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Full Length Research Paper

Chemical and nutrient characterization of *Solanum pseudocapsicum* berries

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***Solanum pseudocapsicum* is a poisonous plant, yet it is used in traditional medicine topically for the treatment of boils and gonorrhoea, and orally as male tonic and for abdominal pain. Chemical analyses of the berries were carried out by GC-MS and photometric procedures. Twenty-five components were identified from the GC-MS spectra, constituting 99.80% of the extract composition. The major components were predominated by alkaloids (38.55%), hydrocarbons (22.18%), fatty acid (19.38%), alcohol (13.27%), and carboxylic acids derivatives (3.73%). The results of the mineral nutrient evaluation showed that the berries contains substantial amount of phosphorous and nitrogen. The majority of the components identified in this plant are known to be poisonous, which explains the toxic nature of these berries on animals including human beings. The possible exploitation of these components as a source of pharmaceutical and biodegradable industrial raw material is discussed.**

Key words: *Solanum pseudocapsicum*, berries, chemical composition, alkaloids nutrients.

INTRODUCTION

Solanum pseudocapsicum L. (Solanaceae), known as winter cherry, is a poisonous plant. It is often cultivated as an indoor ornamental plant due to its beautiful but poisonous berries. It 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, its medicinal values have also been reported. The plant is used for the treatment of acute abdominal pain (Boericke, 1927) and in the treatment of boils, gonorrhea and as tonic for men (Batten and Bokelmann, 1966). The berries contain poisonous solanocapsine and other alkaloids that are reported to be fatal to man and animals (Friedman and McDonald, 1997; Parisi and Farancia, 2000; Watson et al., 2004). However, phytomedical investigations of the species have revealed that the plant possesses cytotoxic, hepatoprotective and anti tumour properties (Vijayan et al., 2002, 2003, 2004; Shrishailappa et al., 2003). The pharmacological and toxicological studies has implicated these berries in causing central anticholinergic syndrome, characterized by thought impairment, recent memory disturbance, hallucinations, hyperpyrexia, ataxia, excitement, drowsiness, coma, dry skin and flushing, tacycardia, mydriasis and absence or reduction of bowel movement (Ceha et al., 1997; Parisi and Farancia, 2000). Despite these data on the phytochemical, pharmacological and toxicological properties of *S. pseudocapsicum*, little or no information is available on its chemical constituents. Yet, such information is vital for proper understanding of its economic and bioactive values.

There is increasing evidence that weeds such as *S. pseudocapsicum* are relatively high in bioactive secondary compounds which are likely to hold promise for drug discovery (Stepp, 2004). This paper reports on the chemical characterization of the berries of this plant.

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Table 1. Chemical composition of *S. pseudocapsicum* berries extract.

Constituents	Retention time (min)	Area (%)
Tetradecanoic acid	08.94	16.51
Propionamide	09.27	2.30
2, 2-dimetyl-4-methylaminobutanone	12.29	0.45
2 –O-methyl-Guonosine	13.01	0.29
1- Dodecanol	13.19	13.27
Z- 9- Octadecenoic acid	13.67	2.87
Hexatriacontane	15.80	3.46
2- Fluorophenyl 1H-purin-6-amine	17.05	1.87
N-Acetyl-2-ethoxyamphetamine	19.21	2.49
Tetrahdroxycyclopentadienone	19.71	0.62
10-Demethylsqualene	20.83	20.69
Trimethylsilyl glycolic acid	22.16	2.30
Aramine	22.53	1.09
Hexahydro-1-methyl - 2H-Azepin-2-one	24.70	2.55
3, 3, 3, D3 –Lactic acid	24.79	1.43
Dopamine	25.37	2.01
2-amino-4, 5, 6, 7-D4 benzimidaole	26.44	2.57
Phenthamines	26.60	1.03
1, 1, 2, 3'- Trimethylsiloxypropyl	28.47	1.49
L-Alanine-4-nitroanilide hydrochloride	28.95	1.45
Fluoxetine	30.05	2.66
2,2,2-trichloro –Acetamide	30.57	3.08
2-fluoro-2', 4,5-benzenethanamine	31.72	8.87
3-methoxyamphetamine	33.10	1.32
3-ethoxyamphetamine	33.86	3.36
Total		**99.80**
Unknown		**0.2**

MATERIALS AND METHODS

Collection and extraction of plant material

Berries of *Solanum pseudocapsicum* were collected from a natural habitat in Alice, South Africa. It was authenticated in the Department of Botany and a voucher specimen (Ali Med 01/05) was prepared and deposited in the University of Fort Hare Herbarium. Dried berries were mechanically pulverized using MF 10 basic Ika Technik.

The method of Kreh et al. (1995) and Tram et al. (2002) was adopted for the extraction. These involved adding 250 ml boiling water to pulverized ripe berries (30 g) and after 30 min, the extract was filtered and acidified to pH 4 with acetic acid. The acidic solution was extracted successively with light petroleum and chloroform after which the acidic aqueous phase was made alkaline (pH 9) with 25% aqueous ammonia and extracted with chloroform thrice.

GC-MS analysis of the extract

The GC-MS analysis of the extract 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 70eV with ion source temperature at 240°C. HP-5 column was used (30 m x 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. The chloroform extract (0.2l µ) was injected into the GC-MS. Constituents of the extract were identified by comparison of their mass spectral pattern and retention time with those of standard samples.

Nutrients analysis

The mineral constituents of the plant were determined by digesting the sample on a labcon digester at 300°C in a mixture of hydrogen peroxide, sulphuric acid, selenium and salicyclic acid (Okalebo et al., 2002). The digests were analysed for total P, N, Na, Ca, Mg and extractable micronutrients of Zn, Cu, Fe and Mn. The total N content in the digests were determined by Kjeltec method using FOSS instrument as described in the ASN3201 as total Kjeldahl nitrogen (TKN). The crude percentage protein was obtained by multiplying TKN values by a conversion factor of 6.25 (AOAC, 1990). Total phosphorous was determined using the ascorbic acid blue colour procedure and the absorbance measured at 880 nm wavelength UV-spectrophotometer. The Ca, K and Mg contents in 1/20 dilution (sample /distilled water) plant digests were measured by reading their absorbance on a UNICAM 969 Atomic Absorption Spectrophotometer at 766.5, 422.7 and 285.2 nm, respectively. The sodium content in 1/20 diluted sample were determined by reading their absorbance at 248.3 nm for Mn and Fe, and at 324.7 and 213.9 nm for Cu and Zn, respectively (Okalebo et al., 2002). To assure the quality of analysis and instrumental calibration, in-house standard was used in the analysis.

RESULT AND DISCUSSION

The components identified from the extract, their retention time and percentage compositions are summarized in Table 1. Twenty-five compounds were identified from the GC-MS spectra which accounted for 99.80% of the extract composition. The extract was predominated by alkaloids (38.55%), hydrocarbons (22.18%), fatty acids (19.38%), alcohols (13.27) and the derivatives of carboxylic acid (3.73%). The prominent alkaloids were 2-fluoro-2',4,5-benzenethanamine, hexatriacontane, 3-ethoxyamphetamine and 2,2,2-trichloroacetamide. The presence of other components such as aramines, phentamines, dopamine, fluoxotine and amphetamines derivatives in this plant are noteworthy, as these compounds are known for their potent psycho-stimulant in humans. The compound, dopamine is a known neurotransmitter whose deficiency was reported to cause Parkinson's disease in human (Wichmann and DeLang, 1993). It is also an antidepressant. Amphetamines containing compounds are potent hallucinogens in human and are reported to have effect on the inhibition, uptake and stimulation of spontaneous release of serotonin (Hegardoren et al., 1990). Similarly, ethoxy and methoxy amphetamines are reported to be useful in

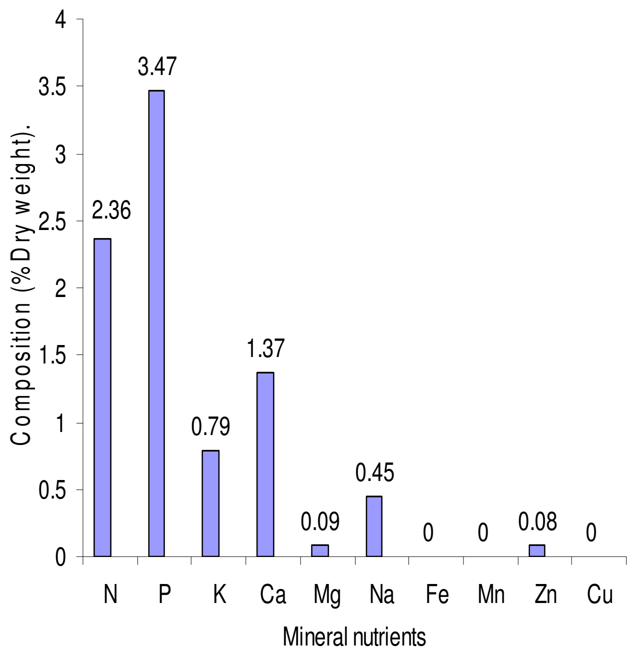

Figure 1. Mineral nutrient composition of *S. pseudocapsicum* berries.

psychiatry due to its effect in decreasing the frequency of threshold measures in intracranial self-stimulation procedures (Hegardoren et al., 1990). It is of interest to note that 10-demethylsqualene, a major constituent of this plant (20.69%) is a good source of industrial biodegradable material. Hence, this plant could be exploited as a potential raw material in industries. The presence of lactic acid in this plant is worth mentioning, as lactic acid from potatoes is used as a natural food preservative and in the production of fabrics and plastics. Majority of the compounds identified in these berries are reported to have pharmacological and toxicological importance in humans. Thus, the berries could be harnessed as a source of raw materials in drug development.

The mineral nutrient composition of *S. pseudocapsicum* berries are presented in Figure 1. The berries are characterized by high content of phosphorous and nitrogen, which are comparatively much higher than calcium, potassium and zinc. The sodium, magnesium and ferrous contents were low, while other nutrients such as manganese and copper were not detected in this experiment. The high content of phosphorous in this berry is worth mentioning as phosphorous containing compounds are used as fertilizer, rat poison, and as a raw material in matches industries. Preedy and Watson (2003) described phosphorous in food as a nutritional toxin. N Phosphorous toxicity has been linked to hyperphosphatemia which is the calcification of non-skeletal tissues such as the kidney. According to Max et al. (1998), *Solanum sessilliflorum* fruits contain high percentage of phosphorous and low ferrous content, which is similar to the result of this study. The high phosphorous and low ferrous content as observed from the results of these findings appears to be an inherent characteristic of the family Solanaceae.

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