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ESSENTIAL OIL IN ROOTS OF *VETIVERIA ZIZANIOIDES* (L.) NASH EX SMALL FROM BANGLADESH

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Abstract

Essential oil from roots of *Vetiveria zizanioides* (L.) Nash ex Small from Bangladesh was examined by gas chromatography mass spectrometry (GC-MS). Fourteen compounds were identified in root oil. The compositions of oil varied qualitatively and quantitatively.

Vetiveria zizanioides (L.) Nash belonging to the family Poaceae and commonly known as 'Khas-Khas' in Bangladesh and India. It is a perennial grass with thick fibrous adventitious roots (Ghani 2003). This species is native of Indian subcontinent and has been introduced in many tropical countries. Roots are stimulant, tonic, cooling, stomachic, diuretic, antispasmodic and emmenagogue, and used in fevers, inflammations and irritability of stomach. Essence of the root is used to check vomiting in cholera. Smoke of grass is inhaled to relieve headache (Ghani 2003). Apart from its use as insect repellent and soil erosion management tool, vetiver grass has numerous traditional uses such as root paste for headaches and leaf paste for rheumatism and sprains. Commercial uses of vetiver grass mainly pertain to the extraction of vetiver oil through distillation of the roots. Vetiver oil has extensive applications in the soap and cosmetic industries, food flavoring and is also used as anti-microbial and anti-fungal agent in the pharmaceutical industry (Kindra and Satayanaraya 1978). This oil is principally used in high class perfumery where its persistent odour makes it of great value as a fixative in admixture with other perfumes. Vetiver grass is also cultivated for the production of a commercially important essential oil used in perfumery and aromatherapy (Chowdhury *et al.* 2002, Weyerstahl *et al.* 1996, Bowles *et al*. 2002). Various tribal people in the subcontinent use different parts of the grass for many of their ailments such as mouth ulcer, fever, boil, epilepsy, burn, snakebite, scorpion sting, rheumatism, headache, etc. (Jain 1991, Singh and Maheshwari 1983). Over 150 compounds have been isolated and characterized from vetiver oil so far. The complex odor of vetiver oil is dominated by a woody balsamic tonality of a very special kind. This tonality indicates the presence of some volatile compounds that have been reported to be mainly sesquiterpenes and their derivatives. Among these, the major active constituents identified are khusimol, vetivone, eudesmol, khusimone, zizaene, and prezizaene (Weyerstahl *et al*. 2000, Sellier and Cazaussus 1991, Martinez *et al*. 2004, Adams *et al*. 2004, Hanayama *et al.* 1973, Weyerstahl *et al.* 2000). Champagnat *et al.* (2006) reported that the characteristic root oil constituents were β-vetispirene, khusimol, vetiselinenol and α-vetivone. As, there is no report available in our country, the present investigation was undertaken to determine the chemical composition of root oil of *V. zizanioides* grown in Bangladesh.

The plant material of *V. zizanioides* was collected from the medicinal garden of BCSIR Laboratory, Chittagong during March 2007. Samples of root were harvested from healthy, well-grown plants. Freshly harvested root samples (500 g) were grounded in a blender. The material was subjected to hydrodistillation using a modified Clevenger-type glass apparatus for 4 h for isolation of oils. The oil samples were stored at 0°C in air-tight

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containers after drying them over anhydrous sodium sulfate, filtered and concentrated under reduced pressure at room temperature to obtain the essential oil for GC-MS analysis.

The essential oil from root of *V. zizanioides* was analyzed by GC-MS electron impact ionization (EI) method on GC-17A gas chromatograph (Shimadzu) coupled to a GC-MS QP 5050A Mass Spectrometer (Shimadzu); fused silica capillary column (30 m × 2.5 mm; 0.25 μm film thickness), coated with DB-5 (J&W); column temperature 100°C (2 min) to 250°C at the rate of 3°C/min; carrier gas, helium at constant pressure of 90 Kpa. Acquisition parameters full scan; scan range 40 - 350 amu.

Compound identification was done by comparing the NIST (National Institute of Standards and Technology) library data of the peaks with those reported in literature, mass spectra of the peaks with literature data. Percentage composition was computed from GC peak areas on BD-5 column without applying correction factors.

Qualitative and quantitative data of root essential oil are shown in Table 1. Fourteen compounds were identified accounting for 100% of the total oils. The percentage of compounds

Table 1. Essential oil in roots of *Vetiveria zizanioides.*

Name of compounds	Per cent
Caryophyllene oxide	5.78
Juniper camphor	3.49
2-Methylenecholestan-3-ol	7.13
tau.-Muurolol	7.54
Tricyclo[8.6.0.0(2,9)]hexadeca-3,15-diene, trans-2,9-anti-9,10-trans-1,10-	3.34
Androstan-17-one, 3-ethyl-3-hydroxy-, (5.alpha.)-	4.95
1H-Cycloprop[e]azulen-7-ol, decahydro-1,1,7-trimethyl-4-methylene-, [1ar-(1a.alpha.,4a.alpha.,7.beta.,7a.beta.,7b.alpha.)]-	4.44
β.-Vatirenene	4.75
3a,7-Methano-3aH-cyclopentacyclooctene, 1,4,5,6,7,8,9,9a-octahydro-1,1,7-trimethyl-, [3aR-(3a.alpha.,7.alpha.,9a.beta.)]-	9.59
2-(4a,8-Dimethyl-1,2,3,4,4a,5,6,7-octahydro-naphthalen-2-yl)-prop-2-en-1-ol	12.44
2(3H)-Naphthalenone, 4,4a,5,6,7,8-hexahydro-4,4a-dimethyl-6-(1-methylethenyl)-	4.03
2(1H)Naphthalenone, 3,5,6,7,8,8a-hexahydro-4,8a-dimethyl-6-(1-methylethenyl)-	7.78
Naphthalene, 1,2,3,5,6,7,8,8a-octahydro-1,8a-dimethyl-7-(1-methylethenyl)-, [1R-(1.alpha.,7.beta.,8a.alpha.)]-	3.42
2,6-Dimethyl-10-methylene-12-oxatricyclo[7.3.1.0(1,6)]tridec-2-ene	21.34

were calculated. In Bangladeshi *V. zizanioides* root essential oil is rich in 2,6-dimethyl-10-methylene-12-oxatricyclo[7.3.1.0(1,6)]tridec-2-ene and 2-(4a,8-dimethyl-1,2, 3,4,4a,5,6,7-octahydro-naphthalen-2-yl)-prop-2-en-1-ol. Result obtained indicated that *V. zizanioides*, growing widely in Bangladesh, may be utilized as a source for the isolation of these two compounds as those are in high concentration in root oil, which has potential antimicrobial activities (Kindra and Satayanaraya 1978, Singh *et al*. 1978 and Dikshit and Husain 1984).

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