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PHYTOCHEMICAL STUDIES ON *Schouwia thebaica* Webb.

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ABSTRACT

Schouwia thebaica, Webb. was collected from South Sinai at two localities ; the 1st one was at 10km west of Dahab city and the 2nd was at 25km north of Sharm El-Sheikh city. The preliminary phytochemical screening on *Schouwia thebaica* showed that it contains: tannins, sterols, flavonoids, carbohydrates and/or glycosides, traces of saponins, chlorides, sulphates and traces of resins.

Chromatographic investigations of sugars showed that it contained sucrose, glucose and galactose as soluble sugar in the two localities. It contained rhamnose, xylose, mannose, sucrose, fructose and glucose as polysaccharide in the two localities.

Analysis of free amino acids of *Schouwia thebaica* of the two habitats, using amino acid analyzer, revealed the presence of 13 free amino acids in Dahab samples and 11 free amino acids in Sharm El-Sheikh samples with different range of concentration. It was obvious from the obtained data that the concentrations of arginine and cysteine were the highest separated amino acids (0.245 and 0.21%) in Sharm El-Sheikh and Dahab habitats, respectively, while serine and glycine were the lowest (0.001% and 0.005%) in Dahab and Sharm El-Sheikh samples, respectively. Meanwhile aspartic acid and serine were detected only in Dahab. On other hand, amino acid analysis of protein using amino acid analyzer revealed also the presence of 17 amino acids in Dahab samples and 13 amino acids in Sharm El-Sheikh samples with different range of concentrations. Histidine was the highest one of the separated protein-amino acids (4.00% and 3.23%) in Dahab and Sharm El-Sheikh samples, respectively. Proline was present with relatively high concentration (2.78%) at Dahab samples than that of Sharm El-Sheikh samples (1.31%). The relatively high concentrations of proline in Dahab samples may be due to the increase of soil salinity in Dahab than that in Sharm El-Sheikh samples.

Lipids analysis of *Schouwia thebaica* showed that there were a low increases in the acid values of Sharm El-Sheikh samples related to that of Dahab samples. The increased in ester value of Sharm El-Sheikh samples indicated that the soluble fatty acids of *Schouwia thebaica* were lower than its estrefied fatty

acids. The saponification values of *Schouwia thebaica* were 158.65 and 168.25 for Dahab and Sharm El-Sheikh samples, respectively, which indicate that the main constituents of lipid were the long chain fatty acids C_{18} and C_{20}. The acid values in Dahab and Sharm El-Sheikh samples, have insignificant difference, while there were increasing of iodine and saponification values of Sharm El-Sheikh samples than that of Dahab samples. It is obvious from the obtained results of the G.L.C. analysis that there was a significant difference between the two habitats, where Dahab habitat contained 13 hydrocarbons and stigmasterol, while Sharm El-Sheikh contained 12 hydrocarbons and cholesterol.

The Gas-Liquid chromatographical analysis of *Schouwia thebaica* lipids revealed the presence of myristic, palmitic and stearic acids in Dahab plant samples, while Sharm El-Sheikh plant samples contained caprilic, capric, lauric, myristic and palmitic acids as saturated fatty acids, beside linoleic and arachidic acids as unsaturated fatty acids, which were present only in Dahab samples. The lipid analysis of Schouwia *thebaica* revealed the presence of long chain fatty acids, C_{16} and C_{18} especially in Sharm El-Sheikh, where palmitic acid was the major fatty acid in it (12.206%).

INTRODUCTION

Family *Cruciferae* (*Brassicaceae*) is one of the largest families. Many species of this family are used in folk medicine as herbal remedies (Rizk, 1986). Seeds of *Lepidium sativum* are used in dysentery diarrhea, skin diseases, diuretic and the plant is used in cases of asthma. Leaves of *Capsella bursa-pastoris* are used for all forms of bleeding from internal organs and used externally as a remedy for nose- bleeding. In Europe, it is considered as a remedy for malaria. Leaves and seeds of wild mustard (*Sisymbriumirio*) are used in medicine to cure respiratory disorders (Mossa *et al.*, 1987).

Evaluation of antimicrobial activity indicated that some seed oils of *Cruciferae* members have moderate antiseptic activity against-gram negative and positive bacteria as well as phytopathogenic (Akhtar *et al.*, 1986). Mustard oils have an inhibitory effect on the production of thyroid hormone (Trease and Evans, 1989).

Tylor (1965) reported that L-arabinose, D-xylose, D-glucuronic acid, D-galactose, L-rhamnose, D-galacturonic acid and 4-0-methyl-D-glucuronic acid were the main sugars of the cress seed (*Lepidium Sativum*) mucilage, D-glucose and D-mannose were the sugars of the dispersed fibrous material associated with polysaccharides. Abu Khalifa (1980) reported that the siliculae of *Anastatica hierochuntica* contained glucose, fructose, sucrose, rafinose and stachyose.

Abu Khalifa (1980) reported that 16 amino acids of different types, (e.g. alanine, arginine, aspartic acid, proline, phenylalanine, threonine and methionine) were detected in the globulin fraction of *Anastatica hierochunitea.* Taguchi and Kondo (1992) found that asparagine, glutamine, and γ-aminobutyric acid contents

were generally high in some species of the *Cruciferae* besides cucurbitine, S-Me-cysteine sufoxide and pipecolic acid.

Kumar and Tsunoda (1978) determined the oil content and fatty acid composition of 24 species seed samples of wild *Cruciferous* plants collected from natural population of west Mediterranean and adjacent area. They found large variations in oil content (6-48%) and oleic acid (5-31%), linoleic acid (2-24.8%), linolenic acid (1.7-64%) and erucic acid (0-55%). They also observed among the collected species that *Conringiac orrentalis* seeds had the highest concentration of linoleic acid (24.8%) and contained (28.8%) eicosenoic acid and (23.3%) erucic acid. *Nasturtium officinole* seeds had the lowest (1.7%) linolenic acid and highest (31.3%) oleic acid content and contained (22.7%) linoleic acid.

Dolya (1986) determined the fatty acids in seed oils of 14 species of *Cruciferae* characterized by intermediate levels of erucic acid. Total lipid content was ranged from 14.64% to 40.28% and each species contained 15-22 fatty acids. Erucic acid was lower in *Diplotaxis tenuifolia.* Akhtar *et al.* (1986) used GLC and various TLC techniques to investigate the fatty acids of some seed oils of *Descurania sophia*, *Allysum saxatile*, *Iberis amara* and *Erysimum perofskianum*. Myristic, palmitic, oleic, linoleic and linolenic acids were the major constituents. Abu Khalifa (1980) isolated the sterol fraction from *Anastatica hierochuntica*. It was composed mainly of β-sitosterol together with small amount of campesterol, cholesterol and stigmasterol. Agullo *et al.* (1987) stated that the sterol fractions were isolated from *Diplotaxis tenuifolia* composed mainly of sitosterol (72%) campesterol (26%) and cholesterol (0.1%).

The aim of the present study is to represent general chemical constituents of *Schouwia thebaica* as a wild plant, collected from two different localities in South Sinai. A survey of the available literature has revealed that *Schouwia thebaica* was not subjected to previous phytochemical studies and thus our investigation aimed to study the main biochemical constituents: carbohydrates, soluble and proteins amino acids and lipids.

MATERIALS AND METHODS

The upergound fresh plants of *Schouwia thebaica* Webb were collected seasonally, during the year (1997-98), from two localities; at 10 km west of Dahab City and 25 km north of Sharm el-Sheikh City, South Sinai. Plant material was cleaned, dried in an oven at 50°C for 48 hours and ground to fine powder, then used for the following investigations.

1. Preliminary Phytochemical Screening:

1-1. Water distillation for volatile oils:

About 50 g of fresh plant were subjected to water distillation according to Balbaa *et al.*, (1981) to extract volatile oil.

1-2. Method of preparing the extract for further screening:

About 50 g of air-dried plant powder were refluxed with 250 ml of 80% ethyl alcohol for 6 hours, then filtered. The residue powder was then washed several times with hot alcohol. The combined filtrates were concentrated under reduced pressure at 50 °C, then used in the following tests: -

Test for tannins was done using ferric chloride solution as described by Balbaa (1986).

Test for sterols and terpens was done using Libermann-Burchard's test according to Fieser and Fieser (1959) and Salkowski reaction's according to Brieskorn and Klinger-hand, (1961).

Test for flavonoids_was done as described by Shinoda (1928) and Wall *et al.* (1954).

Test for alkaloids_was done according to Woo *et al.* (1977) using Mayer's and Dragendorrf's reagent as described by Balbaa *et al.* (1986).

Test for carbohydrates and/or glycosides was done using Molish test as described by Balbaa *et al.* (1981).

Test for saponins was done as described by Wall *et al.* (1954) and Balbaa (1986).

Test for resins was done using copper acetate solution as described by Balbaa (1986).

Chlorides and sulphates were done using silver nitrate test for chlorides and barium chlorides test for sulphates according to A.O.A.C. (1970).

2. Carbohydrates:

2-1. Extraction of soluble sugars:

Twenty grams of the defatted plant powder were extracted with ethyl alcohol (80%), and filtered. The filtrate was clarified by Carrez reagent, filtered and the filtrate was evaporated. The residue was dissolved in 3ml of 10% aqueous isopropanol for chromatographic investigation (Chaplin and Kennedy, 1994).

2-2. Paper chromatography of the soluble sugars:

The isopropanol solution of the soluble sugars was examined chromatographically on Whatmann No.1 paper chromatography by the descending technique, using the solvent system n-butanol-acetic acid-water (4:1:5) along side with authentic sugars (Smith (1962) and Abou-Zeid *et al.* (1995)).

Spraying reagent: Aniline hydrogen phthalate as described by Partridge (1949).

2-3. Hydrolysis of Polysaccharides:

The polysaccharides were extracted from the defatted powder of 20 grams plant after removing the soluble sugars. The hydrolysis was carried out by cold method followed by hot method:

2-3-1. Cold extraction method: (Laidlow and Percival, 1949)

The plant powder was mixed with acidified distilled water (using HCl (pH = 4) then left for 12 hour at room temperature, then filtered and the process was repeated till complete extraction. The total filtrate was concentrated under reduced pressure at 40°C and the extracted polysaccharides were precipitated by slowly adding 95% ethanol.

2-3-2. Hot extraction method: (Laidlow and Percival, 1950)

The previously extracted plant powder by cold method was repeatedly extracted with hot boiling distilled water for 12hr. until complete extraction and the polysaccharides were precipitated by 95% ethanol.

2-4. Hydrolysis of polysaccharides: (Hirst and Jones, 1955).

The precipitates of cold and hot extraction were obtained, washed several times with ethanol (80%) to remove chloride ions, then the polysaccharides were stirred in acetone, filtered and dried in a vacuum desiccator. The total precipitate of polysaccharides were heated on a boiling water bath with 0.5 M H_2SO_4 in a sealed tube for 20hr., then the filtrate was soluble from sulphates ions by precipitated it using barium carbonate, filtered and its volume was completed to 100 ml with H_2O.

2-5. Paper chromatography of the hydrolyzed - Polysaccharides:

A few mg of the dried sugar hydrolyzate were dissolved in 10% aqueous isopropanol solution and applied on paper chromatography using the solvent system n-butanole:acetic acid:water (4:1:5) alongside with authentic sugars (Smith (1962) and Abou-Zeid *et al.* (1995)). Spraying reagent: Aniline hydrogen phthalate (Partridge, 1949).

3. Free and protein-amino acids:

3-1. Preparation of the free amino acids:

Ten gm of defatted air-dried plant powder were refluxed with 50 ml of 70% ethyl alcohol at 100 °C for 30 minutes. The resulting mixture was cooled, filtered and concentrated then passed through a column of purified cation exchange resin. Elution was carried out with 70% ethyl alcohol to take all the carbohydrate present, then with 2% HCl for elution of amino acids. The same steps were repeated again using 2% ammonia instead of HCl to complete elution of amino acids. Each of the acidic and alkaline eluents was concentrated separately to a small volume by evaporation under vacuum at 45°C. The collected solutions were adjusted to pH 5-7, concentrated to a small volume and kept for chromatographic investigation of amino acids.

3-2. Identification of free amino acids using amino acid analyzer:

Free amino acids were determined according to Anderson *et al.* (1977) and Pellet and Young (1980).

3-3. Identification of protein-amino acids using amino acid analyzer:

Defatted plant powder (1 g) was hydrolyzed by 10 ml of 6 N HCl in a sealed test tube, hydrolyzed at 110°C for 24 hours, filtered and amino acids were obtained by evaporation of the hydrolyzate till dryness. The residue was washed with pure methanol, filtered and the volume of the filtrate was adjusted to 100 ml using distilled water. Amino acids of protein were identified as that of free amino acids according to Anderson *et al.* (1977) and Pellet & Young (1980).

4. Lipids:

One hundred grams of the powdered plant were extracted with petroleum ether (b.p.40-60%) : ether (1:1) for 24 hours using soxhlet apparatus. The lipids were obtained by distilling off the solvent. The last traces of the solvent were removed by heating the liquid sample in a vacuum oven at 50°C to constant weight

4.1. Physical properties of lipids:

The lipid fractions were studied physically with regard to its odour, color and physical nature. Their solubility in petroleum ether, diethyl ether, benzene, chloroform, acetone, carbon tetrachloride and warm alcohol were tested.

4-2. Fundamental chemical properties:

Acid value (A.V.), saponification value (S.V.) and ester value (E.V.) were estimated according to British Pharmacopaea (B.P.) (1980), while iodine value (I.V.) was determined according to Mohamed and Amer (1965).

4-3. Chromatographic investigation of lipids content:

4-3- 1. Extraction of the fat sample: (Christie, 1982)

The lipids of the plant were extracted according to Christie (1982) using chloroform: methanol (1:2), saponified for 1 hour, cooled and then extracted by diethyl ether. The ether extract was washed several times with water, dried over anhydrous Na_2SO_4. The non-saponifiable matters (hydrocarbons and sterols) were obtained by removal of ether solvent in a rotary evaporator. The washing water was added to the aqueous layer, which were acidified with 6N HCl and extracted with diethyl ether. The saponifiable matters containing the free and combined fatty acids were obtained after washing the extract with water. They were dried over anhydrous Na_2SO_4 and the solvent was removed using the rotary evaporator.

4-3- 2. Identification of fatty acids:

Methylation of fatty acids was carried out by trimethyl silylation reagent. The fatty acid methyl ester was then subjected to gas-liquid chromatographic (GLC) analysis.

4-3-3. Identification of unsaponifiable matter:

The hydrocarbons and sterols compounds were identified by using gas-liquid chromatographic (GLC) analysis.

RESULTS AND DISCUSSIONS

1. Preliminary phytochemical screening of *Schouwia thebaica*:

The preliminary phytochemical screening on *Schouwia thebaica*, collected from the two studied habitats, showed that *Schouwia thebaica* contains: tannins, sterols, flavonoids, carbohydrates and/or glycosides, chlorides and sulphates, beside traces of saponins, and resins. The volatile oils and alkaloids were not detected. (Table 1).

2. Investigation of carbohydrates:

2. 1. Soluble sugars:

The obtained results of the soluble sugar extract of *Schouwia thebaica* using comparative paper chromatography and the solvent system of n-butanol - acetic acid - water (4: 1: 5) showed that it contained sucrose, glucose and galactose as soluble sugar in the two localities. (Table 2)

2. 2. Polysaccharides:

The obtained results of the hydrolyzed polysaccharides extract of *Schouwia thebaica* using comparative paper chromatography by solvent system of n-butanol - acetic acid - water (4: 1: 5) showed that it contained glucose, fructose, sucrose, mannose, xylose and rhamnose as polysaccharides in the two localities. (Table 2).

Table (1): Preliminary phytochemical screening of *Schouwia thebaica*

Test	Results	Test	Results
Volatile oils	(-) ve	Saponins	Traces
Tannins	(+)ve	Chlorides	(+)ve
Sterols	(+)ve	Sulphate	(+)ve
Flavonoids	(+)ve	Resins	Traces
Alkaloids	(-) ve		
Carbohydrates and/or glycosides	(+)ve		

(-) ve = negative (+)ve = positive

Table (2): Soluble sugar and polysaccharides of *Schouwia thebaica* at Dahab and Sharm El-Sheikh habitaes.

Sugar	Soluble sugar	Polysaccharides	$R_f \times 100$	Color reaction
Galactose	(+)ve	(-)ve	14	Brown
Glucose	(+)ve	(+)ve	15	Brown
Fructose	(-)ve	(+)ve	17	Yellow brown
Sucrose	(+)ve	(+)ve	18	Brown
Mannose	(-)ve	(+)ve	19	Brown
Xylose	(–)ve	(+)ve	20	Red brown
Rhamnose	(–)ve	(+)ve	31	Yellow-brown

(-) ve = negative (+)ve = positive

2. 3. Investigations of free and protein amino acids:

2. 3. 1. Free amino acids:

The free amino acids of *Schouwia thebaica* at the two habitats were investigated using amino acid analyzer. The data present in (Table 3) revealed that *Schouwia thebaica* contained 13 free amino acids in Dahab plant samples and 11 free amino acids in Sharm El-Sheikh plant samples with different ranges of concentrations. It was observed that *Schouwia thebaica* contained no proline in the two habitats. It was obvious from (Table 3) that the concentrations of arginine and cysteine were the highest separated amino acids in Sharm El-Sheikh and Dahab habitats, while serine and glycine were the lowest in Dahab and Sharm El-Sheikh samples, both respectively. Meanwhile aspartic acid and serine were detected only in Dahab.

2.3. 2. Protein amino acid:

The protein-amino acids were investigated using amino acid analyzer, which revealed that *Schouwia thebaica* contained 17 amino acids in Dahab samples and 13 amino acids in Sharm El-Sheikh samples with different range of concentrations (Table 3). It is obvious that histidine was the highest one of the separated amino acids, which was (4.00% and 3.23%) in Dahab and Sharm El-Sheikh samples, respectively, while proline was present with relatively higher concentration (2.78%) in Dahab samples than that of Sharm El-Sheikh samples (1.31%). The relatively higher concentrations of proline in Dahab samples may be due to the increase in the soil salinity in Dahab than that in Sharm El-Sheikh samples, Ali and Sawaf (1992) reported that, salinity could inhibit the transmission reactions and hence glutamic acid is accumulated and then transformed to other nitrogenous compounds such as proline.

4. Investigation of lipids:

4. 1. Physical properties:

The obtained lipid was yellowish green in colour, semi-solid, having a faint odour and disagreeable taste. It was soluble in benzene, petroleum ether, diethyl ether, chloroform, acetone, warm methyl and ethyl alcohol.

4. 2. Fundamental chemical properties:

The fundamental chemical properties of the extracted lipid of *Schouwia thebaica* collected from the two habitats have been presented in (Table 4), where there was low increase in acid values of Sharm El-Sheikh samples than that of Dahab samples (20.19 and 19.99, respectively) and increase in ester value in Sharm El-Sheikh samples than that of Dahab ones (148.06 and 138.66, respectively), which indicate that the soluble fatty acids were less than ester fatty acids.

Saponification values of *Schouwia thebaica* were 158.65 and 168.25 in Dahab and Sharm El-Sheikh samples, respectively, which showed that the main constituents of lipids were long chain fatty acids having C_{20}, C_{18} and C_{16}. The result can be confirmed by the saponification value of rape seed oil which its main constituents was C_{18} and its saponification value, which ranged between 170

and 180 (Farag, 1995). This was confirmed by GLC analysis of *Schouwia thebaica* fatty acids.

Table (3): Free and protein amino acids of *Schouwia thebaica* at the two studied habitats.

Amino acid	Relative % of free amino acid		Relative % of protein amino acid	
	Dahab	Sharm El-Sheikh	Dahab	Sharm El-Sheikh
Aspartic acid	0.010	-	0.48	-
Threonine	0.080	0.130	0.22	0.14
Serine	0.001	---	0.21	0.02
Glutamic acid	0.050	0.050	0.70	0.06
Proline	-	-	2.87	1.31
Glycine	0.007	0.005	0.10	1.16
Alanine	-	-	0.19	-
Cysteine	0.210	0.210	0.22	0.63
Valine	-	-	0.21	-
Methionine	-----	-	0.05	-
Isoleucine	0.026	0.018	0.17	0.04
Leucine	0.010	0.008	0.38	0.07
Tyrosine	0.014	0.064	0.02	0.07
Phenylalanine	0.070	0.147	0.72	0.15
Histidine	0.181	0.038	4.00	3.23
Lysine	0.011	0.012	0.30	1.10
Arginine	0.100	0.245	0.13	0.250

Table (4) showed that the acid values in Dahab and Sharm El-Sheikh samples, have no significant difference, while there were an increase in the iodine and saponification values of Sharm El-Sheikh samples than that of Dahab samples.

Table (4): Acid, iodine, ester and saponification values of lipids extracted from *Schouwia thebaica* at the two studied habitats.

Item	Dahab	Sh. She.	Item	Dahab	Sh. She.
Acid value	19.19	20.19	Ester value	138.66	148.06
Iodine value	86.91	91.77	Saponification value	158.65	168.25

Sh. She. = Sharm El- Sheikh

4. 3. Investigation of unsaponifiable lipids:

The GLC analysis of the unsaponifiable fraction of *Schouwia thebaica* lipids showed that there was significant difference between the two habitats, where Dahab habitat contained 13 hydrocarbons and stigmasterol, while Sharm El-Sheikh contained 12 hydrocarbons and cholesterol as shown in Table (5).

4. 4. Investigation of saponifiable fraction of lipid:

The gas-liquid chromatographical analysis of *Schouwia thebaica* lipids revealed the presence of myristic, palmitic and stearic acids in Dahab plant samples, while Sharm El-Sheikh plant samples contained caprilic, capric, lauric, myristic and palmitic acids as saturated fatty acids, beside linoleic acid in Sharm El Sheikh and arachidic acid in Dahab samples as unsaturated fatty acids. (Table 6).

The illustrated data in Table 6 of the lipids analysis of Schouwia *thebaica* revealed the presence of long chain fatty acids, C_{16} and C_{18} especially in Sharm El-Sheikh, where palmitic acid was the major fatty acid in level of 12.206% (Table 6).

Table (5): Hydrocarbons and sterols of *Schouwia thebaica* at the two studied habitats as detected by relative percentage by GLC.

Hydrocarbons and sterols	RT (Mins)	No. of carbon atom	Relative %	
			Dahab	Sharm El-Sheikh
Dodecane	2.333	12	0.060	0.128
Tetradecane	3.300	13	—	0.034
Hexadecane	4.417	16	0.241	0.399
Heptadecane	5.620	17	0.030	0.038
Octadecane	6.767	18	0.059	0.172
Nonadecane	7.917	19	0.099	0.137
Eicosane	9.983	20	0.052	0.461
Heneicosane	10.933	21	0.257	—
Docosane	11.883	22	0.135	0.700
Tricosane	12.783	23	0.226	0.183
Tetracosane	14.500	24	0.435	0.410
Hexacosane	16.083	26	0.079	—
Octacosane	17.583	28	0.263	—
Squalene	18.533	29	0.223	4.361
Dotriocontane	20.350	32	—	0.012
Cholesterol	21.633	27	—	0.053
Stigmasterol	23.033	27	1.958	—

Table (6): GLC of fatty acids of *Schouwia thebaica* collected from the two studied habitats

Fatty acid	RT (Mins)	No. of carbon Atom	Relative %	
			Dahab	Sharm El-Sheikh
Caprilic acid	3.767	8:0	—	0.073
Capric acid	6.283	10:0	—	0.109
Lauric acid	8.883	12:0	—	0.058
Myristic acid	11.367	14:0	0.836	9.128
Palmitic acid	13.650	16:0	7.145	12.206
Stearic acid	15.867	18:0	4.818	—
Linoleic acid	16.933	18:2	—	36.837
Arachidic acid	19.167	20:2	27.234	—

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دراسات فيتوكيميائيه علي نبات مهد أو أم درهام (الشويا ثيباكا)

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تضم العائلة الصليبيه كثيرا من النباتات ذات الأهمية الاقتصاديـــة والطبيـــة ولذلك فقد تم إختيار نبات مهد أو أم درهام (الشويا ثيباكا) أحد أنواع هذه العائلة لدراسة مكونات النبات الكيميائيه من سكريات وبروتينات ودهنيات وتحليلها لموادهـــا الأوليـــه وإستخلاصها والتعرف عليها وصفيا وتقديرها كميا.

وقد إشتمل البحث علي مسح كيميائي أولي للنبات إتضـــح منـــها أن النبـــات يحتوى على تانينات واستيرولات وفلافونيدات و سكريات و/أو جليكوسيدات وكبريتات وكلوريدات بالإضافة إلى نسبة ضئيله من الصابونين والراتنج.

و قد تم من خلال هذه الدراسة:

لتعرف على أن نبات الشويا ثيباكا يحتوى على السكريات الذائبـــة ســـكروز وجلوكوز وجالاكتوز والسكريات المرتبطة رامنوز وزيلوز ومانوز وسكروز وجلوكوز فى كلا منطقتى الدراسة.

بإستعمال جهاز تحليل الأحماض الأمينيه تم التعرف على وجود ١٣ حمـــض أمينى حر بمنطقة دهب و ١١ أحماض أمينيه حرة بمنطقة شرم الشيخ بنسب مختلفـــة، وكان أعلاها نسبة فى التواجد فى كلا منطقتى الدراسة هو الحمض الأمينـــى سيســـتين (٠,٢١%) وأقلها نسبة هو السيرين بنسبة (٠,٠٠١) فى منطقة دهب والجليسين بنســـبة (٠,٠٠٥) فى منطقة شرم الشيخ.

وبالنسبة للأحماض الأمينية الداخلة فى تركيب البروتين فقد أوضحت النتـــائج أن النبات يحتوى ١٧ حمض أمينى بمنطقة دهب و ١٣ حمض أمينى بمنطقـــة شـــرم

الشيخ بنسب مختلفة، كان أعلاها الهستدين بنسبة ٤,٠٠ و ٣,٢٣% بمنطقتى دهب وشرم الشيخ على التوالى. ببنما تواجد البرولين بنسبة عاليه (٢,٧٨%) ببروتين النبات بمنطقة دهب عنها بمنطقة شرم الشيخ (١,٣١%)، مما يوضح أن منطقة أعلى فى نسبة ملوحة التربة عنها بشرم الشيخ حيث أن زيادة نسب البرولين بالنبات تساعد على مقاومة الملوحة.

تم دراسة محتوى النبات من الدهون مع دراسة خواصها الطبيعية والكيميائية وتقدير الاستيرولات والمركبات الهيدروكربونية والأحماض الدهنية المشبعة وغير المشبعة ونسبها فى النبات باستعمال طرق تحليل الكروماتوجرافى الغازى وقد أوضحت النتائج أنها لا تختلف كثيرا من حيث الصفات فى كلا المنطقتين، بينما لوحظ نقص فى رقم الحموضه والرقم اليودى ورقم التصبن للدهن فى منطقة دهب عنها بشرم الشيخ.

تم تقدير نسبة المواد الغير متصبنه وفصل مكوناتها، حيث إتضح وجود ١٣ مركب هيدروكربون و ستيجماستيرول بمنطقة دهب بينما إحتوت دهنيات النبات بمنطقة شرم الشيخ على ١٢ مركب هيدروكربون و كوليستيرول ، وبتقدير الأحماض الدهنيه بالنبات إتضح تواجد ثلاثة أحماض دهنية مشبعة بمنطقة دهب هى مريستيك وبالميتيك وستيريك. بينما أثبت تواجد خمسة أحماض دهنية مشبعة هى كابريليك وكابريك ولوريك ومريستيك وبالميتيك، بالإضافة لحمضين غير مشبعين هما لينولييك وأراشيديك بمنطقة شرم الشيخ ودهب على التوالى.