

Qualitative phytochemical analysis of rhizomes and roots extracts of

Bergenia ciliata

Muhammad Niaz^{1*}, Hajra Qayyum¹, Hafsa Abrar¹, Ramla Jadoon¹, Saleha Ashfaq^{2*}, Noor e Baseerat², Naqash Khan², Bushra Bibi²

¹Department of Botany, Government Post Graduate College No.1 Abbottabad, Khyber Pakhtunkhwa, Pakistan

²Department of Biology, University of Haripur, Haripur, Khyber Pakhtunkhwa, Pakistan

Correspondence

Muhammad Niaz: ayubian20@hotmail.com

Saleha Ashfaq : saleha.ashfaq@uoh.edu.pk

Funding information

None

Abstract

The purpose of this study was to investigate the phytochemical constituents of *Bergenia ciliata* extracts and evaluate their potential biological activities. The extracts were exposed to qualitative phytochemical screening, revealed the presence of tannins, phenols, carbohydrates, saponins, oxalates, anthocyanins, cardiac glycosides, reducing sugars, coumarins, and alkaloids. These findings suggest that *Bergenia ciliata* possesses a wide range of bioactive compounds that may be involved to its observed medicinal properties. Further research is required to determine the pharmacological potential of these compounds, isolate them, and characterize their specific bioactivities that serves as their therapeutic effects.

KEYWORDS

Bergenia ciliata, qualitative phytochemical analysis, bioactive compounds, therapeutic effects.

1.0 INTRODUCTION

Bergenia ciliata is a perennial herb found in the temperate Himalayas, from Kashmir to Bhutan, at altitudes of 900-3000 meters. It is an evergreen plant that grows to about 0.3 meters tall and 0.5 meters wide. The rhizome of the plant has been shown to have antibacterial and antitussive properties. Kidney stone dissolution has also been reported to benefit from it. *B. ciliata* is used to treat a variety of illnesses in traditional Ayurvedic therapy. The plant is tightly

packed up against rocks in damp, shaded areas. [1]. The leaves are few in number, spreading, and have a ciliate margin. The flowers are pink to purplish and are arranged in a one-sided raceme. The fruit is a capsule that contains numerous, elongated seeds. The plant has two or three carpels, each with axile placentation [2]. It is believed that plants are the primary source of medicinal materials. Of the 2,50,000 higher plant species known to exist worldwide, over 80,000 are utilized medicinally. [3]. A larger part of the global population receives their livelihood and health security

from medicinally plants, which are widely used around the world and serve as a significant resource basis for the traditional medicine and herbal industries. Certain types of active chemical constituents called secondary metabolites can be obtained from medicinal plants which give therapeutic potential to the plants [4]. To isolate the pharmacologically active compounds from the plants, preliminary phytochemical screening is important. These secondary metabolites can be utilized as building blocks for the production of pharmaceuticals or as direct medicinal therapy. [5]. However secondary metabolites normally have a bitter taste, they protect plants from herbivores and other predators. These metabolites, like alkaloids, possess significant physiological and medicinal properties. Alkaloids possess analgesic, antibacterial, antimalarial, anticancer and antihypertensive potential [6]. Due to glycosides being present in plants, these plants can have strong antifungal properties [7]. Flavonoids and other phenolic compounds provide plants their antibacterial, antiviral, antioxidant, neuroprotective, and cardioprotective qualities [8]. Tannins have antimicrobial, antiviral, antibacterial and antiparasitic potential.



Fig 1.1 *Bergenia ciliata* plant

MATERIALS AND METHODS

2.1 Collection and Preservation

Bergenia ciliata plant was collected from the Nathiagali Galiyat region 2,410 m (8,000 ft), district Abbottabad Khyber Pakhtunkhwa Pakistan. Following a complete drying process in a shady area for 20 days, the gathered rhizomes and roots were

cleaned of dirt and dust particles using distal water. The damaged roots and rhizomes were ground into a fine powder with an electric grinder, kept at room temperature in an airtight container, and utilized to create an extract for more research. These materials were used afterward for phytochemical and antimicrobial activities.

2.2. Preparation of extract for phytochemical analysis

2.2.1 Maceration

In the extraction flasks, 150 milliliters of methanol were used to soak around 15 grams of dry powder (Fig. 1, 2). For a week, this mixture was shaken daily in a shaking incubator and stored at room temperature in the dark. The whatman filter paper was used to filter the methanolic extract. In a rotary evaporator, the filtrate was dried at 45°C while under vacuum pressure. Propanol, distilled water, and ethanol were all treated using the same method. Crude extracts were prepared in methanol, ethanol, propanol, and distilled water.



Fig. 1: Dried Rhizome of *Bergenia ciliata* during maceration for phytochemical analysis



Fig. 2: Dried Root of *Bergenia ciliata* during maceration for Phytochemical Analysis

2.3 Phytochemical Analysis

Different plant extracts were screened for the presence of Alkaloids, Carbohydrates, Sterols, Tannins, Saponins, Flavonoids, Quinones, Cardiac glycosides, Anthocyanin, Terpenoids, Phenols, Couramins, Protein, Phlobatannins, Anthraquinone and Glycosides using standard methods.

2.3.1 Alkaloids Test

2.3.1.1 Wagner's test

When a small quantity of plant extract is mixed with a few drops of Wagner's reagent, the presence of alkaloids is indicated by a reddish-brown precipitate [9].

2.3.2 Test for carbohydrates

2.3.2.1 Benedict's test

When 2 milliliters of Benedict's reagent were added to crude extract and boiled a reddish-brown precipitate grew, indicating the presence of carbohydrates. [10].

2.3.3 Tests for Cardiac Glycosides

2.3.3.1 Ferric chloride test

One milliliter of concentrated H₂SO₄ and two milliliters of glacial acetic acid with one drop of ferric chloride solution were added to two milliliters of plant extract. Brown ring formation indicates the presence of Cardiac glycosides [11].

2.3.4 Test for Saponins

2.3.4.1 Foam test

After diluting the plant extract with distilled water, it was shaken for fifteen minutes. The emergence of a foamy layer 2 cm thick shows the presence of saponins. [12].

2.3.5 Test for Proteins

10 of distilled water is taken as a solvent to dissolve plant extract and then filtrate is used to perform the following tests.

2.3.5.1 Xanthoproteic test

1ml of extract few drops of nitric acid were added. The white particles prove the presence of proteins [13].

2.3.6 Test for Oxalates

A few drops of glacial acetic acid were added to 1ml of extract. The visual green color indicates the presence of oxalate [14].

2.3.7 Test for Phenols

After adding a few drops of ferric chloride solution to the plant extract, the presence of phenols was shown by the appearance of a blue-black color. [15].

2.3.8 Test for Tannins

To the plant extract, a few drops of FeCl₃ solution were added. The presence of tannins is shown by the production of white precipitate. [10].

2.3.9 Test for Quinone

1 ml of extract and 1 ml of the conc. HCL was added. The formation of yellow color indicates the presence of Quinones [16].

2.3.10 Test for Reducing Sugars

A few drops of benedict's solution were added in the 2ml of extract and heated in the water bath. The appearance of blackish-green precipitates indicates the presence of benedicts test [17].

2.3.11 Test for Anthocyanin

A few drops of concentrated sulphuric acid were added to the 2 ml of extract forming of Yellowish orange colour that indicates the presence of Anthocyanin [18].

3.0. RESULTS AND DISCUSSION

Medicinal plants are the chief source of active chemical constituents which are of great therapeutic importance [19]. To isolate the pharmacologically active compounds from the plants preliminary phytochemical screening is most important. Secondary metabolites such as alkaloids which are likely to be bitter/acrid in taste, protect the plants from being attacked by herbivores and others. Alkaloids are of great physiological and therapeutic importance and comprise a large number of metabolic compounds. Tannins play a most promising role in the treatment of various calamities. Flavonoids and phenolic substances have prominent roles in various biological activities like antimicrobial, antioxidant, anti-viral, cardioprotective, and neuroprotective [20].

This study was carried out to detect the appearance of various classes of bioactive compounds in *Bergenia ciliata* root and rhizome. The result of preliminary phytochemical analysis of underground parts of *Bergenia ciliata* showed that both

underground parts of *Bergenia* contain high amounts of bioactive compounds. Regarding the presence of proteins, carbohydrates, alkaloids, saponins, phenols, anthocyanins, oxalates, tannins, and other compounds, the majority of the extracts produced good results. The plant's high phenol and phenolic chemical content suggests that it might have used in the treatment of microbes. The largest and most prevalent class of plant metabolites is made up of phenolic chemicals. Their biological features include cardiovascular protection, anti-aging, anti-carcinogen, anti-inflammatory, anti-atherosclerosis, and enhanced endothelial function. They also inhibit angiogenesis and cell proliferation. During our study, it is also revealed that our plant extract also contains saponins the well-known chemicals of inhibitory properties on inflammation. Saponins also cause blood precipitation and its coagulation. A few of the characteristics of saponins are their ability to produce foams in aqueous solutions, their hemolytic activity, their ability to bind cholesterol, and their bitterness. Several qualitative screening methods may be used to identify phytochemicals. However, more sophisticated techniques may be applied to simultaneously find them both numerically and qualitatively without running many separate tests. For millennia, the herb *Bergenia ciliata* has been utilized in traditional medicine.

Table 1: Phytochemical analysis of various extract of *Bergenia ciliata*

Phytochemicals	Phytochemical Tests	Solvents			
		MeOH	EtOH	Propanol	Aqueous
Alkaloids	Wagner's test	+	-	+	-
Carbohydrates	Benedict's test	-	-	+	-
Cardiac Glycosides	Keller-kilani test	-	-	-	-
Saponins	Foam test	+	+	-	-
Proteins	Xanthoproteic test	-	-	-	-
Oxalates		-	-	+	-
Phenols	Ferric chloride test	+	+	+	+
Tannins	Gelatin test	+	+	+	+
Quinone		+	-	+	+
Reducing sugars	Benedict's test	+	-	+	-
Anthocyanin		+	-	-	-

Both the rhizomes and leaves of the plant are medicinally important. Much work has been done to identify and isolate the medicinally important compounds from *Bergenia ciliata*. Investigating other chemicals from this plant is necessary. Numerous components of *Bergenia ciliata* have been shown to have significant therapeutic properties. It has been demonstrated that certain phytochemicals are bioactive and possess physiological and therapeutic qualities. The results of the phytochemical analysis are tabulated in

Therefore, extracts from *Bergenia ciliata* could be a good source of useful drugs. Further work should be carried out to isolate, purify, and characterize the active constituents responsible for the activity of *Bergenia ciliata*. This work will help to develop new drugs from this plant.

Table-2: Results of Qualitative Phytochemical Analysis of Roots of *Bergenia ciliata*

Phytochemicals	Phytochemical Tests	Solvents			
		Methanol	Ethanol	Propanol	Distilled water
Alkaloids	Wagner's test	+	+	+	-
Crbohydrates	Benedict's test	+	+	+	-
Cardiac Glycosides	Keller-kilani test	-	-	+	-
Saponins	Foam test	+	+	-	-
Proteins	Xanthoproteic test	-	-	-	-
Oxalates		-	-	+	+
Phenols	Ferric chloride test	+	+	+	+
Tannins	Gelatin test	+	+	+	+
Quinone		-	-	-	+
Reducing sugars	Benedict's test	+	+	+	-
Anthocyanin		+	+	-	-

4. CONCLUSION

Bergenia ciliata is a plant that has been used in traditional medicine for centuries. Both the rhizomes and leaves of the plant are medicinally important. Much work has been done to identify and isolate the medicinally important compounds from *Bergenia ciliata*. Further work needs to be done to explore new compounds from this plant. Studies have shown that *Bergenia ciliate* contains many medicinally important constituents. These phytochemicals have been shown to be bioactive and to have medicinal and physiological properties. As a result, *Bergenia ciliate* extracts may be a valuable source of medications. To identify, isolate, and define the active ingredients that give *Bergenia ciliata* its action, further research has to be done. This work will help to develop new drugs from this plant.

ACKNOWLEDGMENTS

We greatly acknowledge the Department of Botany Government Post Graduate College No.1 Abbottabad, Pakistan for providing experimental facilities.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

- Adhikari, U., Antibacterial and Antioxidant Property of Selected Medicinal Plants of Daman VDC, Makawanpur District. 2016, Department of Botany.
- Khan, M.Y. and V.J.I.J.P. Kumar, Phytopharmacological and chemical profile of *Bergenia ciliata*. 2016. **6(5)**: p. 90-98.
- Wani, N.A., et al., The Conservation and Utilization of Medicinal Plant Resources. 2021: p. 691-715.
- Bernstein, N., et al., Antiinflammatory potential of medicinal plants: A source for therapeutic secondary metabolites. 2018. **150**: p. 131-183.
- Doughari, J.H., Phytochemicals: extraction methods, basic structures and mode of action as potential chemotherapeutic agents. 2012: INTECH Open Access Publisher Rijeka, Croatia.
- Nugraha, A.S., et al., Anti-infective and anti-cancer properties of the *Annona* species: Their

- ethnomedicinal uses, alkaloid diversity, and pharmacological activities. 2019. **24**(23): p. 4419.
7. Khan, H., et al., Plant bioactive molecules bearing glycosides as lead compounds for the treatment of fungal infection: A review. 2017. **93**: p. 498-509.
8. Bommakanti, V., et al., An Overview of Herbal Nutraceuticals, Their Extraction, Formulation, Therapeutic Effects and Potential Toxicity. 2023. **10**(3): p. 177.
9. Dzotsi, E.Y., Extraction of alkaloids from the stem of the plant *cryptolepis sanguinolenta* (LINDL.) schltr. 2007, University of Cape Coast.
10. De, S., Y. Dey, and A.J.I.J.P.B.R. Ghosh, Phytochemical investigation and chromatographic evaluation of the different extracts of tuber of *Amorphaphallus paeoniifolius* (Araceae). 2010. **1**(5): p. 150-7.
11. Singh, V. and R.J.I.J.o.L.-S.S.R. Kumar, Study of phytochemical analysis and antioxidant activity of *Allium sativum* of Bundelkhand region. 2017. **3**(6): p. 1451-1458.
12. Korwar, P.G., et al., A study on phytochemical investigation of *Drynaria quercifolia* Linn rhizome. 2010. **1**(12): p. 148-158.
13. Salwaan, C., et al., Investigation of the pharmacognostical, phytochemical and antioxidant studies of plant *Withania coagulans* dunal. 2012. **1**(3): p. 32-39.
14. Abu Zarin, M., et al., Investigation of potential anti-urolithiatic activity from different types of *Musa pseudo-stem* extracts in inhibition of calcium oxalate crystallization. 2020. **20**: p. 1-12.
15. Sheel, R., K. Nisha, and J.J.I.J.o.A.C. Kumar, Preliminary phytochemical screening of methanolic extract of *Clerodendron infortunatum*. 2014. **7**(1): p. 10-13.
16. Pierpoint, W.J.B.J., o-Quinones formed in plant extracts. Their reactions with amino acids and peptides. 1969. **112**(5): p. 609-616.
17. Paikara, D., S. Singh, and B.J.I.J.E.S.T.F.T. Pandey, Phytochemical analysis of leave extract of *Nyctanthes arbortristis*. 2015. **1**(3): p. 39-42.
18. Abrar, H., et al., Qualitative phytochemicals profile of five different crude solvents of *Galium asperifolium* Wall. 2023. **2**(2): p. 26-37.
19. Pengelly, A., The constituents of medicinal plants: an introduction to the chemistry and therapeutics of herbal medicine. 2020: Routledge.
20. Nirmala, C., et al., Promising underutilized wild plants of cold desert Ladakh, India for nutritional security and health benefits. 2022. **2**(2): p. 100145.