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Amini-review of medicinal usesand phytochemicals isolated from Himalayan plant Delphinium brunonianum royle

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ABSTRACT: Delphinium brunonianum royle known as the Musk larkspur plantbelongs to the family Ranunculaceaeand is endemic to China that grows at high elevations ranging from 3500 to 6000 m in the Himalayan area, Pamir, south-east Tibet, and Afghanistanhaving glabrous, an erect and tall perennial herb that is 20-40 cm long and leafy on the underside. Flowers are huge and range in color from royal blue to pastel blue. Seeds are angler or winged, with a hairy folicle 5-6. July to September is the months for flowering and fruiting.D. brunonianumcontains different medicinal properties including anti-bacterial, anti-oxidant, anti-lice,anthelmintic, and anti-inflammatory. This plant contains several useful phytoconstituents, according to phytochemical research. The current review is an attempt to give a detailed evaluation of the literature on scientific studies of D. brunonianum's traditional medicinal uses and its pharmacological properties.

Keywords: Delphinium brunonianum royle, Ranunculaceae,pharmacological properties, medicinal properties, photochemistry

I. INTRODUCTION

Plants with medicinal properties have been utilized as the principal source of therapeutic agents and health care since ancient times and are being used today (Allen et al., 2010). With recent developments in drug discovery and the invention of modern medicines, the options for medical treatments have been increased (Allen et al., 2010).There is a long history of medicinal plants and uses in conventional healthcaresystemssince ancient times and a vast majority world population still usesmedicinal plants for treatment (Teklehaymanot and Giday, 2007, Heinrich, 2000, Uprety et al., 2010). According to some estimations, about70-80% of the world's population relies on herbal remedies for essential medical treatment (Farnsworth and Soejarto, 1991, World Health Organization. Programme on Traditional, 2002). In addition, around the world, people use plants for medicinal purposes not only for their primary medical needs but also to enhance their livelihoods and generate revenue (World Health Organization. Programme on Traditional, 2002). Indigenous plants used for medicinal use for many ailments are gaining popularity (Gurib-Fakim, 2006). Because of their efficacy, safety, and cost-effectiveness, herbal medications are gaining interest in European and Arabian countries (Gurib-Fakim, 2006). The annual sale cost of herbal medicines ranges from 7.5 billion United States dollars (b US$) to 108 billion US$ globally, the latter number reveals the sale of processed

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medicines. In 2001, the overall sale of medicinal plants in Canada was $400 million US dollars(World Health Organization. Programme on Traditional, 2005). with a 15% annual increase (Lafrenière and Miller-Chénier, 1997). Through trial and error with the passing of millennia, Indigenous people developed extensive knowledge of plants for healing and passed this information down from one generation to the next generation as part of tradition(Marles et al., 2008, Blouin, 2003). However, recently it comes to concerns that the native knowledge and medicinal plants are going to extinction due to disruption in the traditional ways of life (Borins, 1995, Buenz, 2006). Therefore, the correct documentation of ethnobotanical knowledge as well as the sustainable management and conservationmanagement of medicinal herbs is necessary can help safeguard this heritage(Shah et al., 2003).

Delphinium brunonianum known as the Musk larkspur plantbelongs to the family Ranunculaceae endemic to China that grows at high elevations ranging from 3500 to 6000 m in the Himalayan area, Pamir, south-east Tibet, and Afghanistan(Tripathee et al., 2011). Plants are glabrous, erect, and tall perennial herbs that are 20-40 cm long and leafy on the underside(Chaurasia and Khatoon). Flowers are huge and range in color from royal blue to pastel blue. Seeds are angler or winged, with a hairy folicle 5-6. July to September are the months for flowering and fruiting (Chaurasia and Khatoon).Conservation status isvulnerable(Chaurasia and Khatoon).The species contain methyllycaconinite and diterpenoid alkaloids, which have both toxic and therapeutic properties (Gupta et al., 2018).Previous research revealed that alkaloids are the principal ingredients, with sterols and flavonoids, with detoxifying, antibacterial, Alzheimer's disease,and antiepileptic therapy benefits. When hydroalcoholic extractsof D. brunonianum were administered orally to rats, they demonstrated substantial natriureticand diuretic effects. As a folk medicine, it usually has the effects of anti-inflammatory, analgesicclearing heat, and detoxifying (Asif et al., 2020). Empirically, this species is used to treat a variety of ailments, including fever, headache, and stomach problems, as well as for blood purification (Tripathee et al., 2011). This plant contains several useful phytoconstituents, according to phytochemical research(Tripathee et al., 2011).

Table 1. Medicinal uses of different parts of Delphinium brunonianum royle.

Plant part used	Medicinal uses	References
Seeds	Insecticide, colic, healing, anthelmintic and anti-lice agent	(Chaurasia and Khatoon), (Khan et al., 2018), (Bhadrecha et al., 2017)(Hadi and Singh, 2021)(Bibi, 2019)(Kala, 2006)
Vegetative part	Insecticide and colic	(Chaurasia and Khatoon), (Khan et al., 2018), (Bhadrecha et al., 2017)
Leaves	Cut, burn, pimple. Fever, asthma, malaria, cough, typhoid, sore throat infections, Loss of appetite, Headache, Abdominal pain, and Swelling. Intestinal worms, Fluid Retention, Poor appetite, and trouble sleeping (insomnia). Healing, Dysentery, anthelmintic, wounds, insecticidal, anti-lice, and anti-ticks agent. Cardiac, flu, poor blood circulation, and piles.	(Khan et al., 2009)(Agrawal, 2001)(Ghimire and Aumeeruddy-Thomas, 2009)(Ali et al., 2017)(Husain et al.)(Bibi, 2019)(Rinchen and Pant, 2014)(Samal et al., 2010)(Sharma, 2000)(Abbas et al., 2014)(Ratha et al., 2015)
Flower	Fever, asthma, malaria, cough, typhoid, sore throat infections, loss of appetite, abdominal pain, headache, dysentery, insecticide, antiseptic, swelling and wounds. Chest problems, piles, and blood pressure. Flue, poor blood circulation, and piles	(Khan et al., 2009)(Ghimire and Aumeeruddy-Thomas, 2009)(Ali et al., 2017)(Hadi and Singh, 2021)(Rinchen and Pant, 2014)(VALLEY and GILGIT)(Khan et al., 2015)(Abbas et al., 2014)
Aerial parts	Cooling agent, blood purifier, liver problems, Respiratory depressant, pneumonia, headache and	(Zhang et al., 2022)(Ambasta, 1986)(Bano et al., 2014)

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	stomachache	
Not mentioned	Skin, snake bites and influenza diseases, headache, epidemic fever, poison removal, eczema, itching, cough, common cold, evil spirit and developing bile, baldness, diarrhea, and stomach ache. Anti-oxidant, anti-microbial, anti-glycation, anti-inflammatory, bile malfunctioning, and as a general antidote	(Wang et al., 2012)(Dawa et al., 2021)(Amjad et al., 2017)(Wangchuk et al., 2008)(Abbas et al., 1848)(Tang et al., 2022)(Jeppesen et al., 2012)(Deng and Sung, 1986)(Jeppesen et al., 2012)(Deng and Sung, 1986)(Tripathee et al., 2011).
Plant extract combined with massage oil	Arthritis, joint pain, muscle stiffness, paralysis, facial palsy and Anti-bacterial	(Tripathee et al., 2011)
Whole plant	Baldness, diarrhea, colic, diabetes, stomach ache, jaundice, and fever. Hair tonic, asthma, and pneumonia. Healing, anthelmintic, insecticidal, and anti-lice agent. Destroying maggots in wounds. Flue, cough poor blood circulation, and piles.	(Hussain et al., 2011), (Gupta et al., 2013), (Rajbhandari et al., 2009)(Shabir et al.)(Bibi, 2019)(Devi et al., 2019)(Abbas et al., 2014)(Abbas et al., 2016)
Stem	Fever, loss of appetite, headache, dysentery, swelling and wounds. Intestinal worms, fluid Retention, Poor appetite, and trouble sleeping (insomnia)	(Ghimire and Aumeeruddy-Thomas, 2009)(Husain et al.)
Shoot	Diarrhea, fever, cold, gout, and other joint problems	(Targe et al., 2022)(Rawat et al., 2013)
Roots	Healing, anthelmintic, insecticidal, and anti-lice agent, toothache, Respiratory depressant	(Bibi, 2019)(Kunwar et al., 2012)(Ambasta, 1986)
Tuber/ rhizome	Skin, cuts, wounds, and rheumatism. Fever, headache stomach-ache and cough problems	(Bhatti and Vashishtha, 2008)(Tripathee et al., 2011)

II. MEDICINAL USES OF D. BRUNONIANUM ROYLE

1.1. Medicinal uses of D. brunonianum Roylereported in Pakistan

Delphinium brunonianumRoyle in Gilgit-Baltistan, Pakistan, was used to treat stomach ache, fever, baldness, and diarrhea, its flower decoction is used to treat throat infection, cough, piles, high blood pressure, and chest difficulties(Khan et al., 2014). Residents in Pakistan's SkarduValley, at a high altitude in the Karakoram-Himalayan range, used aerial parts to treat pneumonia (Bano et al., 2014).An ethnobotanical survey from northern areas of Pakistan was conducted and reported that plant leaves and flowers are used for fever, asthma, malaria, cough, typhoid, and sore throat diseases (Khan et al., 2009). In the Ghizar area of Pakistan, flower juice is used orally for fever, asthma, and cough (VALLEY and GILGIT). One study collected folk knowledge from residents of Turmic Valley Central Karakorum National Park in Gilgit Baltistan, Pakistan. Its flower decoction is used to treat piles, high blood pressure, throat irritation, coughs, and chest pains (Khan et al., 2015).

The study investigated traditional medicinal applications and numerous traditional recipes used by local communities to cure various conditions in the Baltistan Region. The whole plant was used to treat Baldness, diarrhea, fever, and stomach aches(Hussain et al., 2011). Baltis and shinas in the Deosai National Park buffer zone, Gilgit Baltistan, Pakistan, Whole plantsare used to treat asthma and pneumonia, and as a hair tonic (Abbas et al., 2021). Native people in the Tormik Valley, Karakorum range, Baltistan, and Pakistan traditional knowledge were investigated (Abbas et al., 2016). The entire plant is dried and crushed with water, and the resultant paste is then applied to the head as a hair conditioner (Abbas et al., 2016).

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Gilgit Baltistan people apply a paste of leaves and blossoms to their skin to remove ectoparasites, and it is also administered to animals to ease abdominal pain (Ali et al., 2017). Diverse tribes and ethnic groups have highlighted the state's pride through medicinal, and cultural practices (Husain et al.). D. brunoniaum stem and leaf portions are used to cure difficulty sleeping (insomnia), low appetite, intestinal worms, fluid retention, and skin ailments such as cough, snake bite, fever, itching and cold (Husain et al.).

Gilgit Baltistan people apply a paste of leaves and blossoms to their skin to remove ectoparasites, and it is also administered to animals to ease abdominal pain (Ali et al., 2017). For many years, the residents of Chitral's Laspur Valley have utilized plant resources for medicinal, human, and animal food, lumber, facial masks, fuel, ornamental, vegetable, housing, and other multipurpose reasons (Bibi, 2019). The decoction of D. brunonianum seeds, whole plant, and leaves acts as a therapeutic, insecticidal, anti-lice, and anthelmintic agent. It is a highly poisonous plant that is used to kill maggots in goat and sheep wounds (Bibi, 2019). Blossoms are thought to be bitter, harsh, and disagreeable (Bibi, 2019).

Surveys were conducted to document indigenous knowledge about the medicinal herbs of the Haramosh Valley, Pakistan Central Karakoram National Park. The decoction of flowers and leaves and the whole plant of D. brunonianum is utilized to treat blood circulation, flu, cough, asthma, piles, and pneumonia (Abbas et al., 2014). D. brunonianumshowed good antioxidant activity which has been confirmed through DPPH assay (Abbas et al., 1848).D. brunonianum dichloromethane soluble portions exhibited anti-glycation activity by 38 % (Abbas et al., 1848). These fractions had a moderate potency but all of them had antiglycation components (Abbas et al., 1848). To defend the body from foreign agents, free radicals and other reactive species develop during inflammation (Abbas et al., 1848). Overproduction of ROS in a chronic state can be harmful to the physiological system (Abbas et al., 1848). Different crude extracts of D. brunonianum were tested against rats to check diuretic activity and results suggested that the plant possesses diuretic potential (Asif et al., 2020). Different D. brunonianum fractions were tested for immunomodulatory activity and they demonstrated anti-inflammatory activity (Abbas et al., 1848)(Tang et al., 2022).

1.2. Medicinal uses of D.brunonianum Royle reported in Ladakh, Jammu and Kashmir

In the Ladakh region,local people used seeds and vegetative partsas insecticides and colic and flowersfor ornamental purposes(Chaurasia and Khatoon).Traditional uses of D. brunonianum among people of the Zanskar valleys and Suru of the cold desert of Ladakh were researched, and leaves decoction is given to the patient once a day to cure malaria, and flower paste is also used to relieve throat pain (Rinchen and Pant, 2014). Researchers studied traditional therapeutic applications by residents of Jammu and Kashmir's Paddar Valley and reported whole plant consumption for diabetes illness (Gupta et al., 2013). Ethno-botanical research and investigations of aromatic and medicinal plants were conducted in some of the most remote towns of the Singay-Lalok region (Wanla, Hanupata, Photoksar, Ursi, Hinju, Fanji-La, Sisir-La) of the Leh district of the Union territory of Ladakh (Dawa et al., 2021). D. brunoniaum was reported for treating eczema, fever, epidemic fever, cold, itching, and evil spirits(Dawa et al., 2021). In the Ladakh region, flower juice and an infusion of the entire plant are used to alleviate colic. The lovely blossoms are often used for decoration (Shabir et al.). In Azad Jammu and Kashmir D. brunonianum (Ba-ru-ra/Ladar) was used to deal with evil spirits (Amjad et al., 2017). Since ancient times, people in the Kargil district have used medicinal plants to treat a variety of ailments. (Hadi and Singh, 2021). The flower and seed are used to treat colic diseases. It is toxic and is used as a pesticide and antiseptic (Hadi and Singh, 2021).

2.3. Medicinal uses of D. brunonianum Royle reported in India

D. brunonianum seed portion was employed as a pesticide in an ethnobotanical study in India's high-altitude cold desert (Kala, 2006).In the Himalayan medicine system, people used Leafpartsto cure cut and burn problems(Agrawal, 2001). Bhotia ethnic community in central India Himalaya leaf juice is applied to pimples, which are then boiled, chopped, and burned (Samal et al., 2010). The Bhotiya tribe's traditional use of D. brunoniaum has been documented and described. Leaf decoction is placed on burns, cuts, and boils, and is useful for cardiac and respiratory problems (Ratha et al., 2015). A systematic field survey was performed in Pin Valley, Himachal Pradesh, India plant shoot part used for diarrhea, fever, gout, and other joint problems (Targe et al., 2022). The Sunderdhunga valley in India's western Himalayas

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harbors a variety of medicinal plants that are used by the locals for a variety of purposes (Rawat et al., 2013). D. brunoniaum tender shoot paste is mixed with tea to treat a cold (Rawat et al., 2013).(Tripathee et al., 2011). The natural herbs utilized in traditional treatment in Uttarakhand's Kedarnath ValleyIndia in the western Himalayas were studied (Bhatti and Vashishtha, 2008). The tuber/rhizome part is used to treat skin problems i.e. cuts, wounds, and rheumatism(Bhatti and Vashishtha, 2008). People who live between India and Tibet border use Leaf oil and applied over affected areas of the body to get rid of ticks (Sharma, 2000).The Indian Himalayan Region (IHR) has a diverse range of medicinal plants. However, there has been little documentation of medicinal plants from many IHR-protected areas. Kanawar Wildlife Sanctuary (KWLS), located in the North Western Himalayas, supports a diverse range of sensitive biodiversity features, including medicinal plants used by locals to treat a variety of maladies (Devi et al., 2019). D. brunonianumwhole plant reported to be used for destroying maggots in wounds, particularly in sheep (Devi et al., 2019).

2.4. Medicinal uses of D. brunonianum Roylereported in Nepal

Methanolic extract of D. brunoniaum used in Nepalese traditional medicine was tested for in vitro antiviral activity against influenza virus and Herpes simplex virus type 1 (HSV-1) and demonstrated good antiviral activity also study show that whole plant used to treat jaundice and fever (Rajbhandari et al., 2009). Interview- and inventory-based methodologies were used to conduct ethno-medico-botanical excursions in five high-altitude communities in Niti Valley. Ethnobotanical research was undertaken in a Tibetan community of agro-pastoralists in Dolpo, northwest Nepal, and the study revealed that the leaf, stem, and flowers were used in the treatment of headache, fever, swelling, loss of appetite, diarrhea, and wounds (Ghimire and Aumeeruddy-Thomas, 2009). In far west Nepal dried roots are valued in toothache(Kunwar et al., 2012).The term "arts" refers to nerves, and "bugs" refers to application/massage. This indigenous herbal substance has long been employed as a foundational treatment in massage therapy. The rise-bugs massage oil contains crude extracts of D. brunoniaum, which are commonly used in patients suffering from musculoskeletal illnesses such as stiffness, paralysis, arthritis, joint pain facial palsy, and muscular (Tripathee et al., 2011).D. brunoniaum extract has antimicrobial effects when mixed with its bugs. For example Salmonella flexinarie, Bacillus subtilis, Staphylococcus aureus and Pseudomonas aureginous inhibition (Tripathee et al., 2011). This demonstrates the ability of its bugs to reduce discomfort caused by inflammation (Tripathee et al., 2011).

2.5. Medicinal uses of D. brunonianum Roylereported in Afghanistan

The Pamir Mountains in northeastern Afghanistan E\extracts, fractions, subtractions, and compounds were tested for antimicrobial activity against a variety of microorganisms (Bacillus subtilis, Pseudomonas aeruginous, Escherichia coli, Salmonella flexitarian,and Staphylococcus aureus). On the tested bacteria, isolated extracts and compounds exhibited moderate to good antibacterial activities (Jeppesen et al., 2012).

Table 2. List of different phytochemicals reported from D. brunonianum royle.

Part used	Phytochemicals	Citations
Aerial parts	Norditerpenoid alkaloid, delbruninol (1)	(Ulubelen et al., 1999)
Not mentioned	Alkaloids delbrunine, delcosine, browniine, blacknidine, 18-methoxygadesine, nudicaulamine, norditerpenoid and diterpenoid alkaloid (anthriscifoldine). Delbrunine, Kaempferol, benzoic acid and Eldeline. 2,5-dihydroxy-3,4-dimethoxy-6-methyl-) and Idebenone metabolites (Benzenebutanoic acid). Phenol, flavonoid, tannin and alkaloids, sterols, diterpenoid, β-amyrin, β-sitosterol, β-sitosterol glucoside, and anthriscifoldine).	(Ulubelen et al., 1999)(Deng and Sung, 1986)(Tang et al., 2022)(Bukhari et al., 2022)(Thawabteh et al., 2021)(Tang et al., 2022)(Asif et al., 2020)(Deng and Sung, 1986)
Roots	Alkaloids namely lycoctonine and methyllycaconitine	(Ulubelen et al., 1999)
Stem, leaves	Amino acids, alkaloids, coumarins, anthraquinone, phenol, glycoside, Saponins,	(Khan et al., 2014)

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	carbohydrates, flavonoids and proteins	
Not mentioned	2,5-dihydroxy-3,4-dimethoxy-6-methyl-) and Idebenone metabolites (Benzenebutanoic acid). Phenol, flavonoid, tannin, alkaloids, sterols, diterpenoid, β-sitosterol glucoside, β-amyrin, β-sitosterol, and anthriscifoldine)	(Bukhari et al., 2022)(Thawabteh et al., 2021)(Tang et al., 2022)(Asif et al., 2020)(Deng and Sung, 1986)

2.6. Medicinal uses of D. brunonianum Royle reported in Bhutan

In Bhutanese traditional medicine,D. brunoniaum is used for cough, cold, skin diseases, bile malfunctioning, and as a general antidote (Wangchuk et al., 2008).

2.7. Medicinal uses of D. brunonianum Roylereported in China

D. brunonianum Royle aerial parts act as cooling agentsand stop itching, minimizepathogenic heat, and disperse wind (Zhang et al., 2022). The treatment for Respiratory depressants,influenza, headache, skin, snake bites,stomachaches, and liver diseasehas also been reported(Zhang et al., 2022)(Ambasta, 1986).

III. PHYTOCHEMICALS ISOLATED FROM D. BRUNONIANUM ROYLE

Different compounds i.e. alkaloids, amino acids, coumarins, phenol, glycoside, Saponins, proteins, anthraquinone flavonoids, sterols, carbohydrates,diterpenoid alkaloids, β-sitosterol, β-amyrin glucoside, and anthriscifoldine respectively were isolated and identified from D. brunonianum specie which is given in table-2(Khan et al., 2014)(Tang et al., 2022, Deng and Sung, 1986, Ulubelen et al., 1999),(Al-Snafi, 2021),(Welch et al., 2015), (Green et al., 2009),(Bukhari et al., 2022), (Thawabteh et al., 2021).

IV. CONCLUSION

The current review is an attempt to give detailed evaluation of the literature on scientific studies of Delphinium brunonianum'sits traditional medicinal uses and pharmacological properties. It is stated that D. brunonianumhas shown anti-inflammatory, cooling agent, anti-lice, healing wounds,and anti-microbial activities. The research data reveals the presence of different phytochemicalsi.e.,amino acids, alkaloids, coumarins, anthraquinone, phenol, glycoside, saponins, carbohydrates, flavonoids, and proteins.

Conflict of interest statement

We declare that we have no conflict of interest.

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