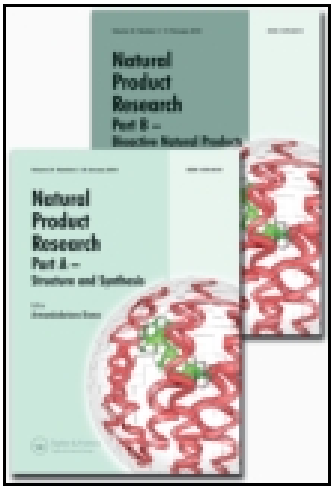

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SHORT COMMUNICATION

Volatile constituents of *Amomum maximum* Roxb and *Amomum microcarpum* C. F. Liang & D. Fang: two Zingiberaceae grown in Vietnam

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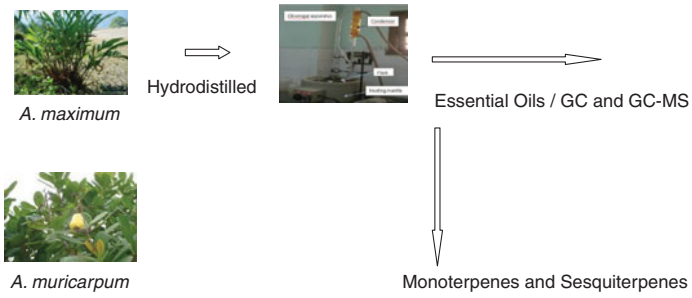

The chemical composition of essential oils obtained from the hydrodistillation of different parts of *Amomum maximum* Roxb and *Amomum muricarpum* C. F. Liang & D. Fang (Zingiberaceae) grown in Vietnam are reported. The analysis was performed by means of gas chromatography–flame ionisation detectoorand gas chromatography coupled with mass spectrometry. The major compounds identified in the oils of *A. maximum* were β-pinene (20.4–40.8%), α-pinene (6.8–15.0%), β-elemene (2.5–12.8%) and β-caryophyllene (2.3–10.3%). Moreover, β-phellandrene (11.6%) was present in the root oil. The main compound identified in all the oil samples of *A. muricarpum* was α-pinene (24.1–54.7%) and β-pinene (9.2–25.9%). In addition, limonene (7.4%) and δ-3-carene (9.4%) were present in the leaves and stem oils, respectively. However, while β-phellandrene (8.3%) could be seen prominent in the root oil, the fruits contained significant amount of zingiberene (6.3%). The largest amount of τ-muurolol (13.0%) was found in the flower oil.

Keywords: *Amomum maximum*; *Amomum muricarpum*; essential oil composition; monoterpenes; sesquiterpenes

1. Introduction

Amomum maximum is a widely distributed plant of the tropical terrain, which has traditional therapeutic potential and culinary values (Nguyen 2000). An investigation has shown that the extract of *A. maximum* acts as anthelmintic against the cestode, *Raillietina echinobothrida*

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(Chetia et al. 2014). Phytochemical studies revealed the characterisation of labdane triterpenoids, diterpenes (Luo et al. 2014), amomaxins A and B as well as isocoronarin (Yin et al. 2013) from the plant. No record of the composition of its essential oil could be found in the literature. Furthermore, *Amomum microcarpum* is a plant that can grow up to 2.5 m tall (Nguyen 2000). It has been traditionally used for the treatment of fever and postpartum bath (Lamxay et al. 2011; Boer et al. 2014). The main constituents of the essential oils from the leaves and fruits were found to be linalool (40.4% and 25.6%) and nerolidol (22.3% and 49.4%).

The objective of this study was to examine the constituents of essential oils from the different parts of *A. maximum* and *A. muricarpum* grown in Vietnam for the first time. This is in reference to our continued interest in the analysis of the chemical constituents of essential oils from poorly studied species of Vietnamese flora (Dai et al. 2014a, 2014b).

2. Results and discussion

The oils composition accounted for 92.3–98.4% of the total contents. The percentage of the major and minor constituents identified in the oil samples as well as the experimental and literature retention indices are summarised in Table 1 and Table S1, respectively, according to

Table 1. Major compounds of essential oils of *A. maximum* and *A. muricarpum*.

			A. maximum			*A. muricarpum*				
Compounds[a]	RI[b]	RI[c]	Leaf	Stem	Root	Leaf	Stem	Root	Fruit	Flower
α-Pinene	939	932	9.7	6.8	15.0	48.4	47.2	54.7	29.3	24.1
Camphene	953	946	0.2	1.1	5.4	1.3	3.2	2.2	0.2	0.9
β-Pinene	980	974	40.8	20.4	28.0	25.9	9.2	14.3	17.9	14.1
β-Myrcene	990	988	0.5	0.6	0.8	2.8	4.1	3.2	0.4	1.0
δ-3-Carene	1011	1008	3.1	–	0.2	–	9.4	–	–	–
β-Phellandrene	1028	1024	–	4.2	11.6	–	–	8.3	–	–
Limonene	1032	1024	1.6	–	–	7.4	–	–	1.3	3.6
Linalool	1100	1095	–	0.1	0.2	0.2	0.1	0.2	0.2	2.7
Methyl cinnamate	1380	1388	–	2.2	0.3	0.2	–	1.2	–	–
β-Cubebene	1390	1390	0.3	–	3.5	–	0.1	–	0.4	4.1
β-Elemene	1391	1398	10.9	12.8	2.5	0.1	0.3	0.2	3.7	0.9
β-Caryophyllene	1419	1417	8.3	10.3	2.3	–	4.3	0.8	1.5	1.1
β-Cedrene	1421	1424	4.9	–	–	–	–	–	–	–
Aromadendrene	1441	1439	–	–	–	–	0.2	–	3.6	2.2
α-Humulene	1454	1452	1.7	3.3	0.6	–	0.9	0.4	1.1	0.6
Germacrene D	1485	1484	–	4.5	–	0.4	1.1	0.5	2.4	0.2
α-Selinene	1493	1498	1.6	–	–	–	–	–	–	–
Valencene	1493	1493	–	–	2.3	–	–	–	–	0.7
Zingiberene	1494	1493	–	–	–	–	–	–	6.3	–
Epizonarene	1502	1501	1.3	–	–	–	–	–	–	–
β-Bisabolene	1506	1505	–	–	–	–	–	0.4	2.9	–
β-Agarofuran	1516	1516	–	–	2.0	–	–	–	–	3.1
β-Sesquiphellandrene	1524	1521	–	–	–	0.4	–	–	3.5	–
Guaiol	1601	1602	0.2	–	–	–	–	–	–	3.3
τ-Muurolol	1646	1640	0.2	2.4	–	–	0.4	–	0.7	13.0
β-Eudesmol	1651	1649	–	4.1	–	–	–	–	0.9	0.5
α-Cadinol	1654	1652	–	3.0	–	–	0.5	0.2	1.5	0.4
Benzyl benzoate	1760	1759	–	0.1	0.1	–	3.8	1.1	1.2	0.5

[a] Elution order on HP-5MS column.
[b] Retention indices on HP-5MS column.
[c] Literature retention indices; – Not identified.

their elution order on HP-5MS capillary column. Monoterpene hydrocarbons (37.0–89.7%) and sesquiterpene hydrocarbons (3.8–38.6%) were the main classes of compounds present in the studied oil samples. Oxygenated sesquiterpene compounds occurred in significant proportions in the stem of *A. maximum* (11.4%) and the flower of *A. microcarpum* (23.7%). The major compounds in the leaves of *A. maximum* were β-pinene (40.8%), α-pinene (9.7%), β-elemene (10.9%) and β-caryophyllene (8.3%) while the stems comprised β-pinene (20.4%), β-elemene (12.8%) and β-caryophyllene (10.3%). However, β-pinene (28.0%), α-pinene (15.0%) and β-phellandrene (11.6%) were the main constituents of the root oil. Other significant compounds include β-cedrene (4.9%) and δ-3-carene (3.1%) in the leaves; germacrene D (4.5%), β-phellandrene (4.2%) and β-eudesmol (4.1%) in the stems as well α-pinene (6.8%) and camphene (5.4%) in the roots. The present results represent the first of its kind aimed at the identification of the volatile constituents of *A. maximum*.

The compounds occurring in higher quantity in the leaves oil of *A. muricarpum* were α-pinene (48.4%), β-pinene (25.9%) and limonene (7.4%). The main constituents of the stems were α-pinene (47.2%), δ-3-carene (9.4%) and β-pinene (9.2%) while the roots comprised mainly of α-pinene (54.7%), β-pinene (14.3%) and β-phellandrene (8.3%). In addition, α-pinene (29.3%), β-pinene (17.9%) and zingiberene (6.3%) were the major compounds of the fruits. The flower oil presented a compositional pattern made up of α-pinene (24.1%), β-pinene (14.1%) and τ-muurolol (13.0%). It was noted that the quantities of linalool and nerolidol in the leaves and fruits were much lower when compared with a previous investigation (Boer et al. 2014). Moreover, some compounds such as α-pinene, δ-3-carene, β-phellandrene, zingiberene and τ-muurolol present in this study were not identified in the previous study.

Previously, the chemical constituents of some *Amomum* oils have been reported. The main compounds in the leaves oil of *Amomum aculeatum* (Huong et al. 2014) were limonene (20.8%), valencene (18.0%) and α-phellandrene (8.7%). The leaf oil of *Amomum longiligulare* (Chau et al. 2014) comprised β-caryophyllene (26.5%), α-pinene (15.6%), humulene epoxide II (14.8%) and α-humulene (12.5%) while the stem was made up of β-caryophyllene (37.4%), α-humulene (16.5%) and hexahydrofarnesyl acetone (10.0%). However, camphene (15.7%), hexadecanoic acid (10.0%) and octadecanoic acid (8.6%) were the main constituents of the root oil. Camphor (23.2% and 34.1%, respectively) and bornyl acetate (14.5% and 17.0%, respectively) were the main constituents of the leaves and fruits of *Amomum vilosum* (Boer et al., 2014). Moreover, eucalyptol (23.87%) and limonene (22.77%) were the major components of *Amomum tsaoko* (Wang et al., 2014). These results may indicate that each *Amomum* species has its own compositional pattern different from others.

3. Conclusion

For the first time, the compositional patterns of essential oils from the different parts of *A. muricarpum* grown in Vietnam were reported. In addition, the volatile constituents of essential oils from *A. maximum* were also described for the first time. It was observed that α-pinene and β-pinene appear to be the most common constituents of the oil samples. The compositions of the oil samples were found to be different from other members of the genus. This may be attributable to factors such as age and nature of the plant, variations in ecological and climatic conditions between the various countries as well as the processing conditions.

Supplementary material

Experimental details relating to this paper are available online, alongside Table S1.

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