

Review on Medicinal benefits of London Rocket or SisymbriumIrio in different contextual aspects

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ABSTRACT

Several studies done throughout the world on ‘SisymbriumIrio L’, also known as ‘London Rocket’ or ‘Khakshi’ has established that this annual herb is of tremendous medicinal benefits. This review paper will focus on researches done using samples collected at widespread geographical range such as Jordan, Saudi Arabia, Kashmir, Rawalpindi, Lahore, Rajasthan, UK, Europe, Mediterranean Islands, North America and Caucasias among others. Further we will study about various phytochemicals produced by aerial parts, seeds and other parts of SisymbriumIrio L and their clinical uses which were discovered experimentally. Such as alkaloids of aerial parts for ‘Liver Disease’; flavonoids, steroids and alkaloids in seeds as expectorant and stimulant for ‘Clinical Asthma’; histamine aerosol for protection against ‘Bronchospasm’; ethyl acetate, aqueous extracts and butanol from other parts as potential ‘Nutraceutical Antioxidant’. Apart from these there is presence of various secondary metabolites such as flavonoids, triterpenoids or steroids, saponins, alkaloids, carbohydrates and tannins and absence of Anthraquinones and cardiac glycosides which were found to be of ‘Chemotherapeutic Interest’. Hence we will analyze the overall effects of various phytochemicals produced from different parts of SisymbriumIrio L and further study the possibility to use this plant as potential replacement various commercially used Antibiotics.

1. Introduction

In modern therapeutic system Antibiotics play significant role in controlling various diseases, mainly infectious ones. Antibiotics are widely available as well as popular tool for fighting with various physiological problem (Finland, 1978, Caldenwood et al., 1980). However growing popularity and careless use of such medications has led to advent of ‘drug resistance’

phenomenon. Also many antifungal and antibacterial agents are found to exhibit serious detrimental effects on host tissues leading to the toxicity in human system (Marr, 1982; Bolard et al., 1986). Due to these untoward effects these medicines need a suitable replacement.

There is a long history of 'Plant based therapies' in treating various ailments. This kind of therapies is comparatively harmless. Due to which modern researchers are all attracted to natural products for the purpose of treating various challenging diseases. There are some chemical components which produce a specific physiological action on human body that defines the actual medicinal value of plants. Some of these components are phenolic compound, tannin, flavonoids and alkaloids. There are several reports on plants used in traditional healing in tribal areas by indigenous communities. (Threlfall EJ et al., 1998).

Various researchers have found family 'Cruciferae' also known as Brassicaceae of many applications in both commercial as well as pharmaceutical aspects w.r.t important sources of oil or food products (Migahid et al., 1996). It has also found its application in folk medicine (AL-Mazroa et al., 2015). One of the cruciferae members named *Sisymbrium* is used in treatment of rheumatoid, voice disorder inflammation etc. (AL-Jaber et al., 2011). Few members also showed anti-microbial, antioxidant, analgesic and antipyretic activities. Researches done throughout the world revealed that this particular genus is characterized by presence of various metabolites such as, steroid, oil, anthraquinone, alkaloid and flavonoid (Bulus et al., 1983).

2. OVERVIEW

Unani Medicine or 'Unani Tibb' is basically a form of traditional medicine practiced in South-Asian and Middle-East countries. It refers to a tradition of Graeco-Arabic medicine, which is based on the teachings of Roman physician Galen and Greek physician Hippocrates and was further developed into a full-fledged medical system in middle age era by Persian and Arabian physicians, such as Ibn Nafis, Al-Zahrawi, Rhazes or al-Razi, and Avicenna or Ibn-e-Sina.

Sisymbrium L (Khakshi or London) is found in various parts of the world such as western Pakistan, Middle East, Saudi Arabia, Caucasia, North America, Europe, Mediterranean island and United Kingdom (Heneidy et al., 2004). In India it is found to exist in Delhi area, Northern Rajasthan, Siwalik range in Punjab, Jammu & Kashmir, Western Uttar Pradesh and Lucknow (Khoshoo et al., 1996). Available literature revealed that leaves and seeds are used as antipyretic, analgesic, antibacterial, febrifuge, in fevers and expectorant in asthma (Ghazanfar et al., 1994). These findings were advent while dealing with isolation of flavonoid and β -sitosterol derivative (AL-Gendy et al., 2004), (Gehan et al., 2009). This plant is a rich source of glucosinolates (Cole et al., 1976), (Griffiths et al., 2001) and flavonoids (Del-Pero-De et al., 1982), (Kahan et al., 1991). It can be used in salads and has sharp flavour. In folk medicine *S. Irio* L is used for infection of chest and throat, treating asthma, as a febrifuge and a stimulating poultice, (Muhammad et al., 2000), liver detoxification, reducing swelling, cleaning wounds, chest congestion, treatment of coughs and rheumatism (Lev F et al., 2003).

3. Uses of sisymbriumIrio in Unani Therapy

Sisymbriumirio Linn of the family 'Brassicaceae' is being used in Unani Medicine since long time as antipyretic-aphrodisiac-expectorant-analgesic-antimicrobial in fever, gastric ulcer,cough, pulmonary and urinary tract infections, skin disorders and liver complaints etc. Its widely mentioned that all the all of the parts are very much useful in traditional medicine but amongst all parts of Sisymbriumirio such as: stem, flowers, seeds, aerial parts & leaves contains several phytochemicals such as 'tannin', 'alkaloids', 'flavonoids', 'saponins', 'glycosides', 'carbohydrates', 'phenolics', 'amino acids', 'proteins', 'steroids', 'fatty acids' responsible for various pharmacological actions such as antifungal, antimicrobial, pimples, cough, hepatoprotective, anticancer, anti-inflammatory, diuretic, antidepressant, bronchoprotective role, phytotoxic, expectorant, cytotoxic, voice disorders, rheumatoid, antipyretic, analgesic, febrifuge, detoxify liver & spleen, stomachic treatmentsand boils. For the identification of the natural template for safer drug designing and discovery there is the necessity for qualitative screening with scientific approach.

4. Compositional study

Ma. Al-Qudah et al., in 2010 extracted and worked upon the essential oils found in SisymbriumIrio and detailed their composition and percentage of existence. The components of oil was analysed by Gas chromatography and mass spectrometry. Experimentations elaborated that oil contained fifty three components in total as mentioned in table 1

No.	Compound	Retention time, min	Percentage
1	Dotriacontane	118.70	0.06
2	Octadecanal	117.23	1.10
3	Squalene	116.71	0.99
4	Heptacosane	111.26	3.89
5	Nonacosane	107.51	0.33
6	Docasanoic	106.38	0.60
7	1-Hexacosene	105.87	0.40

8	Octacosane	103.78	1.25
9	Dioctyladipate	100.00	25.44
10	Eicosanoic acid	98.57	0.15
11	Docasane	95.86	0.36
12	Stearic acid	90.21	2.07
13	12-Methyl- <i>E,E</i> - 2,13-octadecadien-1-ol	89.39	2.04
14	<i>cis</i> -8,11,14-Eicosatrienoic acid	89.16	6.30
15	Palmitic acid	81.34	3.45
16	Oleic acid	76.56	0.67
17	1-Eicosanol	75.35	0.39
18	3,7,11,15-Tetramethyl-2-hexadecen-1-ol	74.96	6.52
19	2,3,6-Trimethyl-1,4-naphthalenenedione	70.25	Trace
20	2-(2-Methylpropylidene)-1 <i>H</i> -indene-1,3(2 <i>H</i>)-dione	70.23	0.08
21	13-Heptadecyn-1-ol	68.49	0.06
22	Methoxyeugenol	67.71	Trace
23	4-(2,4,4-trimethyl-cyclohexa-1,5-dienyl)but-3-en-2-one	63.31	0.05
24	Tetrahydrospirilloxanthin	62.60	Trace
25	5-Isopropenyl-2-methylcyclopent-1-enecarboxaaldehyde	62.16	0.16
26	1,2-Dipalmitate glycerol	61.84	0.07

27	Deoxysericealacone	61.76	Trace
28	1,2,3b,6,7,8,-Hexahdro-6,6-dimethyl cyclopenta[1,3]cyclopropa[1,2]cyclohepten- 3(3 <i>H</i>)-one	60.75	Trace
29	8-Isopropyl-1,2,3,7-tetramethylbicyclo[5,1,0] octa-5-en-2-one	60.80	0.11
30	3_,5_-Dimethoxyacetophenone	60.20	2.54
31	Isovanillin	49.88	0.13
32	3-Methyl indole	48.98	0.05
33	<i>o</i> -Benzyl- <i>L</i> -serine	47.69	0.06
34	1,1,6-Trimethyl-1,2,3,4-tetrahydronaphthalene	47.13	0.11
35	1,1,6-Trimethyl-1,2-dihydronaphthalene	46.85	Trace
36	1,5,8-Trimethyl-1,2-dihydronaphthalene	46.84	Trace
37	Nicotine	46.40	0.06
38	<i>p</i> -Vinylguaiaicol	44.47	0.78
39	Indole	43.06	0.22
40	<i>p</i> -Anisaldehyde	40.35	0.08
41	trans- α -Bisabolene epoxide	30.39	0.05
42	4-(2,5-Dihydro-3-methoxy phenyl)butylamine	30.37	Trace
43	Nonanal	29.79	0.07
44	β -Terpinyl acetate	23.56	0.12

45	3E-Hexenoic acid	22.80	0.05
46	Tetra acetyl- <i>d</i> -xylonic nitrile	20.87	Trace
47	<i>n</i> - Butyl isothiocyanate	15.69	2.85
48	Dimethyl sulphone	14.92	0.10
49	3-Hexen-1-ol	10.11	Trace
50	2E-Hexenal	9.65	Trace
51	Isopropyl isothiocyanate	8.34	11.55
52	Isobutyl isothiocyanate	8.76	6.75
53	<i>N</i> -(<i>n</i> -propyl)acetamide	8.50	14.77

Table 1. Percentage and Composition of the essential oil extracted from *SisymbriumIrio*.

Analysis of essential oil extracted from *SisymbriumIrio*

These 53 components represented about 97.5% of the total oil. Further it was found that 38.80 % was consisting of two Easters and seven acids, 36.41% of eleven nitrogen and sulphur containing compounds, 15 terpenoids consist of about 8.2 %, 6.3% of aliphatic hydrocarbons. 3.53% of aromatic compound, 2.5% of fatty acids and 1.17% of other components.

5. Phytochemical Analysis of *SisymbriumIrio*

The phytochemical screening of different extracts showed the presence of variety of important constituents such as carbohydrates, triterpenoids or steroids, alkaloids, saponins, flavonoids and tannins at different levels in different parts of *SisymbriumIrio* and the absence of anthraquinones and cardiac glycosides as shown in Table 2 [Al- Mazroa et al.,2015; Al-Gendy et al.,2008; Khalil et al.,2017; Khalil et al.,2015; Khalil et al.,2016; Samy et al.,2015 Al-Jaber NA et al.,2011]

Plant organ		Triterpenoids / steroids	Alkaloids	Flavonoids	Tannins	Carbohydrates	Cardiac glycosides	Anthraquinones	Saponins
Stems	AQ	A	A	P	P	P	A	A	A
	BT	P	P	P	P	P	A	A	P
	CH	P	P	P	A	A	A	A	P
	EA	P	P	P	P	P	A	A	P
	nH	P	A	A	A	A	A	A	P
Roots	AQ	A	A	P	P	P	A	A	A
	BT	P	P	P	P	P	A	A	P
	CH	P	P	P	A	A	A	A	P
	EA	P	P	P	P	P	A	A	P
	nH	P	A	A	A	A	A	A	P
Leaves	AQ	A	A	P	P	P	A	A	A
	BT	P	P	P	P	P	A	A	P
	CH	P	P	P	A	A	A	A	P
	EA	P	P	P	P	P	A	A	P
	nH	P	A	A	A	A	A	A	P
flowers	AQ	A	A	P	P	P	A	A	A
	BT	P	P	P	P	P	A	A	P
	CH	P	P	P	A	A	A	A	P
	EA	P	P	P	P	P	A	A	P
	Nh	P	A	A	A	A	A	A	P

Table2: Phytochemical screening w.r.t different fractions of major parts of SisymbriumIrio.

(Where specifications are as follows: AQ, Aqueous; BT, Butanol; EA, Ethyl acetate; CH, chloroform ; nH, n-Hexane.

‘A’ stands for Absence of a particular constituent whereas ‘P’ stands for Presence of a particular constituent.)

Study by above studies revealed that Sisymbriumirio L is characterized phytochemically by its contents of various chemical constituents as well as various parts extracts exhibited good

antioxidant activities majorly aqueous fractions, butanol and ethyl acetate that attributes its higher contents of flavonoid and phenolic constituents. Hence above studies demonstrated the importance of leaves and stems when compared to flowers and roots. Studies identifies higher antioxidant activity therefore will a good source of herbal remedy[Hany et al., 2017].

However according to researches done by Del Pero, De martinz in 1982, Griffiths, Deighton & Nicholas in 2001, 'flavonoids' were found to be prominent in *Sisymbrium Irio*. 'Glucosinolate' was proved to be present by the works of Cole in 1976. During previous studies on this plant isolation of quercetin, isorhamnetin, sitosteryl-D-glucoside and sitosterol was done by kahan, kalim & kahan were performed in 1991.

For the first time 10 flavonoids were isolated from the *Sisymbrium Irio* L from aerial parts during the research in Saudia Arabia. Chromatographic methods were used and the identification was done as luteolin-7-O-glucoside, apigenin, apigenin-7-O-b- D -glucoside, apigenin-7-di-glucoside 5, apigenin-7-O-(6 00 acetyl) glucoside, apigenin- 7-galactoside , apigenin 7 - O gluco 600-1 000 rhamnoside, apigenin-7-O-gluco (6 00 -1 000) rhamnoside 5 methoxide, kampferol-3-xyloside-7-galactoside and kampferol .

Khan et al. in 1991, Itziar et al in 1982 and Rizk et al., in 1986 in their respective studies found that this genus contained flavonoids [Lockwood and Fsharypuor, 1986] , anthraquinones , alkaloids, [Arayno and Zafor, 1983], oils, steroids [Soulier, 1994] and glycosides [Krets et al in 1987].

Three flavonoids and two sitosterols were isolated from aerial parts of *Sisymbrium Irio* L and seeds

[Khan et al in 1991]. It was reported that *Sisymbrium Irio* L. could be used for dietary purposes. Due to the amount and diversity of protein (35%) and nutrients content [Guil et al in 1998]. The ethanol extract from the seeds of *Sisymbrium Irio* L. exhibited significant antipyretic and analgesic activities in addition to marked antibacterial action with no effect against fungi. Preliminary phytochemical screening of the plant revealed the presence of carbohydrates or glycosides, sterols and/or triterpenes, proteins and/or amino acids, coumarines, tannins, flavonoids, alkaloids and/or nitrogenous bases and saponins. *Sisymbrium* contains several classes of secondary metabolites such as flavonoids, alkaloids, anthraquinones, steroids and fatty acids [Al-Jaber, 2011; Al-Qudah and Abu Zarga, 2010; Vohora et al in 1980]. It is well known that main volatile constituents of Brassicaceae plants, including genus *Sisymbrium*, are glucosinolate degradation products, mostly isothiocyanates (ITC) and nitriles, obtained by enzymatic and thermal degradation of glucosinolates. The plant is edible and rich in medicinally important bioactive metabolites e.g. flavonoids, phytosterols and unsaturated fatty acids. These facts make it highly nutritious component to integrate more frequently in our meals and also to be used in the production of health-promoting supplements.

6. Therapeutic Applications of *Sisymbrium Irio*

Guil et al., in 2003 reported that *SisymbriumIrio* can be used for the treatment of rheumatism and inflammation. It has antioxidant, antimicrobial as well as antipyretic potential (guil J et al., 1998) few other medical application and benefits found by various researches throughout the world are mentioned as below.

Parts of <i>SisymbriumIrio</i>	Benefits	Studies
1. Seeds (shows insecticidal phytotoxic and cytotoxic activities according to Singh RK et al., 2015 & 16)	Treatment of voice disorders	Meyer B et al., 1982
	Expectorant and febrifuge	Ghazaufer S et al., 1994
	Treatment of rheumatoid and inflammation	Bolus L et al., 1983
	Fewer, painkilling, antibacterial & antifungal activities	Verses et al., 1980
	Escharotic extracts showed anti-inflammatory activity, broncho protector role, swimstress immobility and antidepressant role	Sing RK 2016 AL Mujalli et al., 2013
2. Aerial parts	Chest congestion, detoxification of liver and Spleen, reduction of swelling and wound cleaning	Rollem R et al., 1997
	Treatment of voice disorders, expectorant	Schulz O et al., 1936
	Inflammation and rheumatoid	Care T et al., 2017

	Antibiotic uses	Sumairash et al., 2013
3. Seeds	Treating disease caused by bacterial strains	Shabnam B et al., 2015
4. Leaves	Inhibiting growth of microbial strains such as styphloeccusepidermidis and klebsiellapneumonia	Gamal M et al., 2017
	Consumed as food and folk medicine for infection of throat and chest	AL- Juber et al., 2011

Temesgen H et al., 2019 mentioned that the preexisting folk knowledge necessitates a scientific approach for a qualitative screening of plant (*SisymbriumIrio* L.) for identification of natural template for safer drug discovery as well as drug designing . They also found out that there are various phytochemicals present in different part of the plant which needs further biological and phytochemical investigation for developing novel drug molecules and discovering other therapeutic uses. Their reasoning was based on the fact that this plant is already used in Unani Medicine System for various therapeutic uses. It is recommended for the preservation of Dengue Fever as well due to presence of several bioactive compounds.

7. Conclusion

In this review paper we came across the presence of various secondary metabolites such as flavonoids, triterpenoids or steroids, saponins, alkaloids, carbohydrates and tannins and absence of Anthraquinones and cardiac glycosides which are found to be of ‘Chemotherapeutic Interest’ .We furtheranalysed the overall effects of various phytochemicals produced from different parts

of *Sisymbrium* L and further studied. Presence of various phytochemicals in different part of the plant needs further biological and phytochemical investigation for developing novel drug molecules and discovering other therapeutic uses.

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