

SEASONAL IMPACT ON YIELD AND MAJOR CONSTITUENT OF ESSENTIAL OIL OF *VETIVERIA ZIZANIOIDES* L. NASH GROWN UNDER JORHAT CONDITION, ASSAM, INDIA

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- **The vetiver or khus plant (*Vetiveria zizanioides* L. Nash) an aromatic perennial grass belonging to the family Poaceae.**
- **Vetiver root oil have considerable industrial demand in cosmetic and soap industry for its perfumery and flavour values.**
- **The root oils are also important in traditional medicine for aromatherapy. The main action of vetiver oil is on the nervous system and also thus beneficial for anemia, rheumatism and arthritis.**

- **Vetiver oil has great demand in market because the oil cannot be substituted with reconstituted and cannot be made synthetically.**
- **Vetiver grass has soil binding properties, can tolerate extreme soil condition and can grow annual rainfall ranges from 200 to 5000mm. The thick fibrous adventitious roots are also used for economical importance.**

- **There are distinct geographical differences in quality and perfumery note of essential oil obtained from different region of the world.**
- **Therefore, considering the importance and variability an exploratory investigation has been made to understand the variation of *Vetiveria zizanioides* root oil content under Jorhat condition.**

Materials and methods

- Field study was conducted at the Experimental farm of NEIST , Jorhat during the period of 2007 to 2010
- Planting materials of vetiver obtained from its germplasm maintained in NEIST , Farm and transplanted in the field with spacing 60x60cm.
- Analysis of soil recorded sandy loam soil, pH5.5, Organic matter 0.86% , NPK 0.075%, 0.0006% and 0.0034% respectively. Average temperature minimum 7.3⁰ C maximum 34.8⁰ C and rain fall ranges from 0.5mm to 312.5mm.

Table 1. Monthly average temperature and rainfall condition of Jorhat during 2007 - 2010

Month	Highest Temp. (°C)	Lowest Temp. (°C)	Rainfall (mm)
January	25.9	7.3	6.6
February	27.1	8.1	18.5
March	33.8	14.3	74.5
April	31.2	17.2	147.0
May	31.9	20.4	228.0
June	33.3	21.2	311.5
July	34.6	23.9	312.5
August	34.8	24.3	166.0
September	33.8	23.0	171.5
October	32.7	18.8	0.5
November	29.5	13.4	5.0
December	25.5	8.8	3.5

- **The two years old vetiver root samples were harvested every month during 2010 beginning from January up to December.**
- **The root samples were collected from field, hydro distilled in Clevenger type apparatus for 16 hours.**
- **Oil yields (v/w) were calculated and analysed by GC and GC MS. NIST library search data indicated that valerenol was the major compound of the oil.**
- **For confirmation , the pure compound was isolated through TLC and purifying the compound was studied through NMR,IR and Mass Spectra.**

Results and Discussion

- The meteorological data and the essential oil content of vetiver obtained with respect of different times was presented in Table 1 & Table 2.**
- The oil was a golden yellow colored viscous liquid having pleasant smell with the yield ranged between 0.2 to 0.7% (v/w).**
- The present work of GC and GC/MS analysis of the vetiver root oil showed the presence of 25 components, out of which valerenol (Fig.1) was the major component with the concentration ranging from 18 to 28%.**

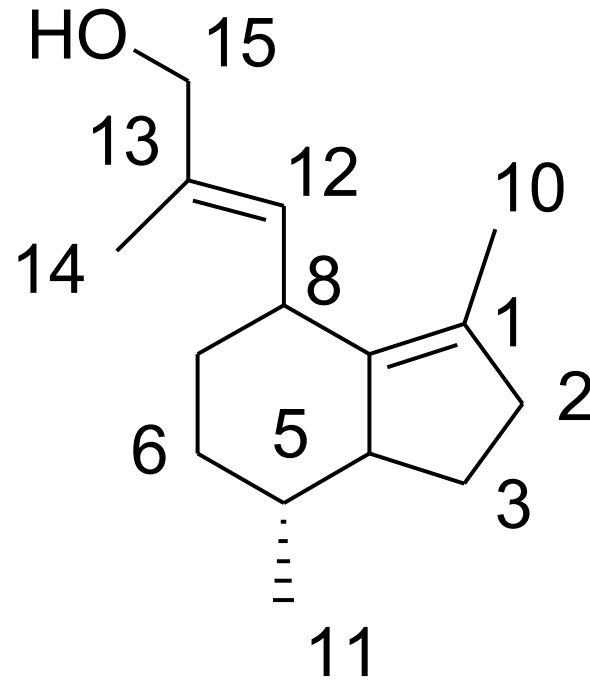


Fig. 1. VALERENOL

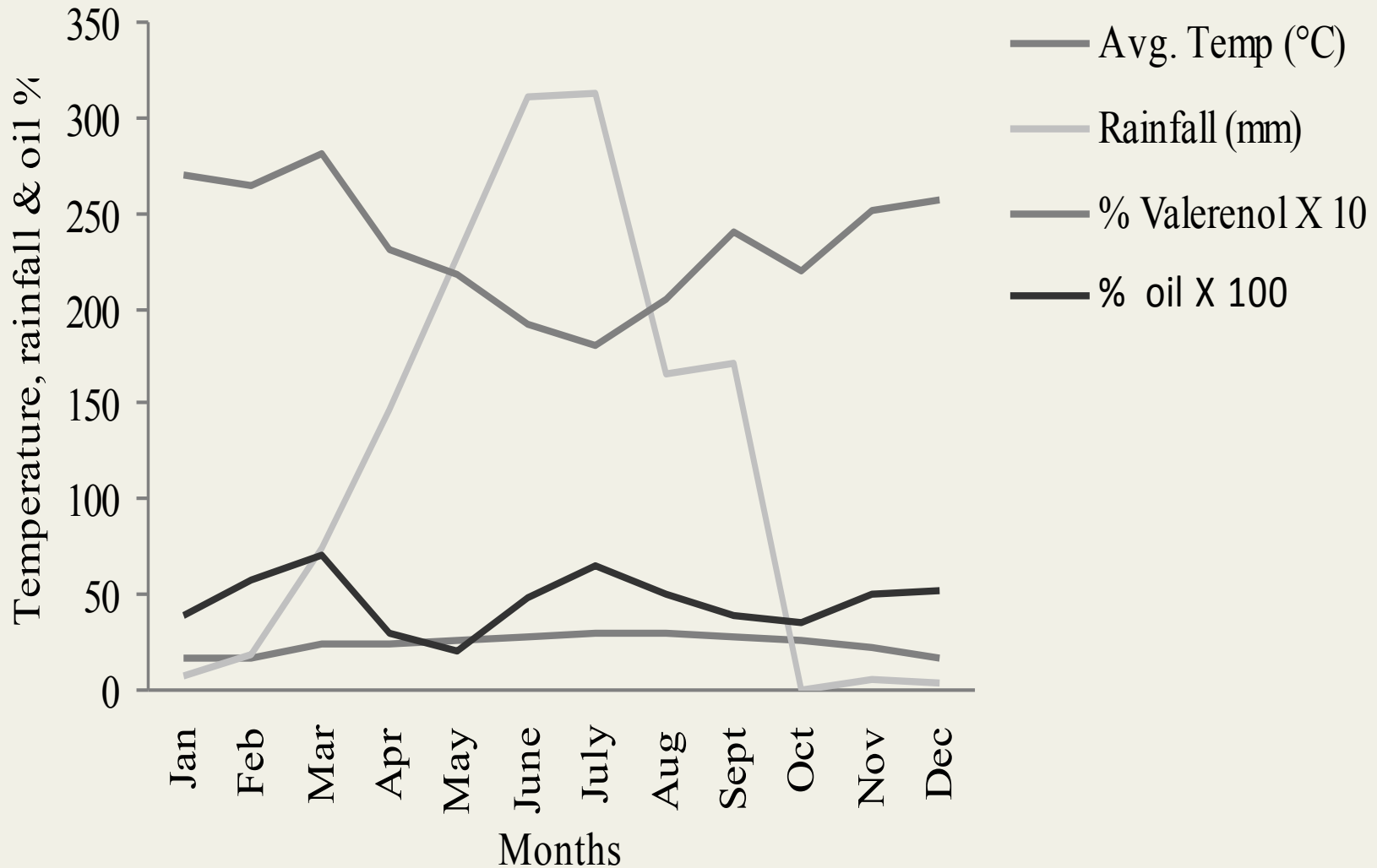
$C_{15}H_{24}O$ Mol Wt. 220

- **The essential oil yield (0.7%) and valerenol percentage (28%) were highest in the month of March.**
- **However, the percentage recovery of oil in the month of July was although higher but with a comparatively lower concentration of valerenol (Table 2, Fig. 2).**

Table 2. Monthly variations on yield and valerenol content of vetiver root oil under Jorhat condition

Month	Percentage of Oil (%)	Valerenol component (%)
January	0.40	27.0
February	0.57	26.4
March	0.70	28.0
April	0.30	23.0
May	0.20	21.7
June	0.48	19.2
July	0.65	18.0
August	0.50	20.5
September	0.40	24.1
October	0.36	22.0
November	0.50	25.2
December	0.53	25.6

Fig. 2. Month-wise variations of temperature, rainfall, oil yield and valerenol content



NMR (300MHz, CDCL₃ δ ppm) 4.73 to 4.56 (3H, overlapping signal), 3.47(2H, overlapping signal), 1.50 to 2.40 (overlapping multiplet), 1.07 (3H, s), 0.78 (3H,d, J =7Hz). (Fig 3)

IR (CHCl₃) cm⁻¹ 3374, 2926, 2865, 1638, 1456, 1378, 1219, 1026, 888, 772. (Fig. 4)

MS m/z at 220 (M⁺, 15%), 205 (8%), 202 (15%), 189(58%), 187 (30%), 162 (100%), 161 (70%), 150 (58%), 145 (32%), 133 (56%), 119 (86%), 105 (70%), 91 (74%), 79 (38%). (Fig. 5).

Mass spectrum of the compound showed its molecular ion peak at 220. 18 loss due to hydroxyl group was clearly evident with a peak at 202.

Other major fragmentations of 150, 133, 119, 105, 91, 79 etc. mass units clearly supports the proposed structure of valerenol.

Fig: 3 Nuclear Magnetic Resonance (NMR) image of valerenol

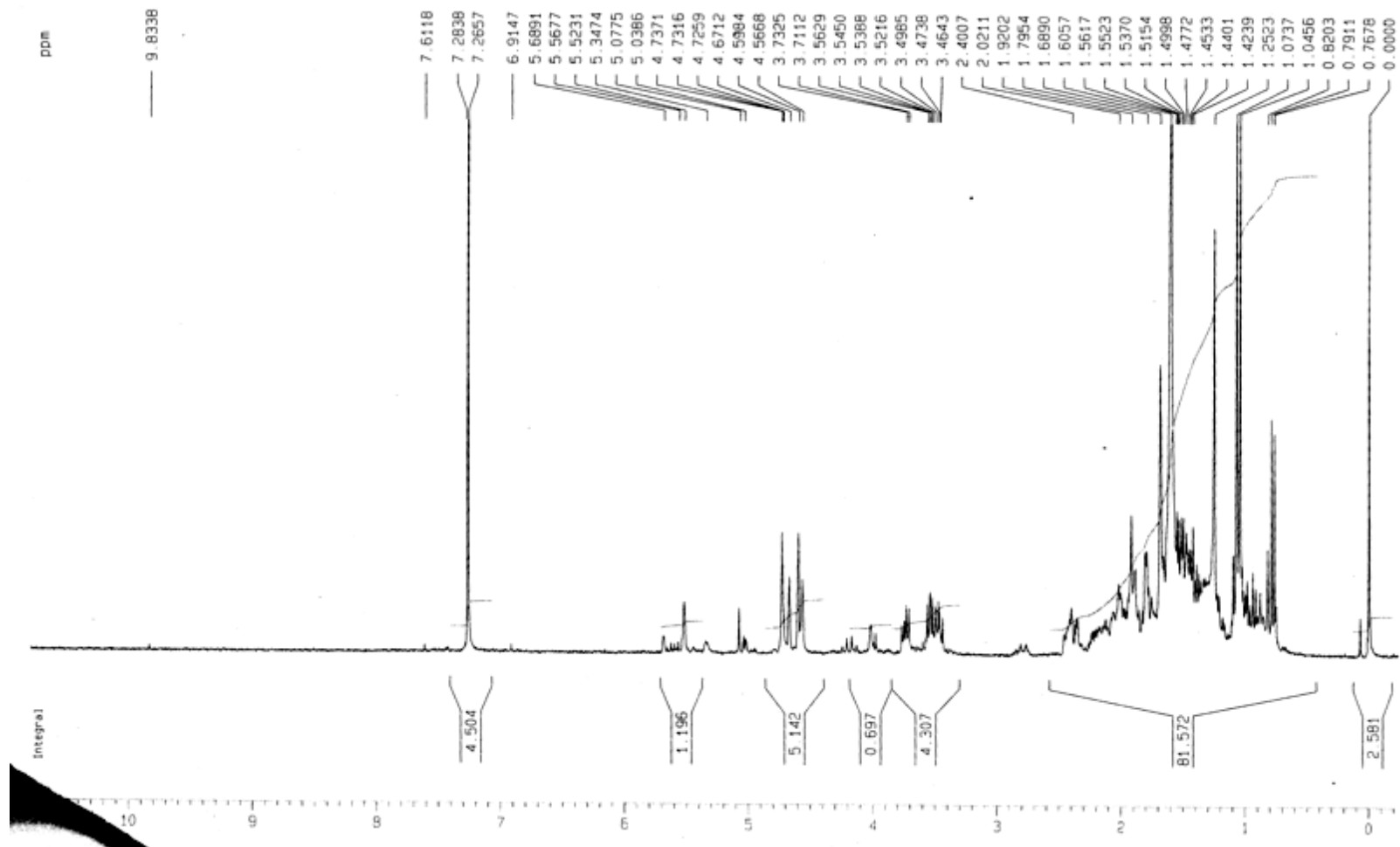


Fig. 4. IR image of valerenol

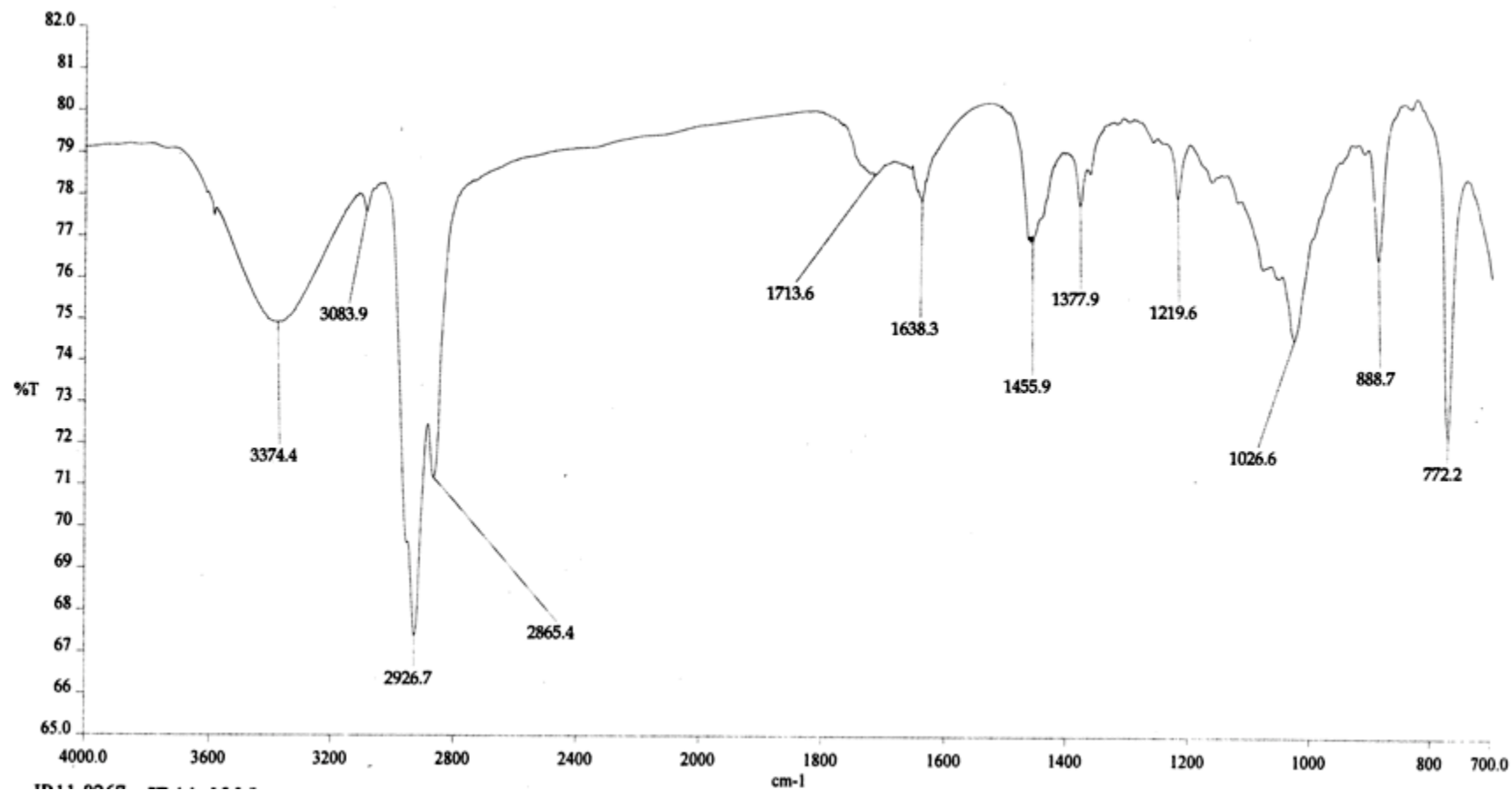
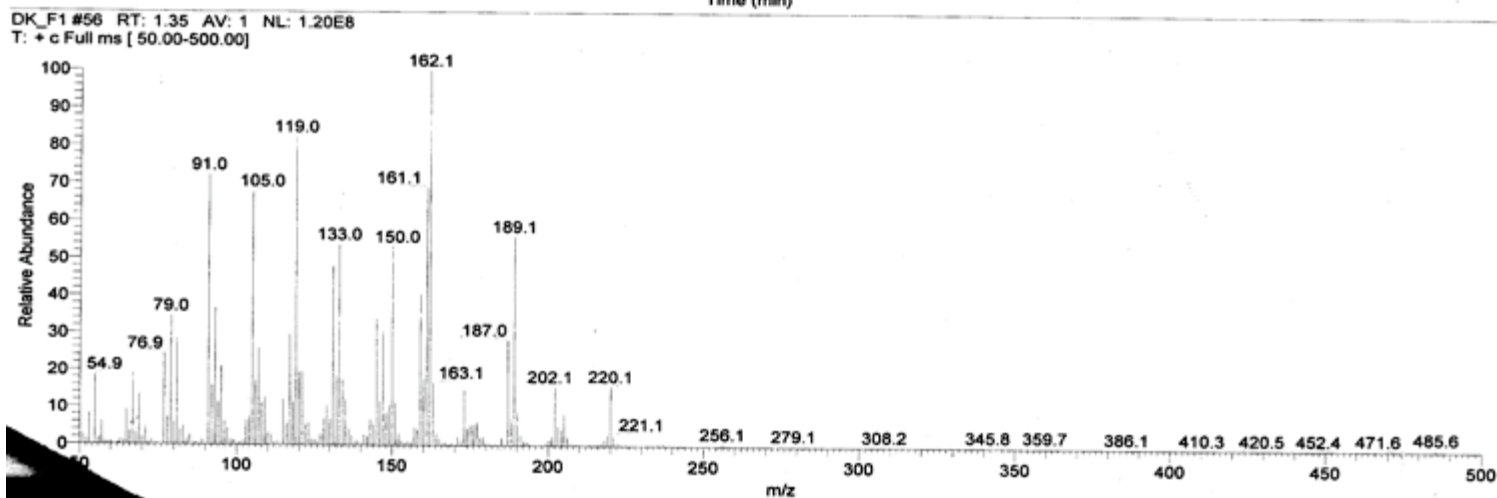
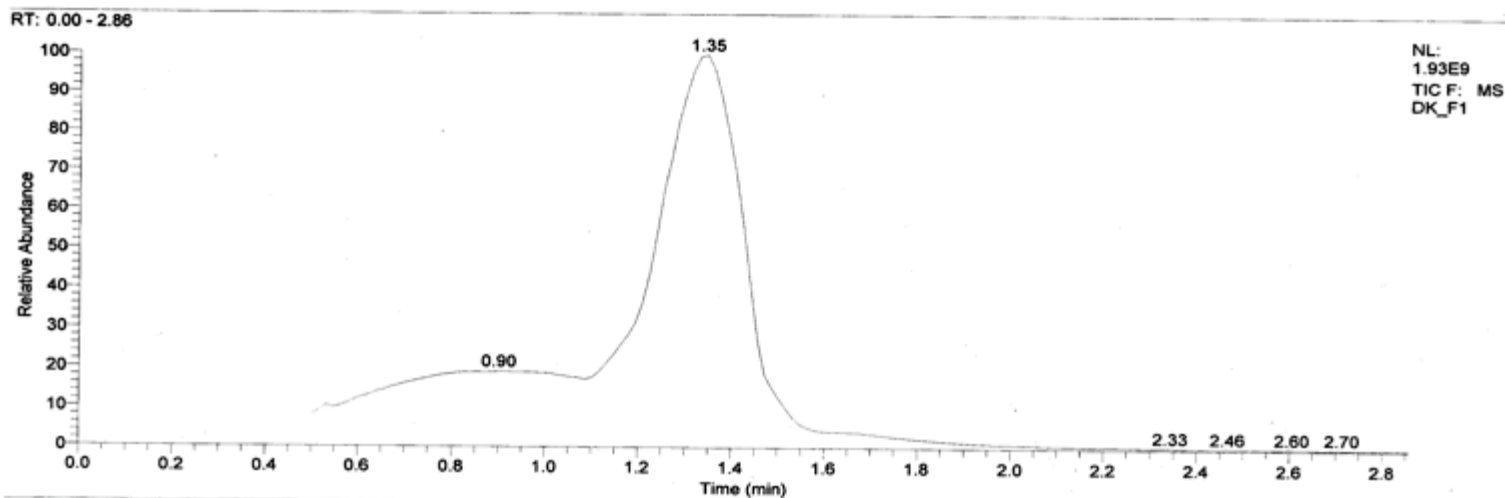


Fig. 5. Mass Spectroscopy (MS) of valerenol



- **The present findings thus clearly indicated the existence of a valerenol rich chemotype in *Vetiveria zizanioides*.**
- **Variation of valerenol up to 3.5% in vetiver root oil was reported previously (Thubthimthed et al 2003).**
- **Literature survey shows, this compound of vetiver oil is either negligible or un traceable**
- **The results suggested that the quality of vetiver essential oil is closely related to the metabolism of its roots which is affected by the agro climatic conditions of Jorhat.**

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THANK YOU

