



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-glucoopyranoside 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. pingalatae* 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, leucorrhoea, dysentery [2-4]. Also, culms are utilized to cure skin diseases, diarrhoea, 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

(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 $\mu\text{g/ml}$) 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 $\mu\text{g/mL}$) 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.
<i>In vitro</i>	Antibacterial	Aerial	Ethanol (95%), ether, n-butanol	<i>Helicobacter pylori</i>	30 μL	[13]
<i>In vitro</i>	Antibacterial	Leaf	Methanol (70%)	<i>Bacillus subtilis</i> , <i>Shigella dysenteriae</i>	200 $\mu\text{g/mL}$	[9]
			Methanol (70%)	<i>Enterococcus faecalis</i> , <i>Staphylococcus aureus</i>	400 $\mu\text{g/mL}$	
			Methanol (70%)	<i>Escherichia coli</i>	460 $\mu\text{g/mL}$	
			Methanol (70%)	<i>Klebsiella pneumonia</i>	320 $\mu\text{g/mL}$	
			Methanol (70%)	<i>Vibrio cholera</i>	250 $\mu\text{g/mL}$	

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

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

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

Abbreviations DPPH: (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

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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