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DETERMINATION OF ESSENTIAL OIL CONTENT, COMPOSITION, AND TOTAL POLYPHENOL CONTENT OF *RHIZOMA HOMALOMENAE OCCULTAE* COLLECTED IN VIETNAM

Nguyen Thi Ha Ly[1], Pham Thi Hien[1], Ngo Thi Thanh Huong[2], Hoang Dieu Linh[1], Tran Huyen Trang[1], Nguyen Minh Khoi[1,*]

[1]*National Institute of Medicinal Materials (NIMM), Hanoi 11018, Vietnam;*

[2]*VNU School of Medicine and Pharmacy, Hanoi, Vietnam*

*Corresponding author: Khoinguyenimm6@gmail.com

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Summary

The quality of *Rhizoma Homalomenae occultae* samples collected in Vietnam was evaluated based on total polyphenol content, total essential oil content, and essential oil composition. The results showed that the total polyphenol content ranged from 0.25% to 2.64%, while essential oil content ranged from 0.27% to 0.92%, meeting the essential oil content criteria specified in the Vietnamese Pharmacopoeia V. Gas chromatography-mass spectrometry (GC-MS) analysis of the essential oil revealed the presence of compounds such as 6-methyl-2-(2-oxiranyl)-5-hepten-2-ol, *trans*-linalool oxide, hotrienol, *L*-terpinen-4-ol, *α*-terpineol, *δ*-cadinene, spathulenol, and notably linalool, which accounted for over 40% (based on peak area percent). The findings provide valuable data for upgrading quality standards for *Rhizoma Homalomenae occultae* in Vietnam.

Keywords: *Homalomenae occultae; Essential oil; Polyphenol; Quality evaluation; GC-MS.*

1. Introduction

The genus *Homalomena*, particularly the species *Homalomena occulta* (Lour.) Schott, is considered a valuable medicinal herb in traditional Vietnamese medicine. It has long been used as a folk remedy for treating various conditions such as rheumatism, joint pain, inflammation, bacterial infections, gastrointestinal disorders, and enteritis [1],[2],[3]. Previous studies have revealed the presence of numerous bioactive compounds in *H. occulta*, such as sesquiterpenoids, triterpenoids, triterpenoid saponins, flavonoids, alkaloids, phenolic acids, lignans, and essential oils [4],[5],[6]. Notably, *H. occulta* contains a high content of linalool, which is known for its sedative, anxiolytic, analgesic, anticonvulsant, and anti-inflammatory properties, among others [7]. Owing to these pharmacological properties, various commercial products derived from *H. occulta* have been developed, including massage oils, capsules, liquid extracts, and traditional prescription-based formulations such as Cot Thoai Vuong, PQA Thien Nien Kien, Tuzamin-F, Phuoc An Trat Da Thap Khop, Phong Te Thap Fito Pharma, and Phong Te Thap DHĐ.

In Vietnam, there are six different species of *Homalomena*, all of which are used medicinally. Among these, *H. occulta* (Lour.) Schott is the most widely distributed, primarily concentrated in the mountainous provinces of Northern Vietnam [3],[8]. As part of the project titled 'Experimental cultivation of *H. occulta* (Lour.) Schott – Araceae) according to GACP guidelines in Lang Son province, efforts are underway to propagate *H. occulta* in Lang Son. The evaluation of the quality of the initially collected samples crucial for the conservation and evaluation of genetic resources. The Vietnamese Pharmacopoeia V specifies quality assessment parameters for *H. occulta*, including macroscopic description, microscopic examination, powder characteristics, identification, moisture content, total ash, and essential oil quantification [9]. Based on the research by Lam Bich Thao and colleagues, essential oils and polyphenols are two key pharmacologically valuable components in *H. occulta* [10]. Consequently, this study focuses on determining the total polyphenol content and total essential oil content in *H. occulta* samples collected from Lang Son, as well as analyzing the essential oil composition for comparison and quality assessment of the genetic resources.

2. Materials and Methods

2.1. Materials

The materials used in this study were the dried rhizome of *Homalomena occulta* (Lour.) Schott (Araceae). The rhizomes of *H. occulta* samples were collected in some provinces in Vietnam during the period of 2024-2025. They were provided and identified by the National Center for Research on Genetic Resources and Medicinal Plant Varieties, National Institute of Medicinal Materials. The information on these samples is presented in Table 1.

Table 1. Sample information used in this study

Sample	Sampling time (month/year)	Sampling location	
		Before July 1, 2025	After the merger (effective from July 1, 2025)
M1	05/2025	Dong Giap, Van Quan, Lang Son	Tan Doan, Lang Son
M2	05/2025	Tan Van, Binh Gia, Lang Son	Tan Van, Lang Son
M3	05/2025	Huu Lien, Huu Lung, Lang Son	Huu Lien, Lang Son
M4	05/2025	Hai Yen, Cao Loc, Lang Son	Cong Son, Lang Son
M5	04/2025	Loc Binh, Loc Binh, Lang Son	Loc Binh, Lang Son
M6	05/2025	Chien Thang, Bac Son, Lang Son	Vu Le, Lang Son
M7	05/2025	Mau Son, Loc Binh, Lang Son	Mau Son, Lang Son
M8	05/2025	Thien Tan, Huu Lung, Lang Son	Thien Tan, Lang Son
M9	06/2025	Tan Van, Binh Gia, Lang Son	Tan Van, Lang Son
M10	06/2025	Van Linh, Chi Lang, Lang Son	Van Linh, Lang Son
M11	11/2024	Phong Van, Luc Ngan, Bac Giang	Bien Son, Bac Ninh
M12	11/2024	Truong Son, Luc Nam, Bac Giang	Truong Son, Bac Ninh
M13	11/2024	Ta Ngao, Sin Ho, Lai Chau	Tua Sin Chai, Lai Chau
M14	11/2024	Ta Ngao, Sin Ho, Lai Chau	Tua Sin Chai, Lai Chau
M15	11/2024	Han Da, Yen Binh, Yen Bai	Thac Ba, Lao Cai
M16	12/2014	Han Da, Yen Binh, Yen Bai	Thac Ba, Lao Cai

2.2. Chemicals

The gallic acid standard was purchased from Chemfaces (China), CAS No. 149-91-7, Lot No. CFS201501, purity of 98%. Folin-Ciocalteu's phenol reagent was purchased from Merck (USA). Solvents and chemicals used to extract and process samples for quantitative analysis all meet analytical purity standards (P.A.). The solvent used for GC/MS analysis was from Merck (USA), meeting purity standards for mass spectrometry analysis.

2.3. Instruments

Gas Chromatography Mass Spectrometry (GCMS-QP2020) system (Shimadzu, Japan) with a SH-Rxi-5Sil MS capillary column (30 m x 0.25 mm x 0.25 μm); UV–Vis Spectrophotometer (UV-1800) system (Shimadzu, Japan), Steam distillation apparatus (Behr – Germany), and some other laboratory glassware.

2.4. Methods

2.4.1. Determination of total polyphenol content in *Homalomena occulta*:

The total polyphenol content was determined by UV-VIS spectrophotometry using the Folin-Ciocalteu method (according to Method 2 of Appendix 12.6 of the Vietnamese Pharmacopoeia V) [9].

Sample extract: Weigh accurately about 2 g of powdered sample and place it in a 100-mL conical flask, then add 20 mL of methanol. The mixture was sonicated for 30 minutes, cooled, and filtered. The extraction process was repeated with 10 mL of methanol. All extracts were collected, filtered into a 25-mL volumetric flask, and made up to mark with methanol.

UV-VIS procedure: Briefly, 0.25 mL of each sample extract was mixed with 1.25 mL of Folin-Ciocalteu reagent. After 5 min of incubation, 1 mL of 7.5% sodium carbonate was added to the mixture and homogenously using a vortex mixer and diluted with distilled water to a final volume of 5 mL. After 1 h of incubation, the absorbance of each solution was measured at 760 nm using a double-beam UV-Vis spectrophotometer. Gallic acid was used to plot the calibration curve using different concentrations (0.137-1.096 mg/mL) to determine the total polyphenol content of each sample extract. Total phenolic content was expressed as milligrams of gallic acid equivalent per gram (mg GAE/g DW) of the extract by using a standard calibration curve. All values were estimated in triplicate using the following formula:

$$P = C.V/m$$

Where P is the total phenolic content (mg/g plant extract, in GAE), C is the concentration of gallic acid (mg/mL), V is the volume of extract (mL), and m is the weight of pure plant extract (g).

2.4.2. Determination of total essential oil content in the rhizome of *H. occulta*:

The rhizomes of the *H. occulta* plant were cleaned, cut, and ground into coarse powder. The essential oil content in the medicinal plant was determined according to the Vietnamese Pharmacopoeia V, Appendix 12.7, "Determination of essential oil in medicinal plants" [9].

2.4.3. Analysis of essential oil composition by gas chromatography-mass spectrometry (GC/MS):

Sample solution: The oil was dried with anhydrous Na_2SO_4, then diluted with *n*-hexane to obtain a 1% (v/v) sample solution for GC/MS analysis.

GC/MS analysis was performed on a GCMS-QP2020 system with a SH-Rxi-5Sil MS capillary column (30 m x 0.25 mm x 0.25 μm), temperature programmed as follows: 60°C (held for 2 minutes), 60°C−120°C (at 10°C/min), 120°C−240°C (at 5°C/min) and 240°C (held for 5 minutes). The carrier gas was helium at a flow of 2.0 mL/min. Injection volume was 1 μL, and the split ratio was 1:20. Mass spectra were taken at 70 eV. Scan mass range was from 50-900 *m/z* at a sampling rate of 1.0 scan/s. The components of the oil were identified by their retention time, mass spectra, and computer matching with the NIST MS Version 2.2 library. The percentage composition of the identified compounds was calculated from the GC peak areas and expressed as relative percentages. The analysis of the essential oil is the average of three replicates [14],[15].

3. Results and Discussion

3.1. Determination of total polyphenol content in the rhizome of H. occulta samples

Determination of total polyphenol content in the rhizome of *H. occulta* samples was conducted according to the method presented in Section 2.4.1. The calibration curve of gallic acid is shown in Table 2 and Fig. 1. The total polyphenol content of *H. occulta* samples collected in Vietnam is presented in Table 2.

Table 2. The data of the calibration curve of gallic acid

No.	The concentration of gallic acid (mg/mL)	Absorbance (AU)
1	0.137	0.146
2	0.274	0.290
3	0.548	0.536
4	0.822	0.802
5	1.096	1.047

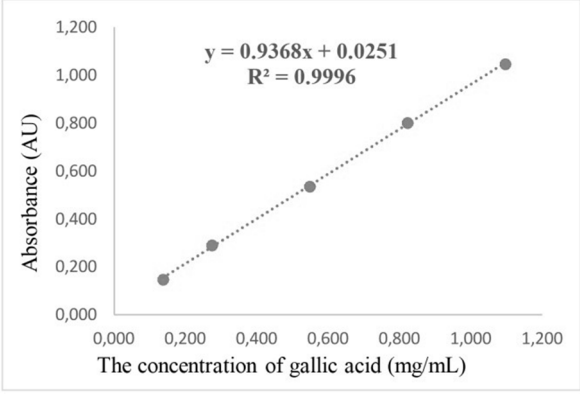

Fig. 1. Calibration curves for gallic acid

Table 3. Total polyphenol content in the rhizome of *H. occulta* samples collected in Vietnam

No.	Sample ID	The content of total polyphenol* (mean ± SD, n=3)	No.	Sample ID	The content of total polyphenol* (mean ± SD, n=3)
1	**M1**	1.28 ± 0.03	9	**M9**	0.66 ± 0.02
2	**M2**	1.25 ± 0.02	10	**M10**	0.41 ± 0.02
3	**M3**	1.19 ± 0.03	11	**M11**	2.09 ± 0.04
4	**M4**	1.52 ± 0.02	12	**M12**	2.08 ± 0.03
5	**M5**	1.11 ± 0.01	13	**M13**	2.18 ± 0.02
6	**M6**	1.06 ± 0.03	14	**M14**	2.35 ± 0.05
7	**M7**	1.03 ± 0.02	15	**M15**	2.52 ± 0.03
8	**M8**	0.25 ± 0.01	16	**M16**	2.64 ± 0.03

** These results were calculated on a dry sample.*

The total polyphenol content among these samples showed a wide fluctuation, from 0.25% to 2.64%. The *H. occulta* samples collected in Bac Ninh, Lai Chau, and Yen Bai provinces (**M11**-**M16**) had total polyphenol content greater than 2%, significantly higher than the total polyphenol content in the *H. occulta* samples collected in Lang Son (**M1**-**M10**).

3.2. Determination of total essential oil content in the rhizome of H. occulta samples

Determination of total essential oil content in *H. occulta* samples was conducted according to the method presented in Section 2.4.2. The results of total essential oil content analysis in *H. occulta* samples are presented in Table 3.

Table 2. Total essential oil content of the rhizome of *H. occulta* samples collected in Vietnam

No.	Sample ID	The content of total essential oil* (mean ± SD, n=3)	No.	Sample ID	The content of total essential oil* (mean ± SD, n=3)
1	**M1**	0.70 ± 0.04	9	**M9**	0.62 ± 0.04

No.	Sample ID	The content of total essential oil* (mean ± SD, n=3)	No.	Sample ID	The content of total essential oil* (mean ± SD, n=3)
2	**M2**	0.58 ± 0.03	10	**M10**	0.62 ± 0.02
3	**M3**	0.92 ± 0.05	11	**M11**	0.27 ± 0.03
4	**M4**	0.92 ± 0.05	12	**M12**	0.28 ± 0.04
5	**M5**	0.69 ± 0.04	13	**M13**	0.55 ± 0.03
6	**M6**	0.71 ± 0.03	14	**M14**	0.52 ± 0.04
7	**M7**	0.58 ± 0.04	15	**M15**	0.41 ± 0.03
8	**M8**	0.69 ± 0.02	16	**M16**	0.46 ± 0.02

**These results were calculated on a dry sample*

The total essential oil content in the rhizome of *H. occulta* samples ranged from 0.27% to 0.92%. In particular, the *H. occulta* samples collected in Lang Son (**M1-M10**) and Lai Chau (**M13** and **M14**) have essential oil content greater than 0.5% and all meet the regulations in the monograph *H. occulta* in Vietnam Pharmacopoeia V. The *H. occulta* samples collected in Bac Ninh (**M11** and **M12**) and Yen Bai (**M15** and **M16**) have essential oil content lower than 0.5% and do not meet the standards of Vietnam Pharmacopoeia V [9].

3.3. GC/MS analysis of the essential oil from the rhizome of H. occulta

The composition of the essential oil from the *H. occulta* samples was analyzed by GC/MS according to the conditions described in Section 2.4.3. The obtained results were presented in Table 4.

Table 4. The composition of the essential oil from the rhizome of *H. occulta* samples

No.	Retention time (min)	Compound	Relative percentages (%)															
			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16
1	6.568	Sabinene	0.73	0.50		0.24	0.22	-	-	-	-	-	-	-	-	-	-	-
2	7.171	*β*-Myrcene	0.51	0.58	0.26	0.21	0.21	-	-	-	-	-	-	-	-	-	-	-
3	7.912	*δ*-3-Carene	0.98	0.50	0.64	0.41	0.36	-	0.35	-	0.38	-	0.69	1.72	0.65	0.73	2.20	-
4	8.244	*α*-Terpinene	0.44	0.27	-	0.26	0.17	-	-	-	-	-	-	-	-	-	-	-
5	8.555	*o*-Cymene	1.01	0.86	0.40	0.57	0.45	-	0.29	-	-	-	-	0.79	-	-	-	0.49
6	8.766	D-Limonene	0.79	0.71	0.51	0.45	0.23	-	-	-	-	-	-	0.42	-	-	-	0.35
7	9.106	*trans*-*β*-Ocimene	0.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	9.579	*cis*-*β*-Ocimene	0.33	0.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	10.092	*γ*-Terpinene	0.96	0.57	0.47	0.48	0.33	-	0.29	-	-	-	-	-	-	-	-	0.35
10	10.350	Unknown	-	-	-	-	-	-	-	-	-	-	3.79	3.12	2.23		2.65	0.89
11	10.707	6-Methyl-2-(2-oxiranyl)-5-hepten-2-ol	0.66	0.82	0.53	0.65	0.71	0.44	0.81	0.96	1.05	1.74	-	-	-	-	-	-
12	11.418	(+)-4-Carene	0.35	0.28	-	0.13	0.11	-	-	-	-	-	-	-	-	-	-	-
13	11.521	*trans*-Linalool oxide (furanoid)	0.45	0.63	0.42	0.49	0.32	0.37	0.66	0.81	0.88	1.38	1.89	1.58	3.20	2.57	0.79	2.52
14	12.508	Linalool	62.3	61.27	63.26	67.35	66.62	68.43	72.87	71.76	67.66	50.49	69.7	74.35	48.70	71.75	69.27	73.10
15	12.555	Hotrienol	0.28	0.42	0.30	0.32	0.41	0.40	1.68	1.34	1.06	1.72	0.81	0.36	3.07	-	-	0.33
16	13.477	*trans*-Sabinene hydrate	0.31	0.22	0.33	0.45	0.29	-	-	-	0.29	-	-	-	-	-	-	-
17	14.454	*cis*-2-*p*-Menthen-1-ol	0.21	-	0.24	0.33	0.47	-	-	-	-	-	-	-	-	-	-	-
18	15.599	*p*-Mentha-1,5-dien-8-ol	0.35	0.26	0.68	0.41	0.32	0.70	0.69	-	0.66	1.20	-	0.62	1.41	-	-	-
19	16.636	L-Terpinen-4-ol	9.17	7.56	8.92	12.88	10.42	4.77	6.35	6.62	1.78	4.57	2.00	8.01	2.93	3.47	7.56	5.66
20	16.888	Crypton	0.27	0.34	0.33	0.45	0.12	-	-	-	-	-	-	0.59	0.67	-	0.35	-
21	17.035	*p*-Cymene-8-ol	0.16	-	0.23	0.20	0.98	-	0.51	-	0.76	0.77	0.48	1.10	2.07	-	0.28	-
22	17.504	*α*-Terpineol	4.77	4.77	2.78	2.45	3.11	1.21	1.09	1.14	0.52	0.99	2.37	0.79	10.31	1.00	1.34	0.40
23	18.345	*cis*-Piperitol	0.24	-	-	0.36	0.29	-	-	-	-	-	-	-	-	-	-	-
24	19.390	*cis*-Geraniol	0.59	0.67	0.32	0.22	0.18	-	-	-	-	-	-	-	-	-	-	-
25	19.617	Citronellol	-	-	-	0.13	0.27	-	-	-	-	-	-	-	-	-	-	-
26	21.058	*trans*-Geraniol	2.11	3.17	1.36	0.78	1.02	-	-	-	-	-	-	-	6.58	1.31	1.25	-
27	25.378	*E*-Methylgeranate	-	-	-	0.16	0.11	-	-	-	-	-	-	-	-	-	-	-
28	26.799	*α*-Terpinyl acetate	0.31	0.46	-	0.20	0.21	-	-	-	-	-	-	-	-	-	-	-
29	27.769	*cis*-Geranyl acetate	0.76	1.11	0.36	0.21	0.43	-	-	-	-	-	-	-	-	-	-	-
30	29.002	*trans*-Geranyl acetate	1.5	2.16	0.79	0.39	0.27	-	-	-	-	-	-	-	-	-	-	-
31	29.328	*β*-Elemen	-	-	0.23	-	-	1.69	-	-	-	-	-	-	-	-	-	-
32	30.928	Caryophyllene	0.23	-	0.43	0.37	0.33	0.71	0.60	-	1.16	1.21	-	-	-	-	-	0.26
33	33.103	Humulene	0.37	0.32	0.71	0.45	0.49	0.69	-	-	-	1.15	-	-	-	-	-	-

No.	Retention time (min)	Compound	Relative percentages (%)															
			M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16
34	33.398	Alloaromadendrene	0.43	0.56	0.75	0.37	0.12	-	-	-	-	0.83	-	-	-	-	-	-
35	35.443	*β*-Selinene	-	-	-	-	-	-	-	2.06	-	-	-	-	-	-	-	-
36	36.545	*α*-Muurolene	0.25	-	0.51	0.25	0.17	-	-	-	-	-	-	-	1.06	1.83	-	-
37	37.563	*γ*-Cadinene	0.32	-	0.65	0.28	0.18	1.20	-	-	-	0.90	-	-	-	-	1.64	-
38	38.096	*δ*-Cadinene	1.54	1.17	3.32	1.45	2.77	4.52	0.93	1.48	0.87	2.93	-	-	4.94	5.33	5.35	1.67
39	38.631	Unknown	-	-	-	-	-	-	-	-	-	0.60	-	-	1.12	1.02	1.16	1.01
40	39.334	*α*-Calacorene	-	-	-	-	-	-	-	-	-	0.68	-	-	-	-	-	-
41	40.223	Unknown	-	-	0.34	-	-	1.05	0.71	-	0.69	1.63	0.29	-	3.14	2.54	2.11	1.68
42	40.882	Nerolidyl acetate	0.24	0.40	-	-	-	0.39	-	-	-	1.30	-	-	-	-	-	-
43	41.206	Spathulenol	4.96	7.11	8.22	4.61	5.10	11.90	10.48	11.68	12.95	19.92	6.94	2.00	6.62	6.63	2.59	8.09
44	41.363	Caryophyllene oxide	0.86	1.27	1.38	1.03	1.96	1.48	1.70	2.16	9.29	4.91	10.62	4.21	0.59	1.60	0.77	2.99
		Total (%)	99.91	99.35	99.67	99.99	99.75	99.95	100.01	100.01	100.00	98.92	99.58	99.66	99.25	99.78	99.31	99.82

-: Not detected.

GC/MS analysis results showed that 44 different chemical components were identified in essential oils from *H. occulta* samples collected in different regions in Vietnam. Some components that appeared in most samples were linalool, 6-methyl-2-(2-oxiranyl)-5-hepten-2-ol, *trans*-linalool oxide, hotrienol, *L*-terpinen-4-ol, *α*-terpineol, *δ*-cadinene, and spathulenol. Linalool accounted for the highest relative percentage of peak area (48.70% to 74.35%), indicating that it is the major constituent in *H. occulta* essential oil, followed by the compound *L*-terpinen-4-ol (1.78% to 12.88%), spathulenol (2.00% to 19.92%), and caryophyllene oxide (0.59% to 10.62%).

The *H. occulta* samples collected in Lang Son (**M1**-**M10**) show similar chemical compositions in essential oils. Meanwhile, samples collected in other regions (**M11**-**M16**) contain fewer components than samples collected in Lang Son.

3.4. Discussion

Thien nien kien (*Rhizoma Homalomenae occultae*), primarily used for treating rheumatism and bone and joint pain, particularly effective for the elderly and frail, is a promising medicinal herb with an estimated annual wild collection yield of 200 to 500 tons [14]. However, the number of studies on chemical composition analysis and quality assessment of *Rhizoma H. occulta* is currently limited. In Vietnam, *H. occulta* is widely distributed, so the quality of this medicinal herb in different regions is an issue that needs to be researched.

This study evaluated the essential oil content and composition, total polyphenol content of sixteen samples of the rhizome of *H. occulta* collected in four different provinces, of which ten samples were collected in Lang Son, two samples in Bac Ninh, two samples in Lai Chau, and two samples in Yen Bai. The selected quality assessment criteria are the content of total polyphenol and the content of total essential oil. The results obtained show that these two criteria have opposite trends in these samples. The samples collected in Lang Son had higher essential oil content than the remaining samples, while polyphenol content was lower. This may be due to differences in geographical location and climate characteristics in the regions, leading to differences in metabolic profiles in the sample. These findings suggest the need for further studies on developing suitable growing areas for *H. occulta*. The total polyphenol content in 16 samples of *H. occulta* ranged from 0.25% to 2.64%. The polyphenol content in the Thien nien kien reached 7.75% [12]. Currently, there is no published research on the polyphenol content in the *H. occulta* samples collected in Vietnam, so the results obtained in this study provide more information about the phytochemistry of this herb in Vietnam. Analysis of the obtained essential oil composition revealed that linalool is the main component, accounting for 48.70% to 74.35%. Linalool is a monoterpene with numerous biological activities, such as antibacterial, anti-inflammatory, anti-cancer, and antioxidant effects [11]. In addition to linalool, the component L-terpinen-4-ol is a natural monoterpene found in the essential oil from the rhizome of *H. occulta*, which has antiviral, antibacterial, antifungal, and insecticidal properties as well as antioxidant and anti-inflammatory effects [12],[13]. Identifying the main chemical components in the essential oil from the rhizome of *H. occulta* is important and provides a scientific basis to demonstrate the use of this medicinal herb in remedies for rheumatism, strengthening tendons and bones, and alleviating bone pain. Luu Dam Ngoc Anh reported that the total essential oil content in the rhizome of *H. occulta* samples collected in Vietnam reached 0.718%, and linalool accounted for 8.6% to 63.394%. Meanwhile, *H. occulta* samples collected in China have an essential oil content of

0.79-0.84%, with linalool ranging from 11.1% to 47.7% [14]. Our study showed that the essential oil content in *H. occulta* samples ranges from 0.27% to 0.92%, and the main chemical component is linalool, accounting for over 40% of the chemical composition in the essential oil. This result shows that the rhizome of *H. occulta* samples collected in Vietnam are of good quality and have great potential to exploit and develop products from this medicinal source.

4. Conclusions

The study determined the total polyphenol content and essential oil content in the rhizome of *H. occulta* samples collected in Lang Son. Total polyphenol content ranged from 0.25% to 2.64%, while essential oil content ranged from 0.27% to 0.92%, meeting the quality evaluation criteria (essential oil content) specified in the Vietnamese Pharmacopoeia V [9]. GC/MS analysis of the essential oil revealed the presence of compounds such as 6-methyl-2-(2-oxiranyl)-5-hepten-2-ol, *trans*-linalool oxide, hotrienol, L-terpinen-4-ol, *α*-terpineol, *δ*-cadinene, spathulenol, and notably linalool, which accounted for over 40% (based on peak area ratio). These results provide valuable data on the chemical composition and quality of the rhizome of *H. occulta*.

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