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Review Article

PHARMACOLOGICAL AND PHYTOCHEMICAL PROPERTIES OF *IRIS KASHMIRIANA* BAKER AS A POTENTIAL MEDICINAL PLANT OF KASHMIR HIMALAYA

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ABSTRACT

Iris kashmiriana Baker is an important member of the family Iridaceae, locally known as *"Mazarmund"* in Kashmir valley. The plant owes its significance because of its endemic nature to the region, and its use in alternative medicine as emetic, cathartic, diuretic and expectorant since long time. In the current review an attempt has been made to assemble up-to-date information on its phytochemical composition, pharmacological properties and use in alternative herbalism, so that it may serve to bridge the gap between its folkloric use and the results of evidence based experiments. It was found that in addition to its vast benefits in traditional herbalism, it has been proved for having potential anti-inflammatory, antioxidant, immunomodulatory, antitumor and antimicrobial properties. Flavonoids, isoflavonoids, glycosides and tannins were the phytochemicals reported from this plant. Besides this, the structure and reported bioactivity of its phytochemical constituents is also presented and discussed.

KEYWORDS: Antimicrobial activity, Mazarmund, Iriskashmirianin, Kashmigenin, Isonigricin, *Iris kashmiriana* Baker

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INTRODUCTION

The genus *Iris* belongs to the family Iridaceae, which comprises over 300 species, of which 12 species are found in India (Bhattacharjee, 1998). Throughout the world plants of this family has been widely used in traditional medicine and modern clinical preparations to treat cold, flu, malaria, toothache, cancer, bacterial and viral infections and bruise (Hanawa *et al.,* 1991). *Iris kashmiriana* is an important member of this family, locally known as *"Mazarmund"* in Kashmir. The plant owes its significance because of its endemic nature to the region, hence is also important on the basis of conservation perspectives. Botanically and taxonomically the plant is herb with a thick and stout rhizome having 4 to 6 straight and glaucous leaves up to 60 cm in length and 3.0 to 4.5 cm in breadth. Flowering season is in May. Peduncle (stem) is 50 to70 cm tall, with few 2 to 3 flowered branches. Bract and bracteoles ranges from 7 to 11 cm in length. Perianth is white and often with some blue marking and yellow-green veins and 2.2 to 2.5 cm long tube. Filament is white in color, 1.3 to 1.8 cm long, and anther is 1.5 cm long. Capsule rarely formed. Fruit is 3.0 to 4.3 cm long and 2.2 cm broad, with thick and woody walls. Seeds are globular, wrinkled and red-brown in color (Ali and Mathew, 2000).

In the current age, the drug detection practice is becoming more complex and capital-intensive, hence systematic and critical review of the methods and approaches towards the entire process is required to rediscover the discovery process afresh. Therefore in order to seek the potential clinical applications of *Iris kashmiriana*, it is very important to establish a connection between its conventional utilization with thorough and modern pharmacological and phytochemical scientific studies. So far no comprehensive database has been developed to enlist all the phytochemical and pharmacological properties of *Iris kashmiriana*. The information available about this plant is either outdated or comparatively insufficient in scope. Therefore the present review was aimed to present the existing knowledge of *Iris kashmiriana*'s phytochemical composition and utilization in local medicine. In addition an effort has been done to report the *in vitro* and *in vivo* pharmacological studies on plant-derived extracts and also to highlight the potential for developing evidence-based *Iris kashmiriana* preparations. The study is likely to help in introducing *Iris kashmiriana* in the modern clinical preparations as a potent medicinal plant and will help on its further research, development and conservation.

MATERIALS AND METHODS

To conduct current review, all available references/reports on *Iris kashmiriana* and its use in primary health care, published scientific journals, books, theses, and conference papers were consulted. A database for its use in alternative medicine, pharmacological studies and phytochemical constituents was formulated, along with evidence based pharmacological potential of individual compounds.

USE IN CONVENTIONAL HERBALISM

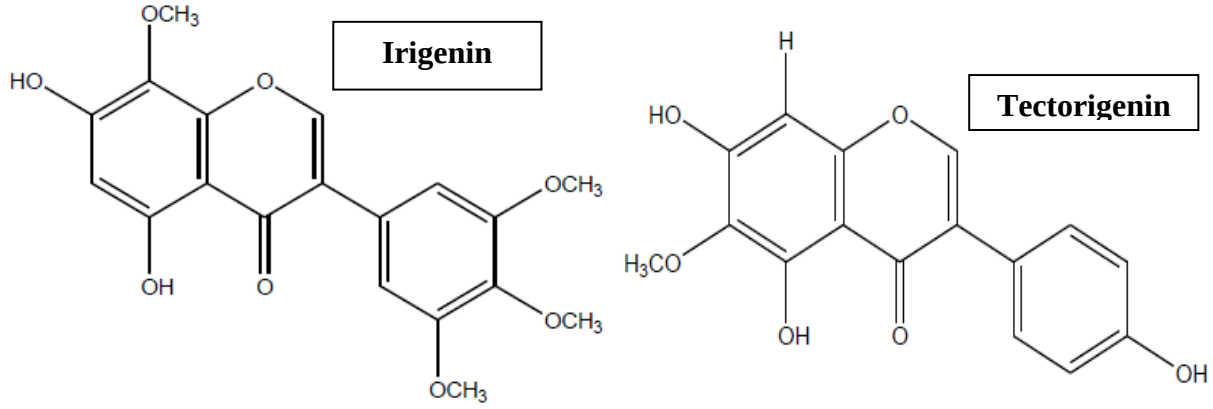
The peeled and dried rhizomes, enjoyed popularity in traditional medicine since past due to their emetic, cathartic, diuretic, stimulant and expectorant properties (Jain, 1987). Though the use of whole plant in the traditional herbalism has also been documented (Mala *et al.,* 2012), but from majority of the studies, the use of rhizome seems to be prominent (Bhardwaj *et al.,* 2013; Lone *et al.,* 2013). Different uses, modes of administration and dosage of the plant have been reported from different parts of Kashmir Himalaya. In Kajinaag range of Kashmir Himalaya, the powder of whole plant was used for treatment of joint pains and after mixing it with oil it was used to cure the skin infections (Mala *et al.,* 2012). In Bandipora area, the dried rhizome was not only used to cure joint pains but also to treat eczyma and respiratory problems (Lone *et al.,* 2013). In traditional medicine the plant was not only used to cure the human related ailments, but also to treat animal ailments. E.g. a mixture of rhizome powder, water and sugar made into semi-solid balls was given as tonic

against general body weakness (Bhardwaj *et al.*, 2013), for hepatic disorders and dropsy in cattle (Beigh *et al.*, 2003). The use of *Iris kashmiriana* in traditional medicine gives the inspiration of its varied and outstanding pharmacological activities.

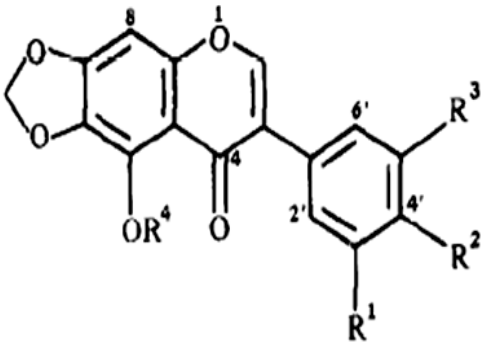
PHYTOCHEMICAL COMPOSITION

The phytochemical analyses of the different extracts of *Iris kashmiriana* have revealed the presence of different compounds including flavonoids, isoflavonoids, glycosides and tannins (Wani *et al.*, 2012). Earlier inspections of the rhizomes have led to the isolation of compounds Iriskashmirianin and Isoiriskashmirianin (Kachroo *et al.*, 1990). In addition, two isomeric isoflavones, Isocladrastin (3'-hydroxy-6,7,4'-trimethoxy-isoflavone), and Kashmigenin (4'-hydroxy-3',5'-dimethoxy-6,7-methylenedioxy-Isoflavone) have also been isolated (Razdan *et al.*, 1996). These new isoflavones have been found to lack the characteristic 5,6,7-trioxygenated pattern which is normal in compounds present in other *Iris* species (Boland *et al.*, 1998). Nazir *et al.* (2008) have isolated three isoflavones in the rhizomes, viz 4'-hydroxy-8-methoxy-6,7-methylenedioxyisoflavone (Isonigricin), 5,6-dihydroxy-4',7-dimethoxyisoflavone (Isoirisolidone), and 5,7-dihydroxy-4,6-dimethoxyisoflavone (Irisolidone). Among them Isonigricin has been reported to be a new addition to the natural products. Recently Amin *et al.* (2013) with HPLC revealed presence of two active compounds namely Irigenin and Tectorigenin, while Alam (2014) in methanolic extracts of rhizome reported presence of many compounds including a new isoflavone Aglycone with its many of acetylated and glycosidic forms. The chemical structure of some important compounds is shown in figure(s) 1.

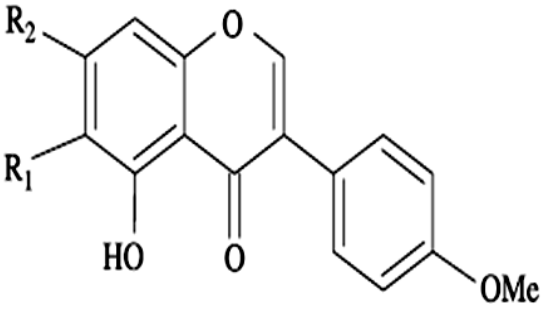
Figure(s) 1: Chemical structure of some important compounds found in *Iris kashmiriana*



	R_1	R_2	R_3	R_4	R_5	R_6
Isocladrastin	H	OMe	OMe	OH	OCH	H
Kashmigenin	H	O-CH_2-O		OMe	OH	OMe



	R1	R2	R3	R4
Iriskashmirianin	H	OH	OMe	OMe
Isoiriskashmirianin	OH	H	OMe	OMe
Irilone	H	OH	H	H
Irisolone	H	OH	H	OMe



Isoirisolidone (R1=OH;R2=OMe)

Irisolidone (R1= OMe;R2 =OH)

These flavonoids have been found to be prominent plant secondary metabolites, playing a significant role in human health care (Agarwal *et al.*, 1984). They have shown anticancer activity by means of inhibiting microtubules at G2/M phase. Studies have shown an association between isoflavones rich dietary consumption and reduced cancer risk, particularly breast and prostate cancers (Williams *et al.*, 1997). The preventive role of isoflavones in cancer, cardiovascular diseases, osteoporosis, and menopausal symptoms, antimicrobial, anti-inflammatory and estrogenic properties have largely been documented (Bonfills *et al.*, 2004). The pharmacological properties of important compounds found in *Iris kashmiriana* are given in table 1.

Table 1: Pharmacological properties of different compounds found in *Iris kashmiriana*

Compound	Pharmacological activity	Reference
Iriskashmirianin	Antitumor	Wollenweber *et al.*, 2003
Isocladrastin	Anti-bacterial, anti-viral	Tian, 2008
Kashmigenin	Antimicrobial	Anthony *et al.*, 2005
Isonigricin	Immunosuppressant, antimicrobial	Nazir, 2013; Nazir *et al.*, 2008
Isoirisolidone	Immunostimulating	Nazir, 2013
Irisolidone	Cardioprotective, antiviral	Mua *et al.*, 2009
Irigenin	Antimicrobial	Ahna *et al.*, 2006
Tectorigenin	Analgesic, anti-inflammatory	Ha *et al.*, 2006

PHARMACOLOGICAL IMPLICATIONS

Anti-inflammatory and anti-cancerous activity

Iris kashmiriana has been found to have potent anti-cancerous and anti-inflammatory properties. Amin *et al.* (2013) evaluated different extracts against human epithelial cancer cell lines A549 and Caco-2 for their possible effect on cell proliferation. They found it to show potent cytotoxic effects on both epithelial cell lines at all the tested concentrations with significant effect at 400 mg/ml. However the study reported that mouse fibroblast cell line NIH-3T3 were less effected, which indicated a possible cell specific activity against epithelial cancers. The results

demonstrate pharmaceutical potential of *Iris kashmiriana* for treatment of epithelial cancers.

Antioxidant activity

Free radical scavenging activity as verified by DPPH (2,2-diphenyl-1-picrylhydrazyl) assay have revealed that the methanolic extracts of *Iris kashmiriana* possess strong antioxidant potential (Kaššak, 2012). Amin *et al.* (2013) found this activity to be dose dependent with the maximum effect at 400 mg, which was due to redox properties of phenolic or flavonoid compounds present in the plant extracts, which were believed to play an important role in absorbing and neutralizing free radicals and hence terminating the free radical chain reaction. Alam (2014) found most of the compounds to show moderate levels of antioxidant activity.

Antimicrobial activity

Potential antimicrobial properties have been observed from different extracts (hexane, methanol and water) in rhizomes of *Iris kashmiriana.* All these extracts showed antibacterial activities against bacterial strains (*Staphylococcus, Escherichia, Psuedomonas, Proteus, Salmonella*), which include both Gram positive and Gram negative types. Of all the extracts, methanolic extracts has been reported to show highest zone of inhibition followed by hexane and aqueous extracts (Wani *et al.*, 2012). Alam (2014) screened the different compounds for antimicrobial activity against six bacterial *Escherichia coli, Pseudomonas aeruginosa, Klebsiella-pneumonia, Staphylococcus aureus, Bacillus subtilis,* and *Bacillus cereus* and two fungal strains *Candida albicans, Aspergillus nigrum* and obtained promising results, highlighting its use in antimicrobials in future.

Immunomodulatory activity

The compounds Isonigricin and Isoirisolidone present in the rhizomes have been found to possess immunomodulatory action. Using flow cytometry Nazir (2013) studied the effect of these compounds on production of T-lymphocytes (CD4+ and CD8+ T-cells) and T-cell cytokines (IL-2, IL-4 and IFN-γ) in a dose-dependent manner in mice. It was found that at oral doses of 0.025 to 0.8 mg/kg, Isonigricin showed immunosuppressant activity on T-cells as well as cytokines, while Isoirisolidone acted as immunostimulator for both the cells and cytokines. Furthermore, when the methylated products of both the compounds were analyzed, it was found that they possess stimulatory effect on interleukins and suppressive effect on T-lymphocytes production.

CONCLUSION AND FUTURE PROSPECTS

Medicinal herbs are the main ingredients of conventional medicines and are thus of vital importance in traditional health care systems. The large human populace with diverse life styles, beliefs, traditions and cultural heritage inhabiting Kashmir Himalaya has learnt to utilize natural resources and products in various ways. This traditional knowledge system needs to be studied, documented, preserved and used for the benefit of humankind, in addition of its official legalization and making it part of the official health care system before it is lost forever. During the current study it was found that there is a strong correlation between the ethnopharmacological usage of *Iris kashmiriana* with that of scientifically proven claims which justify and hence supports the traditional therapy.

Although the plants of the *Iris* genera are globally known for their phytochemicals especially flavones, but very less information is available on the phytochemical and pharmacological aspects of *Iris kashmiriana*. In view of the well-documented medicinal properties of various species of *Iris* and pharmacological effects of active constituents, *Iris kashmiriana* also needs to be scientifically studied further in order to harness its full potential as a medicinal plant of therapeutic value. Government should effectively support for its traditional medicine therapies by providing necessary institutional and financial support to scientific research in order to promote the potential role of herbal medicine in

primary health care delivery and pave the way to modern clinical applications. Some of the measures recommended include that stress should be given for inventorying and documenting all the medicinal uses of *Iris kashmiriana* in herbal medicine, establishing local botanical gardens for its effective conservation, carrying out *in-vitro* and *in-vivo* laboratory studies to study pharmacological values and establishing dosage norms for the proper administration.

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