

PHYSICO CHEMICAL STUDIES OF *SOLANUM* SPECIES OF PAKISTAN

Part II. Fatty Acid Composition of the Total Lipids and Lipid Classes and Trace Elements of *Solanum khasianum* Clarke Seeds

AMIR-UD-DIN, M.A. SAEED AND SALEEM AKIITAR
 PCSIR Laboratories Complex, Lahore-54600, Pakistan

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Solanum khasianum Clarke seed total lipids (9.26%) were examined to find out its fatty acids composition. The total lipids were fractionated into lipid classes by thin layer chromatography. Neutral lipids were found to be 78.43% and the polar lipids 21.57% by weight of the total lipids. The neutral lipids were composed of hydrocarbons (2.77%), wax esters (0.74%), triglycerides (44.22%), free fatty acids (5.31%), fatty alcohols (10.75%), 1:3-diglycerides (5.16%), 1:2- diglycerides (3.92%) and monoglycerides (5.56%). The predominant fatty acids in the total lipids and all its fractions were palmitic, stearic, oleic and linoleic acids. The mineral contents of the seed meal were also identified.

Key words : *Solanum khasianum*, Lipid composition, Trace elements.

Introduction

The genus *Solanum* belongs to the plant family Solanaceae. It consists of about 1400 species which are widely spread in tropical and temperate regions of both the hemi-spheres. In Pakistan 15 species of this genus are reported to grow, out of which 8 are native [1]. The great importance of the plants of this family is due to their use as a source of steroidal drugs [2]. The seeds of these plants are also enriched with oil. Saleem *et.al.* [3] studied the fatty acid composition of some of the species of the Solanaceae such as *Nicotiana tabacum* Linn., *Lycopersicon esculantum* Miller, *Datura alba* Nees. and *Solanum xanthocarpum* Scharde and Wendl. of Pakistani origin and reported the oil contents to be 18.1, 20.0, 15.5 and 5.0% respectively. They found linoleic and oleic acids as major component acids. The fatty acid profile of the seed oils of the genus *Solanum* indicated that the unsaturated acid predominate in these oils. *Solanum xanthocarpum*, *L. esculantum* [3] and *S. indicum* [4] seed oils contained 9.5, 71.5 and 84.5% of the unsaturated fatty acids respectively. The present investigations were conducted to study the lipid and mineral composition of the seeds of *Solanum khasianum*. These studies are in continuation of our work in search of new non-conventional sources of lipids.

Materials and Methods

The seeds of the *Solanum khasianum* were collected from the experimental fields of the PCSIR Laboratories, Lahore. The seeds were finely ground and the lipids were extracted with a solvent mixture chloroform : methanol (2:1 v/v). The lipids were purified [5] and fractionated into different lipid fractions by thin layer chromatography and the percent weights of the fractions were calculated [6].

The methyl esters of the total lipids and lipid fractions were prepared by using methanol-BF₃ mixture [7]. The gas liquid chromatography was done on a Pye Unicam 204 series unit equipped with flame ionization detector and 4 mm x 1.5 m glass column packed with 10% DEGS on diatomite CAW. The column temperature was maintained at 200° and nitrogen gas was used as the carrier gas with a flow rate of 40 ml/min. The peaks were identified by comparison of their retention times with those of the standard methyl esters under the same conditions. Percent peak areas are quoted as composition percent weights.

The seed meal was analysed for its ash content [8]. The mineral composition of the ash was determined by using a Carl Ziess FMD-4 atomic absorption spectrophotometer.

Results and Discussion

The seeds of *Solanum khasianum* Clarke was found to contain 9.26% total lipids. The total lipids were fractionated into different lipid fractions by thin layer chromatography. The total lipids were composed of 78.43% neutral lipids and 21.57% polar lipids (Table 1).

TABLE 1. LIPID FRACTIONS OF *SOLANUM KHASIANUM* CLARKE SEEDS.

Lipid fraction	Weight %
Total lipids (%)	9.26
Neutral	78.43
Polar	21.57
Hydrocarbons	2.77
Wax esters	0.74
Triglycerides	44.22
Free fatty acids	5.31
Diglycerides	9.08
Fatty alcohols	10.75
Monoglycerides	5.56

TABLE 2. PERCENT FATTY ACID COMPOSITION OF TOTAL LIPID AND LIPID FRACTIONS OF *SOLANUM KHASIANUM* CLARKE SEEDS

Fraction	Fatty acids (wt. %)										
	10:0	12:0	14:0	16:0	18:0	18:1	18:2	20:0	22:0	Saturated acids	Unsaturated acids
Total lipids	0.1	0.2	0.3	15.7	19.6	46.8	16.3	0.5	0.5	36.9	63.1
Triglycerides	0.5	0.2	4.8	35.6	13.4	31.1	11.2	1.2	2.0	57.7	42.3
Free fatty acids	9.1	1.4	1.5	24.3	8.9	19.5	33.2	1.0	1.1	47.3	52.7
Diglycerides	0.0	2.8	3.7	36.9	11.5	22.4	9.4	0.9	12.4	68.2	31.8
Monoglycerides	0.0	7.5	6.7	38.2	10.9	24.6	9.8	0.0	2.3	65.6	34.4
Polar lipids	0.0	0.0	1.7	33.6	11.7	26.0	24.6	1.3	1.1	49.4	50.6

TABLE 3. MINERAL COMPOSITION OF *SOLANUM KHASIANUM* CLARKE SEEDS.

Ash (%)	3.85
Mineral content	(PPM)*
Co	3.3 ± 0.01
Cr	0.0 ± 0.008
Cu	11.4 ± 0.003
Fe	191.1 ± 0.008
K	6206.1 ± 0.003
Li	0.0 ± 0.002
Mn	16.3 ± 0.003
Na	6696.7 ± 0.0004
Ni	0.0 ± 0.009
Pb	1.6 ± 0.03
Zn	24.5 ± 0.002

*On dry, defatted material weight basis.

Triglycerides (44.22%) are the major component of the total lipids. The other fractions were hydrocarbons (2.77%), wax ester (0.74%), free fatty acids (5.31%), fatty alcohols (10.75%), diglycerides (9.08%) and monoglycerides (5.56%). The fatty acid composition of total lipids and some lipid fractions were determined and the results are given in Table 2. The total lipids, free fatty acids and polar lipids were rich in unsaturated fatty acids while triglycerides, diglycerides and monoglycerides were rich in saturated fatty acids. However, the predominant fatty acids in the total lipids and all its fractions were palmitic, stearic, oleic and linoleic acids. Dasso *et al.* [9] studied the crude seed oils of 14 Solanaceae species and reported that palmitic, oleic and linoleic acids were major acids whereas very little linolenic acid was found. Pandse [10] and Puntembekar [4] also studied the seed oils of *Solanum nigrum* and *Solanum indicum* respectively and reported similar results. Saleem *et al.* [3] reported the presence of lauric, myristic, palmitic, stearic, oleic, linoleic and traces of linolenic acid in the seed oils of *Nicotiana tabacum*, *Lycopersicon esculantum*, *Datura alba* and *Solanum xanthocarpum* of Pakistan. They also showed the presence of palmitoleic acid (1.3%) in *Solanum xanthocarpum* seed oil. The palmitoleic and linolenic acids were not found in *Solanum khasianum* seed oil but the acids such as capric (0.1%), arachidic (0.5%) and behenic (0.5%) acids were

found to be present besides lauric, myristic, palmitic, stearic, oleic and linoleic acids.

The mineral composition of the ash (3.9%) of the seed meal is given in Table 3. The seeds of the plant are rich in sodium, potassium and iron. Zinc, lead, copper, cobalt and manganese were also detected in the ash. Saiyed *et al.* [11] studied the ash and mineral composition of the seeds of *S. xanthocarpum*. They reported the ash (5.9%) containing the minerals as potassium, sodium, magnesium and traces of iron, cadmium and cobalt. The mineral contents of the species of *Solanum* could be comparable as these have shown the similar profile of macro as well as micro nutrients.

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