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Phytochemical constituents and pharmacological activities of *Breonadia salicina* (Vahl) Hepper and J.R.I.Wood (Rubiaceae)

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Abstract

Background: Medicinal plants have been the mainstay for the treatment of various diseases since antiquity. The importance of ethnomedicinal plants in drug discovery and development can never be overemphasized. *Breonadia salicina* (Vahl) Hepper and J.R.I.Wood (Rubiaceae) is a medium to a large plant that is widely distributed in the tropical and subtropical regions; the leaf, stem bark, and the root have been used in folk medicine for the treatment of cancer, arthritis, inflammation, wound infections, fever, diarrhoea, and vomiting. Studies showed that the plant contains several phytochemical compounds, some of which were isolated in their pure form from various parts of the plant. The compounds isolated include ursolic acid, α-amyrin, stigmasterol, and sitosterol. Other essential compounds isolated were 7-(β-D-apiofuranosyl-(1 → 6)-β-D-glucopyranosyl) umbelliferone (Adicardin), 7-hydroxycoumarin, and 6-hydroxy-7-methoxycoumarin. Literature works on *B. salicina* are limited, and information regarding its nutritional value is lacking. However, the leaf of the plant is used as food preservative.

Main body: This review is a compilation of information obtained from scholarly databases including ScienceDirect, ResearchGate, Sci-Hub, Wiley Online Library, and Google Scholar using search keywords related to the topic of the review. The articles were selected based on the year of publication, which was from 2010 to 2021, but some older references were still be included in this review because some data in recent articles were cited from older sources. This review focuses on the ethnomedicinal uses of this plant as well as the underpinning experimental evidence of its pharmacological activities such as antibacterial, antifungal, and anti-trypanasomal activities.

Conclusion: There is a need to explore the potentials of this plant by initially isolating and characterizing the bioactive compounds and then subsequently evaluating its various pharmacological activities and be considered for further development to a novel therapeutic compound.

Keywords: Phytochemistry, Rubiaceae, *Breonadia salicina*, Ethnomedicinal, Pharmacological activities

Background

Man has been utilizing plants for maintenance of his health and well-being since antiquity (Saranraj et al. 2016; Wyk and Albrecht 2008). Plants are capable of providing health care benefit to humans through the active principle they produced for their growth, development, and protection (Farombi 2003; Saranraj and Sivasakthivelan

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2012; Mahapatra et al. 2012). Many conventional drugs and medicines currently in use originate from plants (Baker and Smart 1995; Siva Sakthi et al. 2011). The world is currently witnessing a rebirth of interest in the use of plants and herbal products for medication, which could be a reflection of the continuous and increasing awareness of the limitations of synthetic pharmaceutical products in the management of life-threatening diseases such as cancer (Fabricant and Farnsworth 2011; Ekor 2014). The vast majority of the world's dwellers dependence on plants as sources of medicine is due to their availability, affordability, and relative safety (World Health Organization, World Health Organization Staff 1999; Ajibesin 2011). Researchers, therefore, intensified efforts more than ever in drug discovery and development from plants with the aim of validating and exploring ethnomedicinal plants, yet only a fraction of the world's flora have been screened for biological activities (Maplestone et al. 1992; Cragg and Newman 2005). This review focuses on *Breonadia salicina*, a plant well known for its medicinal application in traditional medicine in different communities. Although limited, phytochemical and biological studies have been conducted on the leaf, stem bark, and the root of the plant, which are discussed in this review.

Fig. 1 *Breonadia salicina* in its natural habitat

The family Rubiaceae

Breonadia salicina (Fig. 1) is a species belonging to the family Rubiaceae. Rubiaceae is the fourth most abundant flowering plant family (Delprete and Jardim 2012), consisting of 13,000 species, 620 genera, and three subfamilies (Bremer and Eriksson 2009). They grow all over the globe, including Antarctica, where some genera such as *Coprosma*, *Galium,* and *Sherardia* survive (Davis et al. 2007). There is great diversity in the family, from small to higher plants, weedy herbs to large rainforest trees (Bremer and Eriksson 2009). The family is divided into three subfamilies: Rubioideae, Cinchonoideae, and Ixoroideae (Martins and Nunez 2015). Chemical constituents common to the family include alkaloids such as emetine, boroxine, borreline, borrerine, and other indole alkaloids (Conserva et al. 2012). Flavonoids commonly found in the family include but not limited to astragalin, kaempferol, and quercetin (Bhadoria and Gupta 1981). Amyrin, ursolic acid, and sitosterol are among the commonly occurring terpenoids in the family (Benjamin 1980).

The genus

The genus *Breonadia* has just one species, *Breonadia salicina*, making it a monotypic genus of flowering plants in the Rubiaceae family (Gabayi 2017). *B. salicina* is a monoecious plant with leaves occurring in an alternate, the leaf shape is lanceolate, and leaf surface is leathery, while the margin is entire. Its flowers are small, yellow, and aromatic in odour. Its fruit is a capsule that clusters in a small sphere. It has two leaf-like bracts along its circumference. The stamens are thread-like forming spout into the crag of the expanding conduit. The ovary develops with two chambers and slightly yellow balls presenting the leaves from November until March. The wood is yellowish, rough, thick, long-lasting, and oily feel (Coates Palgrave et al. 2002).

The species

Breonadia salicina (Fig. 1) is a medium- to a large-sized plant that grows along the river coast and streams of the tropical and subtropical countries (Al-Qurainy et al. 2013). It is widely distributed in the north-east of South Africa and other countries such as Zimbabwe, Mozambique, and Madagascar as well as some parts of Malawi, Ethiopia, Nigeria, Yemen, and Saudi Arabia (Sani et al. 2018; Bello et al. 2013).

The plant is commonly called *Matumi*, and it is recognized by several local names such as *Leggel* by the Fulani natives of Northern Nigeria, *Kadanyar rafi* by the Hausa communities in Nigeria (Sani et al. 2018; Bello et al. 2013); *Mohlome* by the Sotho natives of Lesotho and small communities in South Africa and Zimbabwe, while

the Zulu of South Africa named it *Umfomfo* (Baard and Kraaij 2014).

Ethnobotanical uses of Breonadia salicina

Breonadia salicina is widely used in the treatment of cancer, gastrointestinal disease, fever, headaches, arthritis, diabetes, inflamed wounds, and ulcers. It has also been used to protect against diarrhoea (Sibandze et al. 2010). The locals of North Central Nigeria use the plant for treating sleeping sickness and respiratory derangement (Nvau et al. 2019). Fulani-speaking communities use the plant in the treatment of trypanosomiasis (Al-Qurainy et al. 2013). The plant's stem bark is used for the treatment of gastric and other abdominal diseases in South Africa (Mahlo et al. 2013). A decoction of the stem bark is used in the treatment of diarrhoea and bloody stool. In contrast, the dried powdered stem bark is sprinkled on fresh injuries and wound to provide analgesia and prevent microbial infections (Neuwinger 1996; Venter and Venter 2002; Amusan et al. 2002). The Zulu natives of South Africa use root's decoction to treat heart disease (Arnold and Gulumian 1984). Tanzanians consume root decoctions as a purgative to treat constipation and abdominal discomfort (Martins and Nunez 2015). Diarrhoea and vomiting complaints among breastfeeding children in Ethiopia were treated with an infusion of the pounded stem bark of the plant. Local alcoholic drink in Madagascar is being supplemented by the addition of the powdered stem bark, while a leaf decoction is prepared and taken for the treatment of malaria fever. In Malawi, leaf infusion of the plant is used for the treatment of diarrhoea and stomach ache (Bisi-Johnson et al. 2010).

Main text

Chemical constituents of *Breonadia salicina*

According to Neuwinger (Neuwinger 1996), *Breonadia*'s twigs contain triterpenes and saponins in abundance; the stem contains high levels of tannins, while the wood is rich in polyphenols and quinolines. Mahlo and Eloff (Mahlo and Eloff 2014) reported the isolation of ursolic acid (Table 1) from the acetone leaf extract of the plant, which displayed vigorous antifungal activity. Nvau et al. (Nvau et al. 2019) elucidated six other chemical compounds from the stem bark of the plant, while Tlhapi et al. (Tlhapi et al. 2021) has recently isolated another eight compounds from the same part. The compounds isolated and identified are 7-(β-D-apiofuranosyl-(1 → 6)-β-D-glucopyranosyl)-umbelliferone and is called adicardin which is a two-sugar substituted coumarin that readily occurs in plants. Others are 7-hydroxycoumarin, and 6-hydroxy-7-methoxycoumarin (Table 2), α-amyrin, stigmasterol, and sitosterol (Table1), kaempferol 3-*O*-(2″-*O*-galloyl)-glucuronide, lupeol, D-galactopyranose, bodinioside Q, 5-*O*-caffeoylquinic acid, sucrose, hexadecane, and palmitic acid (Table 3). The phytochemistry and phytochemical compositions of *Breonadia salicina* confirming the species are promising in obtaining constituents with medicinal potential primarily antioxidant potential.

Pharmacological activities of *Breonadia salicina*

Ethno-medically, *B. salicina* is used in the treatment of various conditions, including cancer, arthritis, related gastrointestinal diseases, diabetes, inflamed wounds, ulcers, bacterial and fungal infections (Al-Qurainy et al. 2013; Sani et al. 2018; Mahlo et al. 2013; Mahlo and Eloff 2014). However, just a few biological studies were conducted despite its extensive usage among rural dwellers and herbalists, especially in tropical and subtropical regions. Moreover, many of the reports on the biological activities of this plant have been limited to crude extracts. Thus, there is a crucial to isolate compounds from different parts of *B. salicina* and evaluate their pharmacological activities which can contribute to human health. The few pharmacological activities associated with *B. salicina* are described in Table 4.

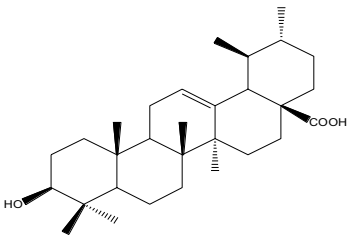
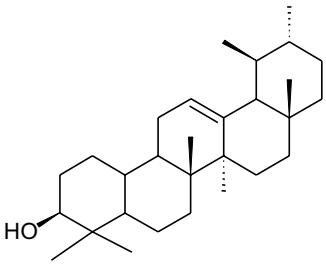
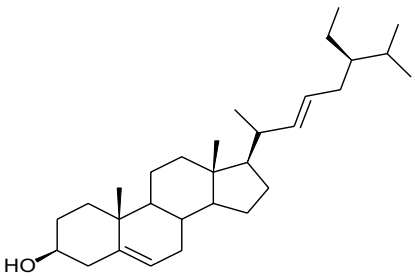
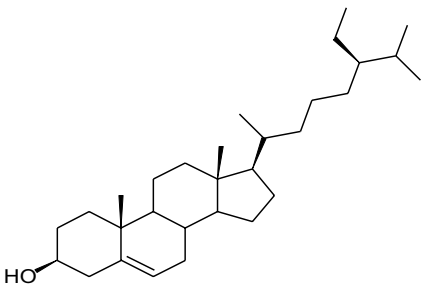
Antibacterial activity

Al-Qurainy et al. (Al-Qurainy et al. 2013) studied the antibacterial activity of the *Breonadia salicina* leaf following extraction with methanol and water. The extracts were screened against *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Shigella sonnei*, *Escherichia coli*, and *Staphylococcus aureus*. Both extracts were active against these bacterial pathogens, but the response of the bacteria tested displayed different sensitivities to the extracts. The minimum inhibitory concentration (MIC) for methanol extract was 1.5 mg/mL for *S. sonnei,* followed by *S. aureus* at 2 mg/mL and *E. coli* at 2.5 mg/mL. At the same time, *P. aeruginosa* is the least sensitive (3 mg/mL). Similarly, the aqueous extract showed the same activities against all the tested bacteria at a concentration of 2.5 mg/mL. This report suggested that the leaf of *B. salicina* is a weak antibacterial agent since the MIC was in milligrams. The activity was not comparable to the standard agent. Other parts of the plant may show better activity if tested. However, the leaf may show better activity if purified, ultimately revealing the actual bioactive principles responsible for its antibacterial activity. The leaf may also exhibit a more potent effect in a multi-component preparation with other plants due to synergy.

Antifungal activity

Mahlo and Eloff (Mahlo and Eloff 2014) reported the isolation of ursolic acid from acetone leaf extract of the *B. salicina*. The antifungal studies of the acetone leaf extract and

Table 1 Terpenes and sterols isolated from *Breonadia salicina*

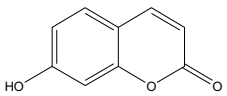
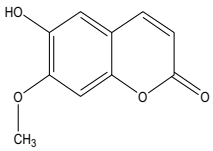
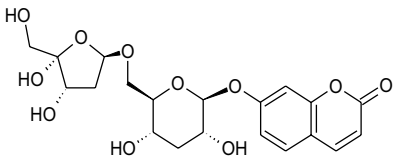
Compound	Chemical structure	Plant's part	References
Ursolic acid		Leaf	Mahlo and Eloff (2014)
α-amyrin		Stem bark	Nvau et al. (2019)
Stigmasterol		Stem bark	Nvau et al. (2019)
Sitosterol		Stem bark	Nvau et al. (2019)

the ursolic acid identified from leaf extract were conducted against three essential plant fungal pathogens (*Penicillium expansum, Penicillium janthinellum*, and *Penicillium digitatum*), while amphotericin B was used as the positive control. The crude extract exhibited substantial antifungal activities against *P. digitatum* similar to the activities of ursolic acid with an MIC value of 0.16 mg/mL compared to a value of 0.08 mg/mL for amphotericin B.

Antimicrobial activity of B. salicina in combination with other plants

Combinational therapy in medical practice is very typical and is appropriate for therapeutic benefit compared to single agents. Combination therapy is convenient for broadening the spectrum of activity of the antimicrobial agent, leading to the prevention of treatment failure as well as antimicrobial resistance. The combination of drugs may have different mechanisms of action, clearly different from a single agent, thus providing their physiological actions at specific body sites. However, the overall effects of the combination therapy can either surpass the predicted effect (synergism) or nullify the biological effects of each other, resulting in a reduced effect (antagonism) (Sibandze et al. 2010). An additive relationship exists where the cumulative action is equal to the sum of each drug's action when used alone (Boucher and Tam

Table 2 Coumarins isolated from *Breonadia salicina*

Compound	Chemical structure	Plant's part	References
7-hydroxycoumarin		Stem bark	Nvau et al. (2019)
6-hydroxy-7-methoxycoumarin		Stem bark	Nvau et al. (2019)
7-(β-D-apiofuranosyl-(1 → 6)-β-D-glucopyranosyl)-umbelliferone (adicardin)		Stem bark	Nvau et al. (2019)

2006). Sibandze et al. (Sibandze et al. 2010) conducted antidiarrheal activities of *Ozoroa sphaerocarpa*, *Syzygium cordatum*, and *B. salicina* (Table 5). The individual plant's antidiarrheal action showed that *O. sphaerocarpa* had the highest antimicrobial activity (MIC value of 1.2 mg/mL), followed by *S. cordatum* (MIC value of 1.44 mg/mL) and *B. salicina* (MIC value of 10.89 mg/mL). The combination of *S. cordatum* and *O. sphaerocarpa* gave the highest synergy (MIC value of 0.33 mg/mL). In comparison, there was a mild synergy between *S. cordatum* and *B. salicina* (MIC value of 1.00 mg/mL). Likewise, very efficient in inhibiting microbial growth (MIC value of 0.44 mg/mL) was the triple combination (1:1:1), used in the conventional preparation. *Breonadia salicina* and *S. cordatum's* antimicrobial activity increased upon the introduction of *O. sphaerocarpa*. These studies, therefore, demonstrated the synergistic action of *B. salicina* in multi-herbal composition with other plants.

Antibacterial activity of selected medicinal plants used in ethno veterinary medicine

Acetone extracts of five plants (*Breonadia salicina*, *Balanites maughamii*, *Dombeya rotundifolia*, *Hyperacanthus amoenus*, and *Piliostigma thonningii*) were tested on four selected bacterial type cultures, three gram negative (*Escherichia coli* ATCC 25,922, *Enterococcus faecalis* ATCC 29,212, and *Pseudomonas aeruginosa* ATCC 27,853) and one gram positive (*Bacillus cereus* ATCC 14,579). Mahlo and Chauke (Mahlo and Chauke 2013) performed antibacterial studies of the leaf extracts of *B. maughamii*, *D. rotundifolia*, and *P. thonningii,* and bark extracts of *B. salicina* and *H. amoenus* were used (Table 6). The selection of the plants was based on the information given by small-scale farmers regarding the use of plants on domestic livestock against various diseases. All the plant extracts, according to the authors, were active against the bacteria examined. Leaf extracts of *B. maughamii* and *P. thonningii* gave the most potent antibacterial actions against *E. faecalis* and *P. aeruginosa* (MIC value of 0.195 mg/mL). Bark extracts of *H. amoenus* and *B. salicina* were mildly effective against *B. cereus*, *E. coli*, and *E. faecalis* within MIC values of 0.39 and 0.78 mg/mL, respectively. Their findings confirmed and suggested that small-scale farmers had used the selected plant species in ethno veterinary medicine to fight bacterial derangement in livestock.

Anti-trypanasomal activity

Sani et al. (2018) investigated anti-trypanasomal activity of 70% and 100% ethanol extracts of *B. salicina* against *Trypanosoma brucei brucei.* The researchers monitored the activity of the plant using different concentrations at different time intervals. For a 70% ethanol extract, the parasites were found to be actively motile at 10-min incubation for 0.5, 2.5, 5, and 10 mg/mL concentrations. The parasites were weak for 2.5 and 5 mg/mL concentrations at 20-min incubation period with no motile parasites at 10 mg/mL in the same period. No parasites were motile for all concentrations at 30-min incubation period. The authors noted that the 100% ethanol extract displayed similar activities against the parasites at concentrations of 0.5, 2.5, 5, and 10 mg/mL. The parasites were actively motile at 10- and 20-min incubation periods at the above concentrations. The parasites were weak at 30 min, but at 40 min, no motile parasite was observed for all concentrations of the extract. They concluded, therefore, that both the 70% and 100% ethanol extracts of *B. salicina* exhibited anti-trypanasomal activities against

Table 3 Other compounds isolated from *Breonadia salicina*

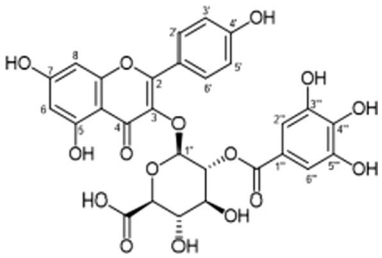
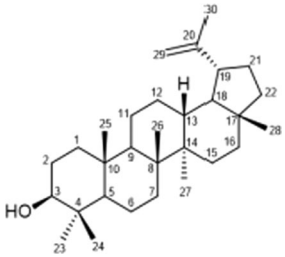
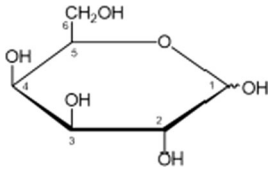
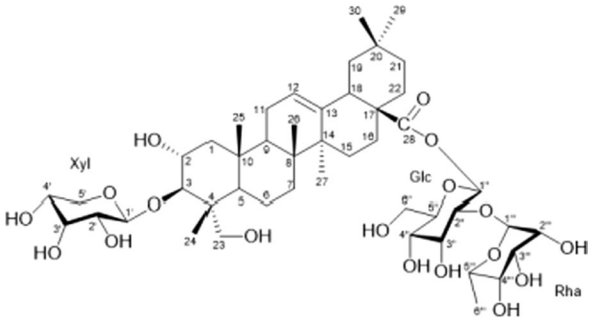
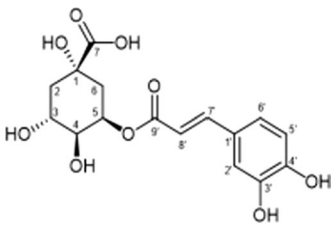
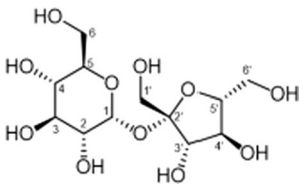
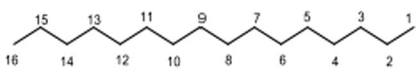
Compound	Chemical structure	Plant's part	References
Kaempferol 3-*O*-(200-*O*-galloyl)-glucuronide		Stem bark	Tlhapi et al. (2021)
Lupeol		Stem bark	Tlhapi et al. (2021)
D-galactopyranose		Stem bark	Tlhapi et al. (2021)
Bodinioside Q		Stem bark	Tlhapi et al. (2021)
5-*O*-caffeoylquinic acid		Stem bark	Tlhapi et al. (2021)
Sucrose		Stem bark	Tlhapi et al. (2021)
Hexadecane		Stem bark	Tlhapi et al. (2021)

Table 3 (continued)

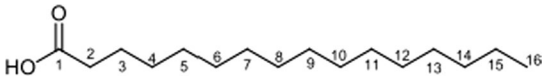
Compound	Chemical structure	Plant's part	References
Palmitic acid		Stem bark	Tlhapi et al. (2021)

Table 4 Pharmacological activities of *B. salicina*

Activity	Organism	Parameter		References
		Methanol extract (MIC in mg/mL)	Aqueous extract (MIC in mg/mL)	
Antibacterial	*B. subtilis*	1.5	2.5	
	E. coli	2.5	2.5	
	P. aeruginosa	3.0	2.5	Al-Qurainy et al. (2013)
	S. aureus	2.0	2.5	
	S. sonnei	1.5	2.5	
		Acetone extract (MIC in mg/mL)	Ursolic acid (MIC in mg/mL)	
Antifungal	*P. expansum*	1.25	0.13	
	P. digitatum	0.16	0.25	Mahlo and Eloff (2014)
	P. janthinellum	0.08	0.13	
Antitrypanasomal	*T. b. brucei*	Ethanol extract (lethal dose)		Sani et al. (2018)
		0.5 mg/mLat 40 min		
Cytotoxicity	Vero monkey kidney cell	Chloroform extract (IC_{50} in µg/mL)	Ursolic acid (IC_{50} in µg/mL)	Mahlo et al. (2013)
		82	25	

MIC: minimum inhibitory concentration; IC_{50}: median inhibitory concentration

Table 5 Antimicrobial activity of *B. salicina* in combination with other plants

Plant/ Combination	Combination ratio	MIC (mg/mL)	References
Ozoroa sphaerocarpa	–	1.20	
Syzygium cordatum	–	1.44	
Breonadia salicina	–	10.89	Sibandze et al. (2010)
Ozoroa sphaerocarpa	1:1	1.67	Sibandze et al. (2010)
Breonadia salicina			
Ozoroa sphaerocarpa	1:1	0.33	Sibandze et al. (2010)
Syzygium cordatum			
Breonadia salicina	1:1	1.00	Sibandze et al. (2010)
Syzygium cordatum			
Ozoroa sphaerocarpa	1:1:1	0.44	Sibandze et al. (2010)
Breonadia salicina			
Syzygium cordatum			

MIC minimum inhibitory concentration

Trypanosoma brucei brucei even at the lowest concentration (0.5 mg/mL) at 40-min incubation period.

This research showed that the leaf of *B. salicina* is a weak anti-trypanasomal agent since the lethal dose was in milligrams. The operation had not been equivalent to the regular agent. Other parts of the plant could show better activity if checked. However, if purified, the leaf could exhibit better activity, eventually revealing the actual bioactive principles responsible for its anti-trypanasomal behaviour. Owing to synergy, they can show more potent actions with other plants in a multi-component preparation.

Cytotoxicity

Mahlo et al. (2013) evaluated the cytotoxicity of a chloroform extract and ursolic acid against Vero monkey kidney cells. Cell suspension of the vero kidney was prepared from confluent monolayer cultures and plated at a density of 0.5×10^3 cells into each well of 96-well micro-titre plate. The plates were incubated overnight at 37 °C in a 5% CO_2 incubator, and the sub-confluent cells in the micro-titre were used in the cytotoxicity assay. Stock solution of the chloroform extract (200 mg/ml) and ursolic acid (20 mg/ml) were prepared in DMSO. Appropriate dilutions of the extract and ursolic acid were prepared

Table 6 Antimicrobial activity of selected plants used in ethno veterinary medicine (Mahlo and Chauke 2013)

Plant	Plant part	MIC (mg/ml)			
		S. aureus	*E. coli*	*E. faecalis*	*P. aeruginosa*
Balanites maughamii	Leaf	0.78	0.78	0.195	1.56
Breonadia salicina	Bark	0.78	1.56	0.78	0.78
Dombeya rotundifolia	Leaf	0.39	0.78	0.39	0.39
Hyperacanthus amoenus	Bark	1.56	1.56	0.39	0.78
Piliostigma thonningii	Leaf	0.39	0.78	1.56	0.195

MIC minimum inhibitory concentration

in growth media and added to the cells. The viable cell growth after 120-h incubation of the extract and ursolic acid was determined using tetrazolium-based colorimetric assay (3-(4,5-dimethylthiazol)-2,5-diphenyl tetrazolium bromide (MTT). Absorbance was measured on a microplate reader at 570 nm. The chloroform extract gave inhibition concentration (IC); IC_{50} of 82 µg/ml, which was slightly less lethal than ursolic acid with IC_{50} of 25 µg/ml. The high cytotoxic activities of the extract and the ursolic acid on the vero kidney cells suggested that the plant cannot be used for preservation purposes. It was believed that the cytotoxicity of the compound has linked with its antioxidant activity; thus, isolating the major compounds and to evaluate their role in the antioxidant activity is crucial.

Non-pharmacological studies conducted on *Breonadia salicina*

Assessment of genetic diversity

Gaafar et al. (2014) had performed an evaluation of genetic diversity in endangered populations of *B. salicina* growing in The Kingdom of Saudi Arabia. To consider the rate and division of genetic variability through *B. salicina* populations and geographical regions, the researchers revealed that there was minimal genetic variation within the population but high among the population. The variation in principle indicated the existence of species, which became extinct primarily due to environmental influences. There is great concern about extinction on the existing population of the species of *B. salicina* that calls for protection and conservation.

In a similar study conducted by Al-Qurainy et al. (Al-Qurainy et al. 2014), the researchers evaluated intergenic spacer sequences variation within *B. salicina*. The observed high level of diversity within the plant is likely to be because of the abundance of ancestral haplotype sharing. A nearly similar degree of genetic diversity has been observed in Yemeni population of the plant.

Conservation concerns

Breonadia salicina is a critically endangered plant species native to South-western Saudi Arabia on a local scale (Gaafar et al. 2014). There is a growing depletion of medicinal plant species due to overexploitation; however, some indigenous medicinal plants are endangered and threatened with extinction for other reasons such as climate change. Subsequent habitat loss for plant species, including but not limited to *B. salicina*, *S. cordatum,* and *O. sphaerocarpa*, is at stake (Al-Qurainy et al. 2014). Therefore, urgent action is needed to conserve them for bio-sustainability and conservation. Gaafar et al. (2014) suggested the following for conservation of *B. salicina*:

- The first proposed strategy part is the self-pollination mating system scheme for *B. salicina*.
- Creation of safe areas onsite for *B. salicina,* so that the impact of human activities will permit its ecosystems to escalate in size via natural regeneration to achieve successful population sizes.
- Via effective propagation and seedling management, plants may be imported from other populations to raise the possibility of gene exchange and recombination and to boost the degree of genetic diversity over time.
- Management activity is the setting up of an ex situ conservation system to capture much of the genetic variation observed and to enhance genetic diversity by crossing various populations.
- Seed and germplasm collection in botanical gardens or other institutions may be of great practical importance for the conservation of genetic diversity.

Micro-propagation protocols need to be established for all the endangered and threatened plant species. To reduce the depletion of the medicinal plant genetic resource, the coverage strategy of sustainable harvesting, traditional propagation methods, and plant biotechnology should be employed (Kunene and Masarirambi 2018).

Rainfall-driven variations

Holmgren et al. (2005) carried out rainfall-driven variations study of *B. salicina* trees from South Africa in

13C composition and wood morphology between AD 1375 and 1995. The study provided the rationales for the significant morphological and anatomical differences observed within and among the *B. salicina* species located in different habitats. The annual rainfall variations studies conducted translate into the noticeable differences in the plant's morphology and anatomy. This, therefore, depicts the variations in the size of the species located in different regions across the globe.

Conclusions

The use of medicinal plants continues to be a popular therapeutic choice worldwide, especially in developing countries; a revival of interest in the biologically active natural compounds in the industrialized countries has also been observed. The public views with concern the safety and desirability of synthetic compounds, whereas naturally derived chemicals and extracts are considered inherently safer and more desirable. *Breonadia salicina* has limited information regarding its nutritional values. However, the leaf is used as food preservative. *B. salicina* is among the plant species that enjoy the confidence of traditional medical practitioners in the treatment of various diseases. Scientific evidence has validated some of its pharmacological effects such as antibiotic, antifungal, anti-trypanasomal, and cytotoxic activities. However, there is a need to explore the potentials of this plant by initially isolating and characterizing the bioactive compounds and then subsequently evaluating its various pharmacological activities and be considered for further development to a novel therapeutic compound. It is hoped that the information provided in this review would serve as a useful tool for proper evaluation of the plant.

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UI, SS, and AFAR contributed to conceptualization and writing—original draft; HI, UAK, SIM and AFAR supervised the study; UI, HI, UAK, SIM, SS, WN.S, JS-R, and Ahmad FAR performed writing—review and editing. All authors have read and approved the manuscript.

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