-	1.1
Stearic acid	-	2.5	-
Tetracontane	0.8	4.0	-
Tetracosane	-	0.7	2.3
Tetradecane	-	-	0.8
Tetrapentacontane	-	1.7	-
Tetratetracontane	-	2.7	2.2
Tetratriacontane	-	3.6	-
trans-Squalene	2.3	-	-
Triacontane	-	-	0.7
Tricosane	-	0.5	1.6
α-Amyrenyl acetate	5.5	-	-
α-Linolenic acid	-	5.0	-
α-Tetradecene	-	-	3.3
β-Cymene	-	-	0.7
β-Farnesene	-	-	1.0
β-Sesquiphellandrene	-	-	3.8
γ-Eudesmol	0.4	-	-
Total	**60.2**	**86.7**	**96.2**

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