Biomedicine & Pharmacotherapy 97 (2018) 708–721

Contents lists available at ScienceDirect

Biomedicine & Pharmacotherapy

journal homepage: www.elsevier.com/locate/biopha

Review

Bergenia ciliata: A comprehensive review of its traditional uses, phytochemistry, pharmacology and safety

Mushtaq Ahmad[a,b,*], Maryam Akram Butt[a,*], Guolin Zhang[b], Shazia Sultana[a,c,*], Akash Tariq[d,e], Muhammad Zafar[a]

[a] Department of Plant Sciences, Quaid-i-Azam University Islamabad, Pakistan
[b] Center of Natural Products Research, Chengdu Institute of Biology, Chengdu 610041 China
[c] Institute of New Energy and Low Carbon Technology, Sichuan University, Chengdu, China
[d] Key Laboratory of Mountain Ecological Restoration and Bio Resource Utilization & Ecological Restoration Biodiversity Conservation Key Laboratory of Sichuan Province, Chengdu Institute of Biology, Chinese Academy of Sciences, Chengdu 610041, Sichuan, China
[e] University of Chinese Academy of Sciences, Beijing 100039, China

ARTICLE INFO

Keywords:
Berginia ciliata
Medicinal uses
Phytochemisry
Pharamacology

ABSTRACT

Bergenia ciliata is a medicinal plant used for the treatment of kidney stones. The presented review is the first attempt to gather utmost information about the distribution, ethno-medicines, phytochemical analysis, pharmacology and toxicology of *B. ciliata.* This review was designed with the aim to compile fragmented information about *B. ciliata* in addition to explore its therapeutic potential and future research opportunities. A total of 185 research papers were reviewed using several data sources such as; Web of Science, Scopus, Google scholar, Science direct and PubMed. Results of this review revealed that B. ciliata is being used to cure 104 different types of ailments. Although among reported disorders *B. ciliata* showed high potential in the treatment of gastrointestinal disorders but it is well known for the treatment of kidney disorders particularly kidney stones. Literature review showed that traditional healers mostly utilize it in powder form. Moreover, *B. ciliata* was reported to possess high antifungal, antiviral, anti plasmodial and antibacterial activities. Pharmacological studies reported that it has good antioxidant, anti-inflammatory, anti-tussive, anti-ulcer and anti-neoplastic activities. Variety of secondary metabolites belonging to different classes of compounds such as phenols, alcohols, terpenoids and fatty acid were reportedly isolated from *B. ciliata*. In spite of having better efficiency of ethno medicines and good pharmacological potential, *B. ciliata* has also shown toxic effects on living system in several studies. We invite the attention of researchers to carry out detailed ethno-pharmacological and toxicological studies on this valuable plant species in order to provide reliable knowledge to the patients and discover more novel compounds for the development of new drugs with fewer side effects on the living system as compare to modern medicines.

1. Introduction

B. ciliata belong (haw.) Sternb belongs to the family Saxifragaceae which consist of 30 genera and 580 species. *B. ciliata* commonly known as hairy *Bergenia* is a perennial herb found between the height of 800–3000 m throughout the temperate Himalayas [1,2] from Afghanistan to Southeast Tibet [1]. In Bhutan it is found in Deothang, Phuntsoling, Mongar and Ha districts. In India it is reported from Lushai hills, West Bengal, Arunachal Pradesh, Meghalaya, Himalayas (Kumaon), Kyongnosla, Karponanag, Gangtok in Sikkim, district Almora Uttarakhand [3–7]. In Nepal it occurs in Makanwanpur district [7] Karepalanchwok district [8] and Dolakha district [9]. In Pakistan it is distributed in northern parts mainly FATA region of Khyber Pukhtunkhwa province, Poonch valley, Swat, Abbottabad, Galliyat and Chitral [10–14].

It was long since this plant has been used as medicines for the treatment of different human ailments. In Himalaya region many rural communities use *B. ciliata* for the treatment of various diseases [15]. For century's rhizome of *B. ciliata* has been used for curing pulmonary infections, leucorrhea, piles and for dissolving bladder and kidney stones [16]. In Ayurveda system of medicine it is commonly used as tonic, astringent, antiscorbutic, laxative, spleen enlargement, dysuria and ulcers [17]. Local people of West Bengal use rhizome juice as an anti-tussive for cough and cold [18]. As a medicinal plant *B. cilata* is

* Corresponding authors at: Department of Plant Sciences, Quaid-i-Azam University Islamabad, Pakistan.
E-mail addresses: mushtaqflora@hotmail.com (M. Ahmad), maryamakram40@gmail.com (M.A. Butt).

http://dx.doi.org/10.1016/j.biopha.2017.10.141
Received 27 May 2017; Received in revised form 21 October 2017; Accepted 24 October 2017

being widely used against cough, cold, fever, pulmonary infections, heart diseases, ophthalmic, hemorrhoids and stomach disorders [15,19–21].

B. ciliata contains number of important phytochemicals such as bergenin, gallic acid, (+) – catechin, Paashanolactone, sitoindoside, quercitin, (+) afzelechin *etc* [22,23]. Presence of tannic acid, albumen, mucilage, glucose, wax, metarbin and mineral salts is also reported [24]. Biological analysis of *B. ciliata* revealed that this plant showed antioxidant, anti-inflammatory, antitussive, antiviral, antiulcer, hypoglycemic and toxicological activities. Rhizome of *B. ciliata* was found to show narrow spectrum of antibacterial activity, leaves and roots show antifungal activity [18,25].

Many researchers have studied this plant species in different aspects but there is no comprehensive review encountering detailed information about the therapeutic potential of *B. ciliata*. Present review is the first attempt to gather utmost fragmented literature about the ethnobotany, pharmacology and phytochemistry of *B. ciliata*. It would provide information about the effectiveness of this miracle herb against different kind of ailments and the responsible potent therapeutic compounds. Moreover, this review would disclose scientific gaps in current knowledge and help scientists around the globe for future studies regarding the discovery of new novel compounds and drugs from *B. ciliata*.

2. Methodology

This review article has been designed by compiling and consulting published papers about the medicinal uses as well as scientific validation of *B. ciliata*. A total of 185 published papers were consulted using different data bases *i.e.* Web of Science, Scopus, Google scholar, Science direct and PubMed. In present review restriction of language was considered, only the published articles in English version were included for conducting a search targets on *B. ciliata* through different databases using a combination of key words including: *B. ciliata* ethno-pharmacology; phytochemistry; anti-microbial activities and anti-oxidant properties. In this paper the literature search was only targeted towards scientific publications which were included in above mentioned data bases which may available to scientific society for reference; though we may admit that there may be some other additional data in less available form like unpublished thesis and reports have not been included in this study. All the obtained data from previous published literature is summarized in 3 tables (traditional uses; phytochemistry and pharmacological activities) and 6 figures. Reported chemical constituents from this species were presented and IUPAC name; chemical and structural formulae draw and verified from Chemspider and Pubchem.

3. Comprehensive literature based information on *Bergenia ciliata*

3.1. Plant description

B. ciliata is evergreen perennial herb up to 50 cm height with sub orbicular leaves which are rounded at the apex and base. Leaf margins are finely denticulate, fringed with soft hairs. Leaves are alternate, opposite and ex-stipulate. Flowers are showy pinkish white with obvate petals, lobes acute and denticular near apex, hermaphrodite, calyx 5 adnate to the ovary (more or less), corolla 4 or 5, perigynous and imbricate, stamens indefinite, ovary 4 or 5 and united, fruit capsular or sometimes baccate, seeds numerous, bloom in spring from February to April. Fruiting period is March-July [3,24,26,27]. The plant along with flowers and roots are shown in Fig. 1.

3.2. Vernacular names of B. ciliata

B. ciliata has different synonyms and vernacular names vary from area to area. In India it is known as Sadpottar [28], Silpari in Nepal [29], in Swat (Pakistan) it is known as Ghat pana [30]. Some vernacular names are presented in Table 1.

3.3. Ethno-medicinal uses of B. ciliata

The use of plants as herbal medicine is as old as the origin of humans, however, now it has been identified an essential part of health care system worldwide [13]. Due to the lack of modern health care facilities and approachability, about 80% of world's population is still dependent on wide range of herbal medicines for primary health care and use medicinal plants like *B. ciliata* [8]. Herbal medicines are used in a number of diseases and have no side effect and are more effective than allopathic medicines. Their mode of treatment is cheaper and easily available as compared to the modern synthetic drugs [14]. A tremendous revival in the interest and utilization of medicinal plant products has been witnessed in the past decade. Since long time B. *ciliata* is well known for its medicinal properties and extensively used for a wide range of medicine in traditional system in different regions especially of Asian countries like Pakistan, Nepal and India *etc*. A total of 104 ailments treated by *B. ciliata* are recorded in this review. These remedies were categorized into gastrointestinal, skin diseases, Renal/urinary disorders, muscular/skeletal disorders, respiratory diseases, eye diseases, oral infections, worm infections, and gynecological disorders, ENT, fever, cancer and others. Among these categories gastrointestinal accounted maximum percentage (23%), skin diseases (17%), urinary/renal (14%), muscular/skeletal (10%), respiratory diseases (8%), fever (7%), eye diseases, oral infections, worm infections, gynecological (3%), ENT and cancer (1%) (Fig. 2). High value of carminative properties of *B. ciliata* rhizome is evident from highest percentage of gastrointestinal disorders. According to some studies [5], in the folk medicine of some areas of south East Asia the species is used for the treatment of stomach diseases. While in many studies [8,12,14,31,32] the use of rhizome to treat gastrointestinal disorders is mentioned while some authors reported the use of roots to cure gastrointestinal disorders [33–36]. [37,38] and mentioned the use of root for the treatment of diarrhea. Parts of *B. ciliata* used for treatment of different diseases were rhizome, roots, stem, leaves, latex, flower and as whole plant. However rhizome was most frequently used part (43%) followed by roots (27%), leaves (19%), whole plant (5%), stem, latex and flower (2%) (Fig. 3). It was found that most of the plant parts are taken individually to cure diseases. Frequent use of rhizome is may be due to the presence of many important phytochemicals. Phytochemical testing of *B. ciliata* rhizome showed the presence of high amount of tannins, phenolics and flavanoids [17]. In present study it was found that for the treatment of skin diseases most used parts were stem and leaves. According to some researchers [7,39,40] stem and leaves of *B. ciliata* are used for the treatment of cuts, wounds and boils. [41] also reported the use of leaves for the treatment of skin diseases. Kidney and urinary disorders was the third major category of diseases cured by *B. ciliata*. Some scientists [13,32,38,42] reported the use of roots and rhizome to cure kidney stones and urinary disorders. In literature [4], litholytic activity of *B. ciliata* rhizome is also reported in detail. Similarly the present review witnessed use of different parts of plant to cure muscular skeletal disorders (10%), respiratory problems (8%), eye diseases (3%), oral infection (3%), worm infection (3%), gynecological disorders (3%), ENT (1%), fever (7%) and many other diseases (8%). Blood cancer was also found to be cured from roots and leaves of *B. ciliata* [43]. Modes of utilization or preparations were decoction, juice, paste, powder, tea and extract. Most commonly used preparation were powder (29%) followed by decoction (20%), juice (21%), paste (21%), tea (6%) and extract (3%). Powder was found to be most common mode of utilization; this might be due to the hard nature of rhizome and roots. According to some workers [44], in traditional medicine system rhizome is used in powder form. All ethno-pharmacological uses of *B. ciliata* are mentioned in Table 2. Fig. 3 showed *B. ciliata* country wise research work on this plant along with their medicinal uses Fig. 4.