International Journal of Chemical and Pharmaceutical Sciences 2014, Sep., Vol. 5 (3)



Helicteres isora (Sterculiaceae) seed oil as a minor source of cyclopropenoid fatty acids

Abdul Malik^{*}, Seema Parveen, Mohammed Taufeeque and Swatika Sharma and Sherwani MRK.

Department of Chemistry, J.N.V. University, Jodhpur, Rajasthan, India.

*Corresponding Author: E-Mail: seemakhan2831@gmail.com

ABSTRACT

The seed oil of *Helicteres isora* (Sterculiaceae) contained Cyclopropenoid fatty acids (CPFA) as a minor component in the seed glycerides. The structural elucidation of CPFA is performed using, Thin layer chromatography, Gas liquid chromatography, U.V, I.R and N.M.R spectroscopy. The Cyclopropenoid moiety is resolved into two components as silver nitrate-methanol derivatives of malvalic and sterculic acids.

Keywords: Helicteres isora, Cyclopropenoid fatty acids, sterculic and malvalic acids.

1. INTRODUCTION

Helicteres isora belongs to Sterculiaceae family (Figure 1). It is also called Indian screw tree. It has both nutritional and medicinal properties. The root juice and bark of *Helicteres isora* are considered to be expectorant, astringent, antiglactagogue, to reduce gripping and a cure for snakebite ^[1]. Its fruits are used as stomachic, vermifuge, vulnerary and useful in bowl gripes ^[2]. Fried pods are given to children to kill intestinal worms ^[3]. The seed oil of *Helicteres isora* showed positive Halphen test which confirmed the presence of Cyclopropenoid fatty acids ^[4]. HBr titration method is used for quantitative estimation of total CPFA ^[5].



Figure -1: *Helecteres isora* plant with flower and pod

2. MATERIALS AND METHODS

The seeds were collected from different sites especially grown in arid and semi arid

regions. After proper cleaning, drying and weighing an exact amount of seeds were soxhlet extracted with petroleum ether $(40^\circ - 60^\circ C)$ and the solvent was evaporated under vacuum using rotary evaporator. The analytical values of oil and seeds were determined according to the procedure recommended bv American oil chemical society ^[6]. The results were reported as weight percentages (Table 1). Kjeldahl method was used to determine the protein content of the defatted seeds. Thin layer chromatographic techniques and silver ion TLC were used to resolve different fatty acid components of the oil. The fatty acids esters were prepared using transesterification of the seed oil. The GLC analyses of oil samples were performed by Amil Nucon gas chromatograph model No.5700 equipped with a flame ionization detector. The IR spectra were Jasco-made determined on FTIR spectrophotometer. The separation of CPFA fraction was done by preparative TLC. Shimadzu UV-1601 spectrophotometer was used to record UV spectra of the oil and its derivatives. The NMR spectra have been conducted with Bruckers x 300 specrophotometer.

3. RESULTS AND DISCUSSION

During the course of chemical analyses, *Helicteres isora* seed oil responded positive Halphen test (red colour when heated with 1% solution of sulphur in CS₂) ^[4] and was taken for the estimation and characterization of Cyclopropenoid fatty acids. The literature showed that some work on fatty acids has been reported by Gunston and co-workers ^[7]. Light petroleum extraction of the crushed seed yielded 2.85% oil. The seed properties and oil characteristics have been given in (Tablen 1). The quantization of total Cyclopropenoid material by HBr-titration showed the presence of 8.75% by wt. of CPFA in *H. isora* seed oil ^[5].

The oil of *H. isora* showed two spots over TLC. The IR spectrum of the oil gave bands at 1010 and 1852 cm⁻¹ along with normal peaks. The oil was separated by preparative TLC into two fractions and each fraction was characterized separately.

Table - 1: Analysis data of seed and oil											
Name & Oil family (%)		Oil (%)	Protein (%) N x 6.25		Moistur (%)	re (V	I.V. S.V. (Wij's)		R.I.	HBr-Equivalent (%)	
Helicte	eres isora										
(Sterculiaceae) 2.85		16.8		2.83	10	107.18		1.4817	8.75	5	
Table - 2: Fatty acid composition determined by GLC (Fraction-I (Uncorrected weight percentage)											
Name & family			16:0		18:0 18:1		18:2		18:3	20:0 others	
Helicteres isora											
(Sterculiaceae)		38.4		12.1	12.9 29.6		9.6	5.7	- 1.2		
Table - 3: GLC Analysis of Silvernitrate-Methanol treated methyl esters of fraction-II											
	(Uncorrected weight percentage)										
	Name &	family	14:0	16:0	18:0	18:1	18:2	18:3	Malvalic	Sterculio	:
	<u>Helictere</u>	<u>s isora</u>	2.40	20.20	9.14	14.30	43.00	2.20	3.25	5.50	
	(Sterculio	aceae)									
$CH_{3} - (CH_{2})_{7} - C = C - (CH_{2})_{n} - \overset{O}{\overset{U}{\overset{U}{\overset{U}{\overset{U}{\overset{U}{\overset{U}{}{}}}}}} - OCH_{3}$ CH_{2} $n = 6 (Malvalic acid)$ $n = 7 (Sterculic acid)$ $AgNO_{3} - Methanol$											
$\begin{array}{cccccccccccccccccccccccccccccccccccc$											
$\begin{array}{cccc} CH_{2}OCH_{3} & O & CH_{2}OCH_{3} & O \\ CH_{3}-(CH_{2})_{7}-C & = CH_{2}(CH_{2})_{7}-C & = CH_{2}(CH_{2})_{7}-C & = CH_{2}(CH_{2})_{7}-C & = CH_{3} \\ + & + & + & + \end{array}$											Η 3
$CH_{3} - (CH_{2})_{7} - C + C + C + C + C + C + C + C + C + C$											Н 3
$CH_{2} - (CH_{2})_{7} - CH_{2} - CH_{2} - CH_{2} - CH_{2} - CH_{2} - CH_{2} - CH_{3} - CH_{$						С H ₃ -(С H ₂) ₇ - С + О - С - С - С - С - С - С - С - О С H ₃ С H ₂					

Scheme - 1: Ether and Keto derivatives of malvalic and sterculic acids

3.1. Characterization of fraction - I

This fraction in the pure form gave $R_f 0.75$ and negative Halphen test ^[4]. IR of this fraction gave no characteristic band at 1010 cm⁻¹ (CPFA).

This fraction did not respond to any positive test for other functional groups. The methyl ester of this fraction on silver nitrate TLC showed spots for saturated, monoenes, dienes and trienes using linseed ester as reference standard. The fatty acid composition of methyl ester of this fraction is given in (Table 2).

3.2. Characterization of fraction - II

The direct TLC of this fraction had Rf 0.55 and responded positively to Halphen test ⁴. HBrtitration estimated CPFA upto 8.75% by weight ^[5]. IR spectrum clearly gave bands at 1010 and 1852 cm⁻¹ in addition to other bands for normal fatty acids. The base catalyzed trans-esterification of this fraction gave methyl esters which also showed the IR band for CPFA at 1010 cm⁻¹. The NMR spectrum of this fraction showed signals at τ 9.29 for cyclopropenoid group in addition to other usual fatty acid proton signals viz. 7 6.4 (3H, COOCH₃), τ 7.8 (2H, α to carbonyl), τ 8.8 (Chain CH₂) and τ 9.12 (3H, terminal CH₃). The U.V. spectrum indicated no conjugation or transunsaturation in this fraction. The GLC of methyl esters with silver nitrate in absolute methanol produced derivatives of CPFA following the procedure of Schneider and co-workers [8]. The GLC chromatogram clearly established the presence of malvalic and sterculic acids in the seed oil using Sterculia foetida ester as reference standard (Table 2). The GLC data of Cyclopropenoid fatty acids were in close agreement with those obtained by HBr-titration [5]

The experimental work showed conclusively the presence of CPFA in this fraction of the oil *H. isora* seed oil. The GLC analysis of AgNO₃-methanol treated methyl esters clearly showed the presence of malvalic acid (3.25%) and sterculic acid (5.50%) in addition to the normal fatty acids. The AgNO₃-methanol treated products formation from malvalic and sterculic esters has been depicted in scheme I.

4. CONCLUSION

In conclusion it may be added that analysis of AgNO₃-Methanol treated esters of CPFA containing seed oil is a method of choice both for characterizing and estimating the individual sterculic and/or malvalic acid in the seed oils. This method of analysis has the advantage of not reacting with other unsaturated acids present in the oil. This method has been successfully used for seed oil containing low level of Cyclopropenoid material.

Acknowledgement

We are extremely grateful to the Head, Department of chemistry, J.N.V.University, Jodhpur for providing necessary facilities,Dr.Pavan Kasera for plant identification, Abdul Malik and Seema Parveen to UGC for financial assistance.

5. REFERENCES

- Kritikar KR and Basu BD. Indian Medicinal plants 2nd Ed., Allahabad: Lalit Mohan Badsu: 1993; 1: 371-372.
- 2. Chopra RN. Glossary of Medicinal plants, New Delhi; CSIR, 1956: 131.
- 3. Asolkar LV. Second supplement to glossary of Indian Medicinal plants with active principles. New Delhi: Publication and Information Directorate, CSIR, 2012: 78-83.
- 4. Halphen G. J. Pharm., 1897; 6(6): 390.
- 5. 5Harris JA. **J. AMER. Oil Chem. Soc.,** 1964; 4: 309.
- 6. Official and Tenative Methods of the American Oil Chemists Society, 3rd Ed., 1978.
- 7. Christie W. Chem. Phy. Lipids, 1968; 2: 196.
- 8. Schneider EL. J. Amer. Chem. Sco., 1968; 45: 585.