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CHEMICAL COMPOSITION OF THE ESSENTIAL OILS DISTILLED FROM TUBER OF RUMPUT TEKI (*CYPERUS ROTUNDUS* LINN.) GROWING IN TANGGAMUS, LAMPUNG, INDONESIA

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ABSTRACT

In order to investigate chemical aspects of the Cyperaceae plant family in Lampung Province, Indonesia, this study is aimed to find out chemical composition of the distilled essential oils from rhizomes of rumput teki (*Cyperus rotundus* Linn.) found in the District of Tanggamus. The essential oils were analyzed using Gas Chromatography-Mass Spectrometry (GC-MS). Sixty-seven compounds were detected and the eight most dominant compounds are *longiverbenone* (17.55%), *β-silinene* (8.75%), *caryophyllene oxide* (6.23%), *isopropenyl* (4.54%), *naphthalenone* (4.22%), *longifolenbromide* (3.19%), *3,4-isopropylidene* (2.17%), *1-eicosanol* (2.15%). Overall, the distilled essential oils from tuber of *C. rotundus* Linn. consisted mainly of terpenoids (sesquiterpene hydrocarbons, oxygenated sesquiterpenes and small percentage of monoterpenes).

KEYWORDS: rumput teki, purple nutsedge, *Cyperus rotundus*, essential oils, GC-MS.

INTRODUCTION

Rumput teki is an Indonesia name for purple nutsedge *(Cyperus rotundus* Linn.). This perennial weed belongs to the Cyperaceae family and is widely distributed in tropical, subtropical, and temperate regions.[1] The rhizomes are used in traditional medicine to cure a number of ailments and used as refrigerant, demulcent, tonic, sedative, analgesic, antipyretic aphrodisiac, hypotensive agent, emmenagogue in uterine complaints; in treatment of colic, diarrhea, vomiting in children and flatulence, as an antidote to poison, promote the milk production, improve memory and the cognitive processes, and to improve the functions of the liver, spleen and pancreas.[2]

Additionally, tuber part of C. rotundus is one of the oldest known medicinal herbs used for the treatment of dysmenorrheal and menstrual irregularities. The infusion of this herb is also commonly used in relieving pain, fever, diarrhea, dysentery, and other intestinal problems.[3,4] Biomedical test of this plant tuber extracts showed that tuber extract of *C. rotundus* has anti-estrogenic effects on endometrial thickness[5] and proven to cause fetal skeleton retardation in mice.[6]

The chemical composition of the volatile oils of this plant has been extensively studied and four chemotypes (H-, K-, M- O-types) of the essential oils distilled from C. rotundus grown in different parts of Asia have been reported.[7] Essential oils of this plant from different countries also showed compositional differences indicating phytochemical varieties. In Nigerian and Tusian the most abundant constituents of the volatile oils are cyperene (19.2-30.9%) and a-cyperone (4.5-5.2%) respectively, however the concentrations of other main components considerably varied.[8]

The variety of composition and concentration of chemical compounds contained in the essential oil of *C. rotundus* plants living in different countries indicate the environmental influence on the chemical qualities of essential oils in plants.[9] As part of our on-going research on the chemical aspects of the Cyperaceae plant family in Lampung Province, Indonesia, this study is aimed to find out chemical composition of the distilled essential oils from rhizomes of rumput teki found in the District of Tanggamus.

MATERIALS AND METHODS

Plant materials and extraction

The fresh rhizomes of rumput teki were collected from district of Tanggamus, Lampung province, Indonesia. The latitude and longitude coordinates are: 5°18'9.9"S - 104°33'55.9"E. Some samples of the fresh weeds were brought to the Botany Laboratory, Faculty of Mathematics and Sciences, University of Lampung for taxonomic verification. The tuber parts of the plant were shade dried at room temperature for a month, minced and

immediately hydro-distilled (1000g) for 3 hours using Stahl distillation technique. The oils were collected, preserved in a sealed tube and stored under refrigeration until analysis.

GC-MS analysis

GC-MS analysis of oils was performed using a GC – QP2010 (Shimadzu) equipped with Omegawax^{TM}250 ID fused silica capillary column (30m X 0.25mm, 0.25µm film thickness). The instrument was set to an initial temperature of 100^{o}C and the injection temperature of 270^{o}C with the column flow rate was 1.21 ml/min. The carrier gas is helium with a flow rate of one ml/min and the linear velocity of 35 cm/sec. All compounds were identified by comparison of both the mass spectra and the retention index data of known components found in the literature and the database of spectrum stored in the GC-MS library.

RESULTS AND DISCUSSION

Compounds identified in the distilled essential oils of rumput teki (*C. rotundus*) using gas chromatography-mass spectrometry (GC-MS) are presented in **Table 1**. Among 67 components of the oils, the eight most predominant content are *longiverbenone* (17.55%), *β-silinene* (8.75%), *caryophyllene oxide* (6.23%), *isopropenyl* (4.54%), *naphthalenone* (4.22%), *longifolenbromide* (3.19%), *3,4-isopropylidene* (2.17%), *1-eicosanol* (2.15%).

Table 1: Compounds detected in essential oil distilled from tuber of rumput teki (*Cyperus rotundus* Linn.) using GC-MS.

Peak Number	Compound	Retention Time (min)	Peak Area (%)
1	α-copaene	10.968	0.20
2	β-element	11.228	0.58
3	cadinene	11.419	1.57
4	cyclohexene	12.358	0.33
5	α-muurolene	12.502	0.53
6	β-silinene	12.865	8.75
7	α-sileene	12.963	0.83
8	naphthalonene	13.023	0.68
9	cis-clamenene	13.318	0.31
10	spathulenol	13.483	2.28
11	tricyclo(2,4)hexane	13.631	0.68
12	velerenal	13.693	0.23
13	caryophyllene oxide	13.797	0.97
14	cyclohexane	13.896	0.44
15	ledene	14.001	0.44
16	2,3-dehydro-α-ionone	14.055	0.16
17	longifolenaldehyde	14.108	0.64
18	caryophyllene oxide	14.293	6.23
19	2-butenal	14.389	1.23
20	calarene	14.498	0.22
21	spathulenol	14.602	0.71
22	1,3-hexadiene	14.667	1.72
23	2-butanone	14.701	1.96
24	5-oxo-isolongifolene	14.846	2.35
25	gamma-gurjunene	14.961	1.10
26	2-cyclohexenone	15.005	1.57
27	2,2,6,7-tetramethyl	15.089	0.63
28	naphthalene	15.167	0.95
29	zierone	15.219	2.01
30	longiverbenone	15.334	2.21
31	α-calacorene	15.412	1.78
32	isopropenyl	15.491	4.54
33	naphthalene	15.584	1.54
34	longiverbenone	15.649	1.54
35	α-selinene	15.732	1.82
36	tetralone	15.825	0.57
37	2-butanone	15.860	0.58
38	naphthalenone	15.935	4.22

39	Longifolenbromide	16.034	3.19
40	3,4-isopropylidene	16.115	7.35
41	2-cyclohevene	16.188	2.17
42	valerenylacetate	16.272	0.50
43	nerolidol-epoxyacetate	16.324	0.56
44	aciphyllyl alcohol	16.363	0.54
45	6-isopropenyl	16.503	0.57
46	longiverbenone	16.713	17.55
47	B-neoclovenene	16.816	0.42
48	zierone	16.874	0.86
49	2,6,10-trimethylundecan	16.905	0.58
50	4-aromedenedradiene	16,949	0.47
51	isochiapin	17.019	0.52
52	longifolenaldehyde	17.083	0.70
53	sesquirosefuran	17.207	0.47
54	nootkatane	17.363	0,19
55	nootkatone	17.420	012
56	1,2-ethandiol	17.468	0.27
57	2,5-cyclohexadine	18.129	0.16
58	hexadecane	18.304	0.12
59	zierone	18.553	0.21
60	Caryophyllene oxide	18.900	0.19
61	cycloisolongifolen	19.130	0.12
62	naphthalenone	19.177	0.18
63	tetrapentacontan	20.711	0.14
64	9-octadecenoic acid	20.775	0.11
65	benzofuran	21.134	0.34
66	1-phenanthrenol	22.353	0.11
67	1-eicosanol	22.612	2.15

Referring to many previous reports on the chemical composition of essential oils of *C. rotundus*, the results of the current study seem to little different. Kilani et al. (2008) found cyperene, alpha-cyperone, isolongifolen-5-one, rotundene, and cyperorotundene as the principal compounds comprising 62% of the *C. rotundus* tuber oils.[10] From South Africa, it was reported that the essential oils from the rhizomes of *C. rotundus* L. collected from two different locations showed a diferent concentration of major components. Samples from location-1 contained α-Cyperone (11.0%), myrtenol (7.9%), caryophyllene oxide (5.4%) and β-pinene (5.3%), while samples from location-2 contained β-pinene (11.3%), α-pinene (10.8%), α- cyperone (7.9%), myrtenol (7.1%) and α-selinene (6.6%).[11] Report from Iran indicated that the chemical composition of essential oil of *C. rotundus* L. comprised of cyperene (37.9 %) and cyperotundone (11.2 %) as the major components.[12] In India, GC-MS analysis of essential oils obtained from rhizomes of *C. rotundus* resulted in the main constituent of cyperene (9.76%), humulen (7.97%), β-selinene (7.88%), zierone (4.62%), campholenic aldehyde (3.83%), α-pinene (3.51%), longiverbenone (2.72%), β-vatirenene (2.32%), copaene (1.79%) and limonene (1.45%).[13]

The differences in the findings of this study with previous research results elsewhere, actually confirm that the chemical content of the plant is influenced by both genetic and environmental factors.[14, 15] With regard to the essential oil, Priyadarshi and Borse (2014) found that in coriander (*Coriandrum sativum* L.), the content and composition of essential oil are influenced by climatic conditions, geography of growing region, abiotic stress such as salinity, agro technology and stage of maturity at time of harvesting.[16] Even foliar nitrogen application in some plants found to increase essential oil content and affects essential oil composition.[17]

CONCLUSION

The chemical composition of the essential oil distilled from tuber of rumput teki (*Cyperus rotundus* Linn.) growing in the district of Tanggamus, Lampung province, Indonesia comprises 67 compounds. Among all, the eight predominant compounds are longiverbenone, β-silinene, caryophyllene oxide, isopropenyl, naphthalenone, longifolenbromide, 3,4-isopropylidene and 1-eicosanol. Overall, the distilled essential oils from tuber of rumput teki consisted mainly of terpenoids (sesquiterpene hydrocarbons, oxygenated sesquiterpenes and small percentage of monoterpenes).

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