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Chemical Composition of the Essential Oil from *Solanum pseudocapsicum*

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Abstract: *Solanum pseudocapsicum* is a poisonous plant; yet it is used for the treatment of boils, gonorrhea, tonic and against abdominal pains. The essential oil obtained by hydrodistillation of unripe berries of the shrub was analyzed by Gas chromatography-mass spectrometry. Twenty-one compounds were identified, constituting 69.24% of the total oil components. The major compounds were homologous series of alkanes, alcohol, aldehyde and terpenoids. The oil is predominated by decane (41.06%), undecane (29.26%), monoterpenoids (14.79%), sesquiterpene (3.21%) and a diterpene pytol (5.94%). These compounds are reported for the first time in this species.

Key words: *Solanum pseudocapsicum,* medicinal plant, essential oil, decane, undecane, monoterpenes, sesquiterpenes

INTRODUCTION

Solanum pseudocapsicum L. (Solanaceae), also known as winter cherry, is an erect and highly branched shrub with non-spiny stem reaching a height of five meters. It bears star-shaped flowers with dark-green lanceolate leaves. At maturity, its glabourous red to yellow berries are attractive but very poisonous. The number of seeds per berry ranges from 50 to 100 while the berries could be as many as 100 per plant (Bassett and Munro, 1985). Although it is cultivated as an indoor ornamental plant due to its brightly coloured berries, its medicinal values have also been reported (Van Den Berghe *et al*., 1987; Shrishailappa *et al*., 2003). The plant is used for the treatment of boils, gonorrhea, tonic for men (Batten and Bokelmann, 1966) and in the treatment of acute abdominal pain (Boericke, 1927). The berries are reported to contain poisonous solanocapsine and other alkaloids that are fatal to man and animals (Hohne *et al*., 1970; Mitscher *et al*., 1976; Chakravarty *et al*., 1984). Alkaloids with antibacterial activity against tubercle bacilli have also been reported (Boll *et al*., 1955). The total alkaloid fractions of the unripe fruits and leaves of *S. pseudocapsicum* have been reported to have cytotoxic, hepatoprotective and antitumour properties (Vijayan *et al*., 2002, 2003 and 2004).

There is no available information on the essential oil composition from this plant, yet comprehensive information on its chemical composition is vital for the proper understanding of its toxicological and pharmacological values. This study reports the chemical characterization of the essential oil from this plant.

MATERIALS AND METHODS

Plant material: The aerial parts of *Solanum pseudocapsicum* were collected from a natural population on the campus of the University of Fort Hare in Alice, South Africa. The species was authenticated in the Department of Botany and a voucher specimen was prepared and deposited in the Griffen Herbarium of the University of Fort Hare.

Oil extraction: Essential oil was hydrodistillated for 3 h separately, from freshly collected ripe and unripe berries of *S. pseudocapsicum* (422.2 g) using Clevenger-type apparatus in accordance with British Pharmacopoeia (1980).

Analysis: The analysis of the oil was carried out on a Hewlett packed gas chromatography HP5973 interfaced with a VG analytical 70-280s double-focusing mass spectrometer. Electron ionization was at 70 eV with ion source temperature at 240°C. HP-5 column was used (30 m×0.25 mm i.d.), which was similar to DB 5; film thickness was 0.25 μm, while helium was used as the carrier gas. The oven temperature was 70-240°C at 5° min^{-1}. The oil (0.2 μL) was injected into the GC-MS.

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n- alkane was run under the same condition for Kovát indices determinations. Constituents of the oil were identified by comparison of their mass spectral pattern and GC retention time with those of standard samples and literature (Adams, 1989, Joulain and Koenig, 1998).

RESULTS AND DISCUSSION

The ripe berries of *S. pseudocapsicum* yielded no essential oil, however, a colourless oil with pungent scent of 0.09% (w/w) yield was obtained from the hydrodistillation of the unripe berries. Twenty-one compounds were identified from the GC-MS spectra of the oil, which amounted to 69.24% of its composition (Table 1). The oil was characterized by the presence of hydrocarbons, aldehyde and terpenoids. The major components of the oil were decane (41.06%), undecane (29.26%), α-thujone (6.06%), pytol (5.94%) and L-camphor (3.08%). Sesquiterpenes hydrocarbons identified were β-Caryophylle (1.91%), butylatedhydroxytoluene (0.47%), alloaromadendrene (0.33%), δ-cadinene (0.25%) and one sesquiterpene alcohol nerolidol (0.25%). The proportion of sesquiterpenes hydrocarbon δ-cadinene and alcohol nerolidol are the same in the oil (0.25%). One aliphatic aldehyde decanal was identified and constituted 1.03% of the total oil composition. β-caryophylle, a dominant sesquiterpene identified in this oil (1.91%) was reported to have anti-inflammatory and anticarcinogenic activities and also plays a role in plant defence (Tellez *et al*., 1999).

Monoterpenes alcohols, α-thujone, L-camphor, geraniol, borneol, α-terpeneol and nerol were prominent constituents of the oil with cumulative percentage of 14.08%. It is worth mentioning that α-thujone and β-thujone have been reported as active ingredients in herbal medicines and as seasoning for food and drinks, while geraniol has been implicated in apoptosis (Izumi *et al*., 1999). Although safrole was found to be a dominant compound in *Solanum sessiliflorum* (Max *et al*., 1998), this compound was not detected in *S. pseudocapsicum*.

The presence of volatile oil in the unripe berries and its absence in ripe berries might have been because, as berries ripen, pungency decreases due to peroxidase degradation (Contreras and Yahia, 1998). The presence of sesquiterpenes in the essential oil might be responsible for cytotoxic and antitumour properties of *S. pseudocapsicum*.

Table 1: Chemical composition of the essential oil from the *unripe berries of *S. pseudocapsicum*

Constituents	Ki[a]	Composition (%)
Decane	975	28.43
Heptane	1038	1.24
Undecane	1092	20.26
α-Thujone	1102	4.20
β-Thujone	1110	1.65
L-camphor	1142	2.13
Borneol- L	1166	1.47
Terpine-4-ol	1179	0.49
α- Terpineol	1195	0.87
Dodecane	1202	0.62
Decanal	1210	0.71
Z-Nerol	1236	0.56
Geraniol	1267	0.52
Tetradecane	1443	0.25
β- Caryophyllene	1470	1.32
Allo-aromadendrene	1563	0.23
Buytlated hydroxytoluene (BHT)	1586	0.33
δ-Cadinene	1599	0.18
Nerolidol	1651	0.18
Hexadecane	1696	0.49
Phytol	2166	4.11

[a] = Retention time on an HB-5 capillary column at 5° min^{-1} from 70-240°C. *The ripe berries yielded no essential oil

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