

Fatty acid composition of seed oil from some *Cleome* species

Aparadh* V. T. and Karadge B. A.

Department of Botany, Shivaji University, Kolhapur – 416004.

ABSTRACT

Present paper describes seed oil fatty acid composition of *Cleome viscosa*, *C. simplicifolia*, *C. gynandra*, *C. chelidonii* and *C. speciosa*. In most of these species linoleic and hexadecanoic acids were found to be prominent. However, palmitic acid was predominant in *Cleome viscosa*.

Editor: Srisailam Keshetti, Phcog.Net

Copyright: © 2010 Phcog.net

INTRODUCTION

Oil is any substance that is liquid at ambient temperatures and is hydrophobic but soluble in organic solvents. All oils can be traced back to organic sources. Most naturally occurring fatty acids are of the *cis* configuration, although the *trans* form does exist in some natural and partially hydrogenated fats and oils. Oils are liquid form esters of fatty acids^[1]. Fatty acids are Lipids which are insoluble in water but soluble in organic solvents. Fatty acids are C, H, and O compounds, carbon chain skeletons with (C-COOH) carboxylic group at one end. Generally fatty acids are of two types, saturated and unsaturated fatty acids.

Common examples of unsaturated fatty acids present in seed oil are Myristoleic acid, Palmitoleic acid, Sapienic acid, Oleic acid, Linoleic acid, Erucic acid, Docosaheptaenoic acid etc. Saturated fatty acids are Propanoic acid, Butanoic acid, Pentanoic acid, Hexanoic acid, Heptanoic acid, Octanoic acid, Nonanoic acid, dodecanoic acid, Tetradecanoic acid, Pentadecanoic acid, Hexadecanoic acid, Heptadecanoic acid, Octadecanoic acid, Nonadecanoic acid and Eicosanoic acid.

Gabriel *et al.*^[2] studied fatty acid constituents present in the seed oil of *Cleome viscosa*. Uma Devi and Zaidi^[3] studied fatty acid composition of *Cleome icosandra* and they observed that seeds contain 26% of oil. The oil contains only a small amount of saturated fatty acids and high amounts of unsaturated fatty acids.

An attempt was made to estimate oil and its fatty acids composition in seeds of some additional *Cleome* species.

MATERIALS AND METHODS

Seeds of *Cleome* species were homogenized and extracted in petroleum-ether and crude oil content as estimated according to the method by Sadasivam & Manikam^[4]. The seed oil was further used by adding 1:1 methanol for GCMS analysis for fatty acid composition^[5]. In GCMS study peaks of different fatty acids (according to retention time and percent area) were obtained which were compared to those for standard fatty acids from the library of GCMS.

RESULTS AND DISCUSSION

The GCMS analysis of fatty acids in the oil from seeds of *Cleome* species has been recorded in Table 1 and Fig. 1. It is found that all *Cleome* species contained Octadecadienoic and Hexadecanoic acids (commonly) at higher concentration (Table 1). In *Cleome viscosa* 49.66% hexadecanoic acid (ethyl and methyl esters together) was found with 48.85% ethyl ester of hexadecanoic acid. According Gabriel *et al.*^[2] fatty acid esters especially ethyl palmitate is a major constituent present in the seed oil of *Cleome viscosa*. Ethyl palmitate is nothing but a form of hexadecanoic acid. In other species seed oil it was secondary major compound e.g. in *Cleome simplicifolia*, 17.33%; *Cleome chelidonii*, 21.08%; *Cleome gynandra*, 24.57% and in *Cleome speciosa* it was 24.59%.

In all these species hexadecanoic acid was found in various forms such as ethyl ester, methyl ester, Hydroxy methyl or 1, 2 ethanediy ester. However, in the remaining four species hexadecanoic acid was found in measurable amount (Table 1). In seed oil of all *Cleome*

Figure: Gas chromatographs of fatty acids in the seed oil of different *Cleome* species

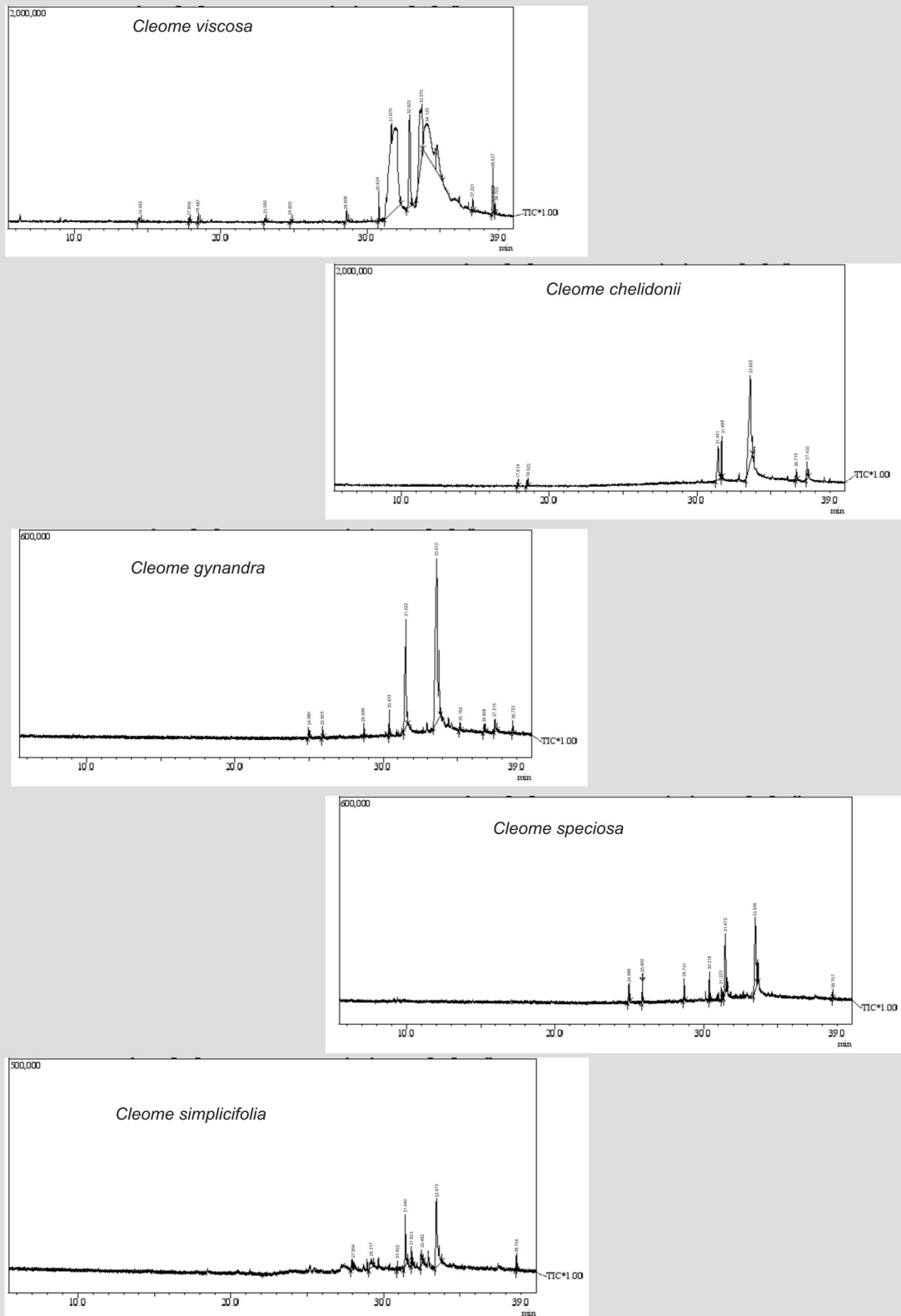


Figure 1. Gas chromatographs of fatty acids in the seed oil fo different *Cleome* species

Table 1: Fatty Acids composition of the Seed Oil from Different *Cleome* Species

Fatty acid	Concentration (%) in				
	<i>Cleome viscosa</i>	<i>Cleome simplicifolia</i>	<i>Cleome chelidonii</i>	<i>Cleome gynandra</i>	<i>Cleome speciosa</i>
Octanoic Acid	0.36	–	–	–	–
(Z)6,(Z)9-Pentadecadien-1-ol	–	–	4.56	–	–
1,2-Benzene-dicarboxylic acid, bis(2methylpropyl) ester	–	–	–	1.85	5.83
di isooctyl ester	0.35	4.99	–	1.36	2.30
2,4-Decadienal	0.47	–	1.67	–	–
9,12-Octadecadienoic acid (Z,Z)	22.26	74.06	–	68.07	51.29
1-methylethyl ester	0.52	–	–	–	–
2-hydroxy-1-(hydroxymethyl)ethyl ester	–	–	2.11	–	–
methyl ester	10.42	3.63	–	–	–
ethyl ester	12.66	–	70.59	–	–
9-Oxononanoic acid	0.21	–	–	–	–
Cyclopentadecanone, 2-hydroxy	–	–	–	–	4.22
Diethyl Phthalate	–	–	–	0.96	–
Dodecanoic acid	0.08	–	–	–	–
Hexadecanoic acid	–	15.56	15.47	23.78	24.59
n ethyl ester	48.85	–	5.61	–	–
methyl ester	0.81	1.77	–	–	–
1(hydroxymethyl)-1,2-ethanediyl ester	–	–	–	0.79	–
Lauric anhydride	–	–	–	1.12	7.04
Pentadecanoic acid	–	–	–	–	–
Propyleneglycol monooleate	–	–	–	0.84	–
Tetradecanoic acid	0.52	–	–	1.23	6.23
Z-6,17-Octadecadien-1-ol acetate	2.48	–	–	–	–

species except *Cleome viscosa*, 9–12 Octadecadienoic acid was the major fatty acid found in various ester forms such as methyl-ethyl ester, 2 hydroxy-1-(hydroxymethyl)ethyl ester, methyl ester and ethyl ester as shown in Table 1. Concentration of this fatty acids in *Cleome* species varied from about 45 to 78%, the highest concentration being 77.69% in *Cleome simplicifolia* and that lowest (45.86%) in *C. viscosa*.

In seed oil of all these species 9,12-Octadecadienoic acid (Z,Z) was predominant while its ester forms were found in less amounts. However, in *Cleome chelidonii*, 9,12-Octadecadienoic acid ethyl ester was present at the highest level i.e.70.59% as shown in Table 1.

In seed oil of all studied *Cleome* species 1,2 Benzenedicarboxylic acid was also present but at lower amounts and in *Cleome chelidonii* seed oil it was not found. In *Cleome viscosa* it was 0.35% only, in *Cleome simplicifolia*, 4.99% and in *Cleome gynandra*, 3.2% only. In *Cleome speciosa* however, it was found to be relatively at higher concentration (8.13%).

1,2 Benzendicarboxylic acid, in its ester forms, e.g. diisooctyl ester was common in seed oil of all *Cleome* species (except *Cleome chelidonii*) and bis (2 methyl propyl ester) was found in *Cleome speciosa* and *Cleome gynandra* seed oil. In *Cleome speciosa* it was at higher level i.e. 5.83%.

Tetradecanoic acid appeared to be common in three *Cleome* species i.e. *C. viscosa* (0.52%), *C. gynandra* (1.23%) and *C. speciosa* (7.04%).

Lauric anhydride which is structural derivative of dodecanoic acid (Lauric acid) was present in *Cleome gynandra* (1.12%) and in *Cleome speciosa* (7.04%). While, 2,4 decadienal was observed in *Cleome viscosa* as well as *Cleome chelidonii*.

In seed oil of *Cleome viscosa* other fatty acids and their derivatives were also present such as Octanoic acid, Oxononanoic acid, Dodecanoic acid and Z-6,17 Octadecadien-1-ol acetate (2.48%). In seed oil of *Cleome chelidonii*, (Z)6 (Z)9 pentadecadien 1-ol (4.96%) derivative of Pentadecanoic acid was also present. In *Cleome*

Fatty acid composition of seed oil from some *Cleome* species

gynandra, Propyleneglycol monooleate (0.84%) and Diethyl Phthalate (0.96%) have been recorded. While in *Cleome speciosa* 2-hydroxy Cyclopentadecanone, (4.22%) was at low level.

In *Cleome viscosa* dodecanoic acid was found with a very low conc. (0.08%) while in *Cleome simplicifolia* 1,2 benzendicarboxylic acid diisooctyl ester was present at 4.99%, concentration as lower fatty acid and in *Cleome gynandra* it was tetradecanoic acid (0.84%) which was at the lower concentration.

On the basis of GCMS analysis, seed oil from five different *Cleome* species showed much more similarity. Some compounds found common in all studied species at measurable concentration may be taxonomically important for family Cleomaceae or genus *Cleome*. While some compounds were specific and were found only in

single species. This character is also helpful for the study of variation among the species.

REFERENCES:

1. Mukherji, S. and Ghosh, A. K. (2006). *Plant Physiology*. New Central Book Agency (P) Ltd, 483.
2. Gabriel, O., Peter, W. & Stephen, O. (2005). Chemical Investigation of the Volatile Constituents of *Cleome Viscosa* From Nigeria. *Bull. Chem. Soc. Ethiop.* **19**(1), 139–143.
3. Uma Devi Y. and Zaidi, H. R. (1975). Composition and Characteristics of *Cleome icosandra* L. Seed Oil. *Fette, Seifen, Anstrichmittel.* **79**(2), 91–92.
4. Sadasivam, S. and Manickam, A. (1991). 'Biochemical Methods'. Wiley Eastern Limited, New Delhi; 2nd Ed. pp. 107–110.
5. Singh, R. K., Kumar, A. K. and Sethi, S. (2006). Preparation of karanja oil methyl ester. *Offshore World*, <http://dSPACE.nitrkl.ac.in/dSPACE> April-May 2006.