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SHORT COMMUNICATION

Phytochemical variations among four distinct varieties of Indian cardamom *Elettaria cardamomum* (L.) Maton

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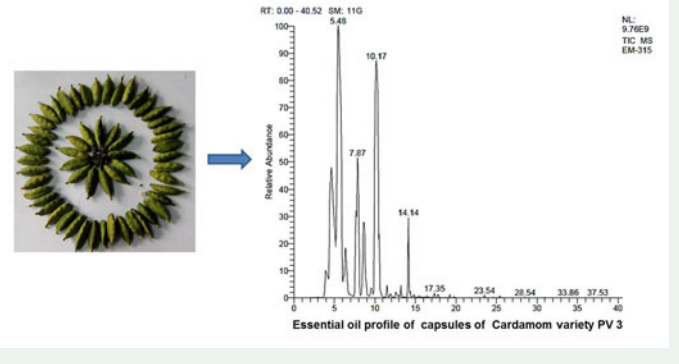
ABSTRACT

Elettaria cardamomum (L.) Maton prestigiously called as Indian cardamom and is mostly cultivated in south India at higher altitudes ranging from 900 to 1400 msl. The chemical composition of dry capsules essential oil of the four distinct varieties was chemo-profiled by gas chromatography-mass spectrometry (GC-MS). Results revealed a higher concentration of major monoterpene 1, 8-Cineole ranging between 28.94% and 34.91% in PV 1 and PV 2 varieties respectively. Other monoterpenes like α-Pinene, Sabinene, Linalool, α-Terpineol and Nerol were present considerable quantities in all of the four cardamom varieties. Two sesquiterpenic constituents namely, ç-Elemene and 1,6,10-dodecatrien-3-ol (Nerolidol) were identified in all varieties. Three ester constituents were also obtained in PV 1 in which α-Terpinyl acetate (26.68%) exhibited as a major ester constituent followed by Ocimenyl acetate (0.80%) and E5-Dodecenyl acetate (0.30%). This is the first published report on the phytochemical concentration of recent varieties of Indian cardamom.



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Cardamom; essential oil; 1,8-cineole; α-terpinyl acetate; α-terpineol; α-pinene; sabinene; linalool

1. Introduction

Cardamom (*Elettaria cardamomum* L. Maton) is a perennial, herbaceous rhizomatous monocot plant, belongs to family Zingiberaceae. It is native of the furthermost tropical

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evergreen forests of the Western Ghats (WG) in southern India (Ravindran 2002). Indian cardamom (also called small cardamom) has been used worldwide for culinary and traditional pharmaceutical applications. Essential oils and other high value antioxidant and gastroprotective bioactive metabolites present in cardamom capsules chiefly contribute to its distinctive aroma and role as functional food as well as nutraceutical and pharmaceutical substance (Hamzaa and Osman 2012). The bioactive phytochemicals of cardamom capsules have several biological roles including antidiabetic, antibacterial and anticancer activities (Marongiu et al. 2004). Several insect pests attack cardamom capsules thereby changing the texture and the appearance of the capsules. Interestingly, even thrips infested capsules found to possess higher concentration of volatile oils and its bioactive phytochemicals (Murugan et al. 2002). Variations occur in the essential oil composition primarily due to differing environmental factors such as soil conditions, altitude, latitude, climate change and seasonal factors (Heywood 2002). Difference in the chemical compositions and other characteristics of small cardamom from different parts the world have earlier received an extensive analysis (Kumar et al. 2005; Kaskoos et al. 2006; Saleem et al. 2008).

Based on the previous research accounts, it is apparent that essential oils of spices and herbs have been attracting great interest by the researchers across the world. Analysis of essential oil in the recently released varieties of cardamom would update the current concentrations of volatile oil as well as counterpart the inadequate information on the applications as well as guide new perceptions on the potential use of their bioactive natural products. The results of this analysis will be useful for selection and identification of new potential sources of varieties as well as volatile constituents for various applications by industries interested in value addition of spices.

2. Results and discussion

Eleven major constituents were characterized with ~66.5% of monoterpenes by GC-MS analysis (Table S1 – available online only). Of the six major monoterpenes 1,8-Cineole (eucalyptol) was the predominant constituent in PV 2 (34.91%) followed by PV 3 (34.06%), Green gold (30%) and PV 1 (28.94%) and it is also a major component of cardamom oil as reported in previous studies (Murugan et al. 2002, 2005). This study also observed five other monoterpenes namely α-Pinene (1.15%–2.42%) Sabinene (11.17%–13.50%), Linalool (1.43%–2.97%), α-Terpineol (12.47%–14.89%) and Nerol (3.69%–6.10%) that were also found to possess noticeable variability in all four cardamom varieties. Moreover 1,8-Cineole has potential anti-inflammatory properties against inflammatory airway diseases like asthma and chronic obstructive pulmonary disease (Juergens 2014). Previous studies also reported that α-Pinene has gastroprotective activity (Polo et al. 2012) and Sabinene and Linalool have anti-inflammatory activities (Valente et al. 2013). Sesquiterpene constituents ç-Elemene and 1,6,10-dodecatrien-3-ol (Nerolidol) ranged 0.37%–0.58% and 1.39%–3.34% correspondingly, but the concentration was greater than previously reported 0.14% (ç-Elemene) and within the range of 1.5% (Nerolidol) in cardamom oil (Kumar et al. 2005). Essential oil profile of the capsules of four cardamom varieties and molecular structures of identified

major constituents were presented in Supplementary Figure S1 and S2 (available online only) respectively.

The essential oil of the variety PV 1 was detected three ester constituents and the other 3 varieties were detected only with two ester constituents except the E5-Dodecenylacetate (Table S1). Among three ester constituents, α-Terpinyl acetate exhibited as a major ester constituent and was ranged between 26.68% and 29.60%. The earlier reported value of α-Terpinyl acetate (27.1%) in cardamom oil corroborates our findings (Kaskoos et al. 2006). The concentration of other two ester constituents namely Ocimenyl acetate and E5-Dodecenyl acetate was in higher in the essential oil of cardamom capsules (PV 1). In earlier studies, the cardamom variety PV 1 has been reported as thrips tolerant (Murugan et al. 2007) and owing to the presence and combination of volatile oil constituents particularly α-Terpinyl acetate and 1-8-cineole. Hence, detailed studies need to confirm these two Constituents' key function on insecticidal activity of cardamom oil.

3. Conclusion

The chemo-profiling of GC-MS analysis reveals that there were eleven bioactive phytochemicals that represent ∼98% of the essential oils and others were trace level. Among major constituents were three monoterpenes namely 1,8-Cineole (28.94%–34.91%), α-Terpineol (12.47%–14.89%) and Sabinene (11.17%–13.50%) as well as an ester constituent, α-Terpinyl acetate (26.68%–29.60%). The presence of these biologically active molecules as major constituents in cardamom oil serves as a new potential natural source for monoterpenes and ester constituents which can be used in food, aroma, cosmetics and pharmaceutical domains.

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Disclosure statement

No potential conflict of interest was reported by authors.

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