Int. J. Chem. Sci.: 7(2), 2009, 969-975

CONSTITUENTS OF HYDRODISTILLATE OF *CLEOME GYNANDRA* L. OF INDIAN ORIGIN

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ABSTRACT

In view of reported anti-pest properties of the strongly smelling Indian medicinal herb *Cleome gynandra* L (Cleomaceae), hydrodistillate from its aerial parts was analysed by GC and GC-MS. The present study reveals 12 minor constituents, the major (56.4%) being 1,2-benzene dicarboxylic acid diisooctyl ester. Qualitatively and quantitatively, the result is distinctly different from that reported for the Nairobi sample. Such difference might be due to eco-geographical difference of the areas concerned or due to genotypic variation of the species being compared.

Key words : Hydrodistillation, Anti-pest, *Cleome gynandra*, GC-MS.

INTRODUCTION

Out of thousands of plant metabolites, some act as communicators between plants and animals in species specific manner while some others act as deterants to predators in acute or chronic way[1]. Plant volatiles find application as perfumes, food additives and as tools in eco-friendly pest management techniques[2-7].

Plant volatiles are collected by steam distillation or hydrodistillation or by steam distillation extraction (SDE)[8-1o]. The components are separated by GC and identified by GC-MS[11-13].

Cleome gynandra L, (Cleomaceae), Syn. *Cleome pentaphylla* L, *Gynandropsis gynandra* (L) Briq a strongly smelling annual weed, growing throughout the warmer parts of the globe was reported to be endowed with anti-pest properties[14]. It was shown to exhibit repellent and acaricidal properties to larvae, nymph and adult ticks (*Rhipicephalus appendiculatus*) higher than the commercial arthropod repellent, N, N-diethyltoluamide, when the essential oil extract of the plant was used. Field investigation indicated that ticks

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were not found upto a distance of 2-5 m from the plant growing areas. *C. gynandra* oil has been used to repel headlice (*Pidiculus humanus capitis*) and as general vermicide in hair dressing[15]. *Cleome monophylla* essential oil showed repellency against tick (*R. appendiculatus*) and maize weevil (*Sitophillus zeamais*). E. oil analysis of these two species of cleome showed the presence of 28 and 14 compounds, respectively[16,17].

The Indian medicinal plant *Cleome gynandra* L is strongly smelling and reported to have antipest properties besides other uses[18-22].

The present study reports for the first time, the character and composition of hydrodistillate of *Cleome gynandra* L of Indian origin.

EXPERIMENTAL

Plant material

Cleome gynandra L growing in various parts of Barak Valley of Assam (India) were collected during December-January at its flowering stage. The plant was identified at Botanical Survey of India, Kolkata.

Isolation of steam volatiles

Fresh aerial parts of *Cleome gynandra* L were used for extraction of hydrodistillate. Sample (100 g) was cut into small pieces and hydrodistilled using a Clevenger type apparatus. The condensates were extracted in diethyl ether, dried by anhydrous Na_2SO_4 and the solvent removed by vaccum evaporation to yield the residue, which was stored at 4ºC in sealed glass vial until required.

Gas chromatography

GC analysis of hydrodistillate of *Cleome gynandra* L was carried out on a Varian Model 3700 GC coupled with FID. A packed GC column of 15% SE-52 on chromosorb HP 80/100, 6.5 mm o.d. – 2 mm i.d. glass was used for compositional analysis. Column temperature was maintained at 125ºC and temperature programmed at the rate of 3ºC min^{-1} upto 245ºC with final temperature hold time of 15 min. N_2 was used as carrier gas with a flow rate of 30 mL min^{-1}. Injection and detection temperature were maintained at 250ºC each. 0.2 μL of sample solution in ether was injected.

GC chromatogram was recorded on a omniscribe strip chart recorder with chart speed of 0.5 cm min^{-1}. Qualitative identification of a few peaks were done with authentic

sample. Quantitiative analysis was done by area % method without correction.

GC-MS

The GC-MS data were obtained on a Shimadzu QP 2000 instrument. GC column used was ULBON HR-1 equivalent to OV-1 fused silica capillary 0.25 mm x 50 m with film thickness of 0.25 μ. The programming was at initial temperature of 100ºC for 6 min., then heated at the rate of 10ºC min^{-1} to 250ºC. Carrier gas used was helium at flow rate of 2 mL min^{-1}. The GC-MS instrument was operated at 70 eV and 250ºC. Component peaks were recorded against retention time (min) and components were analysed by recording MS, followed by consultation of MS library (Wiley)[23]

RESULTS AND DISCUSSION

Yellowish oily product was obtained by hydrodistillation of aerial part of *Cleome gynandra* represented 0.12% w/w of fresh sample.

Packed column GC of *Cleome gynandra* L hydrodistillate using 15% SE-52 on chromosorb HP 80/100 and temperature programming showed 13 components of which the major component (56.4%) eluted at high temperature (RT 54.73 min) (Fig. 1). Other components were mostly trace. Linalool (RT 13.5 min) was observed to be present to the extent of about 3% [24]. This component was shown to occur to the extent of 13.3% in the Nairobi sample[17]. Other component were not identified for want of authentic samples.

GC-MS data of hydrodistillate of *Cleome gynandra* obtained by using HR-1 column showed (Fig. 2) the presence of 13 constituents representing 98.8% of the sample of which the major constituent (56.4%) eluted at high temperature (RT 54.73 min). Moderate quantities of four other constituents were observed and the rest were minor constituents (Table 1).

Consulting mass spectral library, the major constituent (peak 13) at RT 54.73 min was identified as 1,2-benzene dicarboxylic acid diisooctyl ester (Wiley 272273) having molecular formula $C_{24}H_{38}O_4$, with m/z 390 [M^+], 279 (7.7%), 167 (36.5%), 149 (100%), 71 (38.5%), 57 (60.5%), 44 (59.6%) (Fig. 3). Such compounds were reported in the wood oil of *Aquilaria agallocha* Roxb.[25] and in the aerial part of Indian *Artemisia annua*[26].

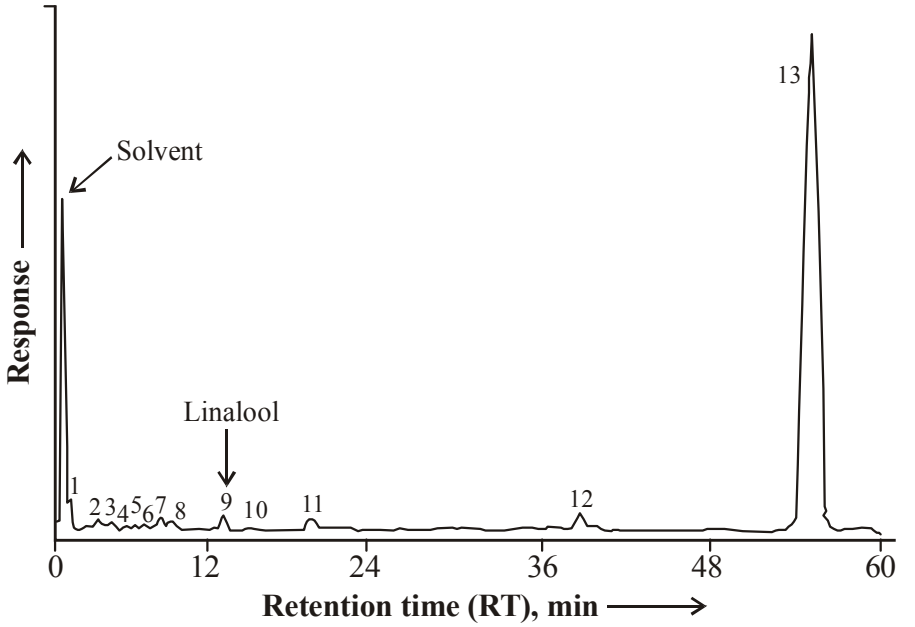

Fig. 1 : Packed column GC Chromatogram of hydrodistillate of *Cleome gynandra* L.

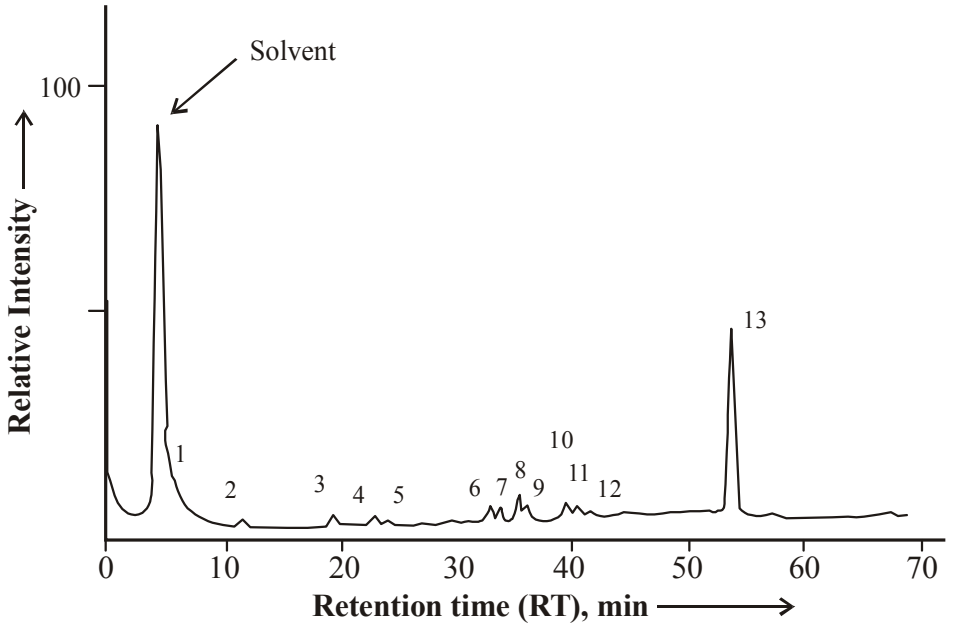

Fig. 2 : Capillary column GC Chromatogram of hydrodistillate of *Cleome gynandra L.*

Table 1 : Constituents of hydrodistillate of *Cleome gynandra* L. by capillary GC

Peak No.	RT (min.)	Relative amount (%)
1	7.36	3.6
2	11.60	0.4
3	19.80	3.6
4	23.40	1.6
5	24.53	0.4
6	33.53	8.0
7	34.56	2.8
8	35.23	10.4
9	36.20	4.4
10	36.66	4.2
11	40.23	3.0
12	40.80	0.4
13	54.73	56.4

Two more compounds, viz. ethyl benzene and propyl benzene were identified as minor constituents (3.6% and 0.4%, respectively) corresponding to peak **1** and **2** at RT values 7.36 min and 11.60 min,. respectively, from comparison of EI MS fragmentation data with literature. These compounds were not reported in the Nairobi *C. gynandra* essential oil[17].

GC-MS of hydrodistillates of *Cleome gynandra* L in the present study reveals distinct difference of composition with that of the Nairobi sample reported earlier. The latter contained carvacrol as the largest component (29.2%) followed by trans-phytol (24%), linalool (13.3%), trans-2-methyl cyclopentanol (7.2%), β-caryophyllene (4.4%) and 23 other minor constituents. Such compositional contrast may be due to different environmental setup for the samples under consideration or due to the distinctness of the genotypes involved[26-29].

ACKNOWLEDGEMENTS

The Authors thank Director, NEIST (formerly RRL), Jorhat for allowing us to conduct packed column GC and Dr. K. P. Madhusudanan (CDRI, Lucknow) for recording GC-MS spectra. One of the authors (SR) also acknowledges financial support by UGC in the form of Minor Research Project.

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Accepted : 20.03.2009