Sisymbrium irio L.: A Herb used in the Unani system of medicine for broad spectrum therapeutical applications

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Medicinal herbal plants constitute effective sources of natural products consumed as phytomedicines and the products obtained from medicinal plants have been playing a significant role in drug discovery efforts for treatment of animals and human diseases. Sisymbrium irio is one of the class of Cruicerae family used in Unani medicine. The plant is known for its value in traditional medicine. The various parts of Sisymbrium irio such as, flowers, leaves, stem, seeds and aerial parts contain different types of phytochemicals such as tannin, alkaloids, flavonoids, saponins, glycosides, carbohydrates, phenolics, amino acids, proteins, steroids, fatty acids that are responsible for pharmacological actions such as antimicrobial, antifungal, anticancer, antiinflammatory, antidepressant, rheumatoid, antipyretic, analgesic, detoxify liver and spleen, bronchoprotective role, voice disorders, cytotoxic, phytotoxic, diuretic, expectorant, febrifuge, boils, pimples, cough, hepatoprotective and stomatich treatments. The different solvent extracts of the plant parts such as leaves, stem, seeds and flowers exhibited a higher antioxidants activity which could be attributed to its higher contents of phenolics and flavonoids constituents. This preexisting knowledge necessitates a qualitative screening of the plant with scientific approach to identify natural template for safer drug discovery and designing.

Keywords: Cruciferae, Phytochemicals, Phytomedicine, Sisymbrium irio, Unani medicines

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Drugs derived from plants have great interest due to diverse applications in Unani medicine. The medicinal herbal plant materials are the basis for synthetic drugs, modern medicines, pharmaceuticals, food supplements, and folk medicines1. The discovery of new drugs is attained through natural compounds and their products, followed by other synthetic drugs. This situation runs in the direction of improved international quest for natural medicine, leading to the phytochemical investigation of plants in diverse ecological environments for their various medicinal properties2. These medicinal herbal plant materials are used to treat different types of human and animal diseases because they contain different types of secondary metabolites or pharmacologically bioactive components belonging to different classes of compounds such as tannins, saponin, flavonoids, alkaloids, phenolic substances, glycosides, steroids and terpenoids. These bioactive secondary metabolites play different role, in the human body and also protects the plants from predators. The medicinal herbal plant Sisymbrium irio belong to the family Cruciferae, called Khubah (Arabic); Asalio, Khubkalan, khubkala (Hindi); Khakasi, Khakshi (Persian); Khubakalan (Urdu) and London Rocket/Rocket Mustard (common names) and is found in different parts of the world4. In the traditional medicine this plant has a significant role for treatment of coughs, upper body mobbing, rheumatism, purification of liver, irritation, decrease inflammation and injuries4. In 2003, Guil et al., reported that Sisymbrium irio is used to treat inflammation, rheumatism, antipyretic, analgesic, antimicrobial and antioxidant potential and food supplements5. The seeds of plant are widely used for treatments of voice disorders6, as an expectorant, febrifuge7, treating inflammation & rheumatoid8, reduces fever, painkilling, antibacterial & antifungal activities9. The 70% ethanolic extract of the plant was subjected to qualitative phytochemical analysis and the results showed the existence of various types of pharmacological active components such as nitrogen containing compounds, phenolic compounds, saponins, gums, mucilage, tannins, oils, saturated and unsaturated fatty acids, glycosides, proteins, amino acids, carbohydrates, phytosterols and flavonoids10. This report focuses on the details of phytochemistry...
and broad-spectrum pharmaceutical applications of various parts of *Sisymbrium irio*.

**Phytochemistry**

The plants synthesize secondary metabolites to protect themselves, nevertheless, the study also shows that they have significant roles for protection and prevention of the different kinds of livestock and human diseases. These plant metabolites have anticancer activity, antimicrobial activity, scavenges free radicals, act as hormone, stimulates enzymatic activity & various therapeutic uses. Numerous free radicals, act as hormone, stimulates enzymatic anticancer activity, antimicrobial activity, scavenges human diseases. These plant metabolites have prevention of the different kinds of livestock and that they have significant roles for protection and protect themselves, nevertheless, the study also shows the oils obtained from *Sisymbrium irio* comprised of two esters & seven acids (38.80%), eleven sulfur and eleven nitrogen containing compounds (36.41%), fifteen terpenes derivatives (8.19%), five aromatic compounds (3.53%), six aliphatic hydrocarbons (6.29%), four fatty alcohols (2.49%) and three additional chemicals compounds (1.17%)\(^9\). Another study on phytochemical investigation of the different parts (leaves, stem, flowers and roots) of *Sisymbrium irio* showed the presence of flavonoids, triterpenoids, steroids, tannins, carbohydrates, saponins and alkaloids at different levels in different extracts of plant organs and the absence of cardiac glycosides and anthraquinones\(^15\). The different types of bioactive secondary metabolites found in various parts of *Sisymbrium irio* plant and are mentioned in the Table 1.

**Pharmaceutical applications of Sisymbrium irio**

The plant *Sisymbrium irio* is used for the treatment of different types of diseases such as inflammatory conditions and rheumatism\(^21\), expectorant, febrifuge and for treatment of voice disorders, chest congestion, rheumatism, detoxify liver and spleen, reduces swelling and clean wounds, antipyretic, analgesic, antimicrobial and antioxidant potential.\(^24\)

The seeds of London rocket are used for the treatment of inflammatory conditions, boils, pimples, cough, cholera and non-specific fever. Crude extracts of the seeds were tested for antipyretic, analgesic and antimicrobial effects. The ethanolic extract exhibited significant antipyretic and analgesic effects as well.\(^25\) It also exhibited marked antibacterial action against both gram-positive and gram-negative organisms and was found to be non toxic in acute studies.\(^9\) The polarity-based extract of the *Sisymbrium irio* was active to inhibit the growth of major disease-causing bacterial strains.\(^26\) The n-hexane extract of plant leaves inhibited the growth of microbial strains such as *Klebsiella pneumoniae* and *Staphylococcus epidermidis*.\(^27\) The ethyl acetate extract of the leaves was active against the gram-negative bacteria such as *Escherichia coli*, *Klebsiella pneumonia* and *Pseudomonas aeruginosa*, whereas the plant seed demonstrated greater inhibitory effect against *Pseudomonas aeruginosa* and *Staphylococcus epidermidis*.\(^27\) *Sisymbrium irio* aqueous extract

<table>
<thead>
<tr>
<th>Table 1 — Compounds isolated from <em>Sisymbrium irio</em></th>
<th>Part of the plant</th>
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<tbody>
<tr>
<td><strong>Phytochemicals</strong></td>
<td>Aerial part(^14)</td>
</tr>
<tr>
<td>Flavonoids (apigenin, apigenin-7-galactoside, apigenin-7-O-β-D-glucoside, luteolin-7-O-glucoside, apigenin-7-di-glucoside, apigenin-7-O-(6′ acetyl)glucoside, apigenin-7-O-gluc(6′,1″′)rhamnoside, apigenin-7-O-gluco(6′,1″′)rhamnoside, apigenin-7-O-gluco(6′,1″′)rhamnoside-5-methoxide, Kaempferol, kaempferol-3-O-xylosid-7-galactoside)</td>
<td>Aerial parts(^15)</td>
</tr>
<tr>
<td>Alkaloid (nicotine)</td>
<td>Aerial parts(^15)</td>
</tr>
<tr>
<td>β-sitosterol, stigmasterol and β-sitosterol-glucoside</td>
<td>Aerial parts(^16)</td>
</tr>
<tr>
<td>β-sitosterol, β-sitosterol-D-glucoside, isorhamnetin &amp; quercetin</td>
<td>Aerial &amp; Seeds parts(^17)</td>
</tr>
<tr>
<td>Glucosinolates</td>
<td>Aerial parts(^18), (^19)</td>
</tr>
<tr>
<td>Terpenoids, diocetyl adipate, N-(n-propyl)acetamide, isopropyl isothiocyanate, isobutyl isothiocyanate, 3,7,11,15-tetramethyl-2-hexadecan-1-ol, cis-8,11,14-ecosatrienoic acid, heptacosane, palmitic acid, n-butyl isothiocyanate, di-methoxy acetophenone aliphatic hydrocarbons &amp; aromatic compounds</td>
<td>Aerial parts(^12)</td>
</tr>
<tr>
<td>Sisosteryl-6′-O-undecanoate-β-D-glucoside, (Z)-8, 11, 12-trihydroxyoctadec-9-enoic acid, 1,2-dipalmitoyl-3-O-α,6′′-sulfoquinovosyl glycerol, crotanoyl cosmosin, tetracosanoic acid, β-sitosterol, ursolic acid, indole-3-carboxaldehyde, indole-3-carboxylic acid, -sitosterol-D-glucoside, apigenin, naringenin-4′-O-glucopyranoside, -adenosine and apigenin-7-O-glucoside</td>
<td>Aerial parts(^20)</td>
</tr>
</tbody>
</table>
was active against all tested pathogenic microbes such as *Staphylococcus aureus*, *Enterococcus faecium*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, *Escherichia coli* ATCC 25922, *Enterobacter cloacae*, *Staphylococcus aureus* ATCC 29213, and *Klebsiella pneumoniae*. The plant has numerous therapeutic uses for the treatment of acute diseases, chronic, ribs bottleneck, to decrease pain in the joints and muscles pain, inflammation, treat the liver and the irritation, injuries, painkilling, reduce fever & antibiotic uses. The ethanolic extracts of *Sisymbrium irio* seeds shows phytotoxic, cytotoxic and insecticidal activities. The ethanolic extracts of the seeds of this plant showed antiinflammatory activity, antidepressant, swim stress immobility and bronchoprotective role. Secondary metabolites such as isothiocyanates and nitriles, which are found in *Sisymbrium irio* have wide applications against different kinds of the microbial diseases. The study shows the uses of *Sisymbrium irio* for the treatment/inhibition of cancers and development of safer and more effective therapeutic agents. The activity may be attributed to the presence of β-sitosterol, as in vivo study showed β-sitosterol had a significant role in the diets of mice & rats fed with colon carcinogens that reduced the proliferative variations of the cancer growth. β-sitosterol had distracted the structure of cancer cell membranes & altered the signalling pathways that regulate cancer growth & apoptosis. The *Sisymbrium irio* extracts showed hepatoprotective effects against CCl_4 induced hepatotoxicity in albino rats. The hepatotoxic properties of the CCl_4 was mainly due to the presence of intermediate reactive metabolite, trichloromethyl radical. Trichloromethyl radical bound covalently to the macromolecules & encouraged peroxidative deprivation of membrane phospholipids of endoplasmic reticulum rich in polyunsaturated fatty acids, that leads to unnecessary build-up of phospholipids in tissues such as liver. Histopathological study revealed that post treatment with *Sisymbrium irio* clearly exhibited the significant protection of liver cells. The effectiveness of anthepatotoxicity of drug may rely on its capacity in decreasing the harmful effect/mending the usual hepatic functioning impaired by a hepatotoxin. *Sisymbrium irio* extracts have powerful reducing ability of carbon tetrachloride action to raise the levels of the enzyme in testing groups, this shows the defense of structural integrity of hepatocyte membrane or renewal of injured liver cells, this may be due to the existence of bioactive flavonoids. In the Mediterranean region *Sisymbrium irio* leaves are consumed as food and used as folk medicine for infections of the throat and chest. This plant is used in Unani system of medicine for various therapeutic uses and recommended for the prevention of dengue fever due to the presence of bioactive components.

**Conclusion and Recommendation**

From this review, it is certain that various phytochemicals are present in different parts of *Sisymbrium irio* plant, which need further phytochemical and biological investigation to develop into useful therapeutic uses and for the development of novel drug molecules.

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**Conflict of interest statement**

The author(s) declare(s) that here is no conflict of benefits concerning the publication of this paper.

**References**


