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Bioactivities of *Desmostachya bipinnata* (L.) Stapf

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Abstract

Desmostachya bipinnata (L.) Stapf is a grass that goes to the Poaceae family. It is used to treat such as wounds, urinary tract disorders, rheumatism, piles, and cholera. Until now, there is no comprehensive systemic review of bioactivities of D. bipinnata. Thus, this article evaluates, reviews, and documents the reported bioactivities of this plant species. Reported studies show that various parts of D. bipinnata have anticancer, antibacterial, antiurolithiasis, antidiarrheal, hepatoprotective, and antioxidant activities. So far, only in vitro and in vivo levels of scientific evidence are existing for bioactivities. β-Sitosterol-D-glucopyranoside was the only bioactive compound that has been isolated from this plant species. This compound exhibited antibacterial activities. The findings of this work valuably contribute to future bioactivities and phytochemistry researches related to this plant species.

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Introduction

Desmostachya bipinnata (L.) Stapf [synonyms: *Briza bipinnata* L.; *Cynosurus durus* Forssk.; *Dactylis interrupta* Rottler ex Stapf; *D. cynosuroides* (Retz.) Stapf ex Massey; *D. pingalaiae* Raole & R.J.Desai; *Dinebra dura* Lag.; *Eragrostis bipinnata* (L.) K.Schum.; *E. cynosuroides* (Retz.) P.Beauv.; *E. thunbergii* Baill.; *Leptochloa bipinnata* (L.) Hochst.; *Megastachya bipinnata* (L.) P.Beauv.; *Poa cynosuroides* Retz.; *Pogonarthria bipinnata* (L.) Chiov.; *Rabdochloa bipinnata* (L.) Kuntze; *Stapfiola bipinnata* (L.) Kuntze; and *Uniola bipinnata* (L.) L.] is a grass that goes to the Poaceae family [1]. It is native to Asia (Afghanistan, Bangladesh, Cambodia, China, India, Iran, Iraq, Laos, Lebanon, Syria, Myanmar, Nepal, Oman, Pakistan, Palestine, Saudi Arabia, Thailand, Vietnam, and Yemen) and Africa (Algeria, Central African Republic, Chad, Egypt, Eritrea, Ethiopia, Kenya, Libya, Mauritania, Morocco, Niger, Somalia, Sudan, Tanzania, Tunisia, and Uganda) and introduced into Indonesia [1,2]. Furthermore, D. bipinnata is called Tharuppai in Tamil. This plant species broadly utilized in Saiva rituals in India and Sri Lanka. Various parts of D. bipinnata are utilized to cure many illnesses in traditional medicines. Leaves are applied to heal wounds and urinary tract disorders (1) and roots are used to treat rheumatism, piles, cholera, wounds, carbuncles, dysuria, leucorrhea, dysentery [2-4]. Also, culms are utilized to cure skin diseases, diarrhea, urinary tract disorders, asthma, liver disorders, and menorrhagia [5-7]. Compounds including 2,6-dihydroxy-7-methoxy-3H-xanthen-3-one, β-sitosterol-d-glucopyranoside, quercetin, apigenin, and luteolin have been isolated from this plant species [8,9].

The aim of this minireview to systematically analyze, summarize, and document the reported bioactivities of this *D. bipinnata*. As mentioned above, this plant species has numerous applications in traditional medicines. Hence, this work will be useful to conduct future pharmacological and phytochemical studies of *D. bipinnata* regarding its traditional medicinal uses.

Materials and Method

Major electronic databases like the Web of Science, Scopus, PubMed, and ScienceDirect were employed to identify the suitable publications from 1900 to May 2021. "*Desmostachya bipinnata*" was utilized as an exploration term and only articles related to bioactivities were taken into account in this work.

Results and discussion

Reported bioactivities

More data together with the level of scientific evidence, bioactivity, part used, extract, bioassay/model, dose/concentration, duration, and reference are presented in Table 1. So far, only *in vitro* and *in vivo* levels of scientific evidence are existing for the bioactivities of these different parts of plant species. More *in vitro* evidence available and the majority of the studies were carried out to study the antibacterial activities. The methanol extract was used in a greater number of investigations and roots exhibited more bioactivities of this plant species. Anyhow, only one bioactive compound has been isolated from *D. bipinnata*. β-Sitosterol-D-glucopyranoside isolated from leaves exhibited antibacterial activities [9]. Traditional medicinal uses such as urinary tract disorders, cholera, and liver disorders only have been evidenced by some researches. Only more important reported studies

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(based on the lower concentration / dose) are deliberated below.

Reported *in vitro* studies

Antibacterial activity

Aerial, leaf, and whole plant of this plant species showed antibacterial activities. β-Sitosterol-D-glucopyranoside at (MIC 6.2 µg/ml) isolated from leaves exhibited antibacterial activity in *Vibrio cholera* assay [9].

Anticancer activity

A study conducted by Rahate et al. (2012) used root methanol (70%) (IC_{50} 109 µg/mL) in human cervical cancer cell lines [10].

Table 1: Reported bioactivities of *D. bipinnata*

Level of scientific evidence	Bioactivity	Part used	Extract/Compound	Assay/Model	Dose/Concentration	Ref.
In vitro	Antibacterial	Aerial	Ethanol (95%), ether, n-butanol	Helicobacter pylori	30 µL	[13]
In vitro	Antibacterial	Leaf	Methanol (70%)	*Bacillus subtilis, Shigella dysenteriae*	200 µg/mL	[9]
			Methanol (70%)	*Enterococcus faecalis, Staphylococcus aureus*	400 µg/mL	
			Methanol (70%)	*Escherichia coli*	460 µg/mL	
			Methanol (70%)	*Klebsiella pneumonia*	320 µg/mL	
			Methanol (70%)	*Vibrio cholera*	250 µg/mL	

Antidiarrheal activity

Methanol (70%) was prepared using the whole plant (100 mg/kg) was orally administered to castor oil–induced diarrhea in mice. After 6 hours antidiarrheal activity was observed and the health conditions were improved [11].

Antioxidant activity

Root and whole plant of this plant unveiled antioxidant activities. Root hydroalcoholic extract at 23 µg/mL (IC_{50}) showed antioxidant activity in the ferric reducing ability of plasma assay [12].

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Level of scientific evidence	Bioactivity	Part used	Extract/Compound	Assay/Model	Dose/Concentration	Ref.
			β-Sitosterol-D-glucopyranoside	*Bacillus subtilis, Escherichia coli*	12.5 µg/mL (MIC)	
			β-Sitosterol-D-glucopyranoside	*Enterococcus faecalis*	15 µg/mL (MIC)	
			β-Sitosterol-D-glucopyranoside	*Klebsiella pneumonia, Proteus mirabilis*	25 µg/mL (MIC)	
			β-Sitosterol-D-glucopyranoside	*Proteus vulgaris*	17 µg/mL (MIC)	
			β-Sitosterol-D-glucopyranoside	*Pseudomonas aeruginosa*	10 µg/mL (MIC)	
			β-Sitosterol-D-glucopyranoside	*Shigella dysenteriae*	12 µg/mL (MIC)	
			β-Sitosterol-D-glucopyranoside	*Staphylococcus aureus*	24 µg/mL (MIC)	

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Level of scientific evidence	Bioactivity	Part used	Extract/Compound	Assay/Model	Dose/Concentration	Ref.
			β-Sitosterol-D-glucopyranoside	*Vibrio cholera*	6.2 µg/mL (MIC)	
In vitro	Antibacterial	Whole plant	Acetone, chloroform, ethanol, petroleum	TLC bio-autography for antibacterial activity (*Pseudomonas aeruginosa*)	NS	[14]
In vitro	Anticancer	Root	Methanol (70%)	Human cervical cancer cell	109 µg/mL (IC_{50})	[10]
			Methanol (70%)	Human laryngeal epithelial carcinoma cell	166 µg/mL (IC_{50})	
			Methanol (70%)	NIH/3T3 cell	216 µg/mL (IC_{50})	
In vitro	Antioxidant	Root	Hydroalcohol	DPPH radical scavenging	78 µg/mL (IC_{50})	[12]
			Hydroalcohol	Ferric reducing ability of plasma	23 µg/mL (IC_{50})	
In vitro	Antioxidant	Root	Methanol (70%)	DDPH free radical scavenging	471 µg/mL (IC_{50})	[10]
			Methanol (70%)	Hydrogen peroxide scavenging	127 µg/mL (IC_{50})	

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Level of scientific evidence	Bioactivity	Part used	Extract/Compound	Assay/Model	Dose/Concentration	Ref.
			Methanol (70%)	Hydroxyl radical scavenging	434 µg/mL(IC_{50})	
			Methanol (70%)	Nitric oxide radical scavenging	163 µg/mL (IC_{50})	
In vitro	Antioxidant	Whole plant	Acetone, chloroform, ethanol, petroleum	TLC bioautography for antioxidant activity	NS	[14]
In vitro	Hepatoprotective	Root	Methanol (70%)	BRL3A cell	NS	[8]
In vivo	Antidiarrheal	Whole plant	Methanol (70%)	Castor oil-induced diarrhea in mouse	100 mg/kg	[11]
In vivo	Anti-urolithiasis	Aerial	Aqueous	Rat	400 mg/kg	[15]
In vivo	Hepatoprotective	Root	Methanol (70%)	Tamoxifen-induced hepatotoxic rat	100 mg/kg	[8]
In vivo	Sedative	Root	Aqueous	Mouse	10 mL/kg	[16]

AbbreviationsDPPH: (1,1-diphenyl-2-picrylhydrazyl); IC_{50}: Half maximal inhibitory concentration; MIC: The minimum inhibitory concentration; NA: Not applicable; NS: Not stated; TLC: Thin Layer Chromatography

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In vivo studies

Anti-urolithiasis activity

Kishore et al. (2014) orally administered 400 mg/kg of aerial aqueous extract to rats for 10 days improved urolithiasis conditions [15].

Hepatoprotective activity

Root methanol (70%) extract (100 mg/kg) was orally directed to tamoxifen-induced hepatotoxic rats for 21 days showed protective effects in the liver [8].

Sedative activity

An extract prepared root and water (10 mL/kg) was injected into mice observed sedative effects after 30 minutes [16].

Conclusion

Reported bioactivities approve the ethnomedicinal uses of *D. bipinnata*. On the other hand, more ethnomedicinal uses have no scientific evidence at the moment. Therefore, more *in vitro, in vivo*, and clinical investigations should be carried out in the future. Also, the active compounds should be discovered and they might be a lead compound in a future drug. The findings of this work valuably contribute to future bioactivities and phytochemistry researches related to this plant species.

Conflict of interest

None of the authors have any conflict of interest to declare.

Consent for publications

All authors approved the final manuscript for publication.

Availability of data and material

Data are available on request from the authors.

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