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RESEARCH ARTICLE

PHARMACOLOGICAL ACTIVITIES OF *Nymphaea pubescens* WILLD. EXTRACTS

Saravanan Vivekanandarajah Sathasivampillai[a,b]* and Pholtan Rajamanoharan[c,d]

[a]*KnowledgeLink Group, Inc., Waltham, MA 02451, USA*
[b]*Boigai Institute, Batticaloa 30000, Sri Lanka*
[c]*Provincial Herbal Garden Management Center, Trincomalee 31000, Sri Lanka*
[d]*Planning Unit, Provincial Department of Indigenous Medicine, Trincomalee 31000, Sri Lanka*
Corresponding Author E-mail:* **vivekanandarajahs@yahoo.co.uk

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ABSTRACT

Nymphaea pubescens Willd belongs to the *Nymphaeaceae* family. This plant species is used to treat various diseases including diabetes, diarrhea, dysentery, hemorrhages, and indigestion in traditional medicines around the world. Compounds like Arbutin, D-malic acid, Ergosterol, Fumaric acid, and Gluconic acid have been isolated from *N. pubescens*. As *N. pubescens* pharmacological activities are not systematically reviewed, this review is intended to analyze, recap, and document the reported bioactivities of *N. pubescens*. Appropriate published papers were obtained using the Web of Science, Scopus, PubMed, and ScienceDirect databases from 1900 to June 2021. Until now, anticancer, antidementia, antidiabetic, antihepatotoxic, antiinflammatory, antioxidant, and hypolipidemic activities have been reported for different parts of *N. pubescens*. Remarkably, hitherto, no pharmacological active compound has been isolated from *N. pubescens*. This review provides a foundation for future research on this plant species.

KEYWORDS

Nymphaea pubescens, Nymphaeaceae, Sri Lanka, Siddha Medicine, Ayurveda.

1. INTRODUCTION

Nymphaea pubescens Willd. [synonyms: *Castalia pubescens* (Willd.) Wood; *Nymphaea devoniensis* Hook.; *Nymphaea purpurea* Rehnelt & F.Henkel; and *Nymphaea semisterilis* Lehm.] belongs to the *Nymphaeaceae* family. It is called செங்கழுநீர் (Sengkaluneer) in Tamil and red water-lily in English. *N. pubescens* is native to Sri Lanka, India, New Guinea, Philippines, Australia, Bangladesh, Vietnam, Cambodia, Thailand, China, Laos, Pakistan, Myanmar, and Malaysia and it has been introduced into Cuba (Kew Science, 2021). This plant species is used to treat various diseases including diabetes, diarrhea, dysentery, hemorrhages, indigestion, eye illnesses, jaundice, cancer, and inflammation in traditional medicines around the world (Karthiyayini et al., 2011; Nadkarni, 1996; Sathasivampillai et al., 2017, 2018, 2016, 2015). Compounds like Arbutin; Benzoic acid; D-malic acid; D-mannitol; D-threitol; Ergosterol; Estradiol; Fumaric acid; Gallic acid; Gluconic acid; Glyceric acid; Glycolic acid; Isoquercitrin; Kaempferol; Malonic acid; Myricetin; Niotinic acid; Oxalic acid; Quinic acid; Shikimic acid; Stigmasterol; Succinic acid; and Uric acid have been isolated from *N. pubescens* (Acharya et al., 2018). As *N. pubescens* pharmacological activities are not systematically reviewed, this review is intended to analyze, recap, and document the reported bioactivities of *N. pubescens*.

2. MATERIALS AND METHODS

Appropriate published papers were obtained using the Web of Science, Scopus, PubMed, and ScienceDirect databases from 1900 to June 2021. "*Nymphaea pubescens*", "*Castalia pubescens*", "*Nymphaea devoniensis*", "*Nymphaea purpurea*", and "*Nymphaea semisterilis*" served as search words.

3. RESULTS AND DISCUSSION

3.1 Reported pharmacological activities of *N. pubescens*

At this time available reported pharmacological activities of *N. pubescens* are listed in Table 1. Until now, anticancer, antidementia, antidiabetic, antihepatotoxic, antiinflammatory, antioxidant, and hypolipidemic activities have been reported for different parts of *N. pubescens* (Acharya et al., 2018; Aimvijarn et al., 2018; Angadi et al., 2013; Debnath et al., 2013; Karthiyayini et al., 2011; Shajeela et al., 2012). However, there are more antidiabetic activity studies have been reported. Parts of plants like flowers, tubers and leaves showed different pharmacological activities. Nevertheless, the flowers showed more pharmacological activities. Ethanol, methanol, aqueous, chloroform, and methanol extracts were used in the reported investigations. While, methanol extract was used in the majority of the investigations. Remarkably, hitherto, no pharmacological active compound has been isolated from *N. pubescens*. Hence, more phytochemical studies should be carried out to identify various pharmacological active compounds from this plant species.

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Table 1: Reported pharmacological activities

Level of scientific evidence	Bioactivity	Part used	Extract	Assay / model	Dose / concentration	Reference
In vivo	Antidiabetic	Flower	Aqueous, Ethanol	Alloxan-induced diabetic	400 mg/kg	Karthiyayini et al. (2011)
In vivo	Antidiabetic	Leaf	Methanol	Alloxan-induced diabetic	250 mg/kg	Angadi et al. (2013)
In vivo	Antidiabetic	Tuber	Ethanol	Alloxan-induced diabetic	200 mg/kg	Shajeela et al. (2012)
In vivo	Antihepatotoxic	Flower	Aqueous	CCl_4-induced hepatotoxic	500 mg/kg	Debnath et al. (2013)
In vivo	Antiinflammatory	Flower	Aqueous	Carrageenan-induced rat paw edema	500 mg/kg	
In vivo	Hypolipidemic	Leaf	Methanol	Alloxan-induced diabetic	250 mg/kg	Angadi et al. (2013)
In vivo	Hypolipidemic	Tuber	Ethanol	Alloxan-induced diabetic	200 mg/kg	Shajeela et al. (2012)
In vitro	Anticancer	Flower	Ethanol	B16 melanoma cell	800 µg/ml	Aimvijarn et al. (2018)
In vitro	Antidementia	Flower	Methanol	Acetylcholinesterase inhibitory	51.33 µg/ml (IC_{50})	Acharya et al. (2018)
In vitro	Antioxidant	Flower	Aqueous	DPPH	37 µg/ml (EC_{50})	Debnath et al. (2013)
In vitro	Antioxidant	Flower	Aqueous	Fe^{2+} chelating	98 µg/ml (EC_{50})	
In vitro	Antioxidant	Flower	Aqueous	NO radical scavenging	98 µg/ml (EC_{50})	
In vitro	Antioxidant	Flower	Aqueous	O^{2-} radical	20 µg/ml (EC_{50})	
In vitro	Antioxidant	Flower	Chloroform	DPPH, Fe^{2+} chelating, NO radical scavenging, O^{2-} radical	500 µg/ml (EC_{50})	
In vitro	Antioxidant	Flower	Ethanol	DPPH	0.33 Vitamin C equivalent/g	Aimvijarn et al. (2018)
In vitro	Antioxidant	Flower	Ethanol	FRAP	3.64 M $FeSO_4$/g	
In vitro	Antioxidant	Flower	Methanol	DPPH	154 µg/ml (EC_{50})	Debnath et al. (2013)
In vitro	Antioxidant	Flower	Methanol	Fe^{2+} chelating	89 µg/ml (EC_{50})	
In vitro	Antioxidant	Flower	Methanol	NO radical scavenging	500 µg/ml (EC_{50})	
In vitro	Antioxidant	Flower	Methanol	O^{2-} radical	42 µg/ml (EC_{50})	

Abbreviation:
CCl_4: Carbon tetrachloride; DPPH: 1,1-diphenyl-2 picrylhydrazyl; EC_{50}: Half maximal effective concentration; Fe^{2+}: Ferrous ion chelating; $FeSO_4$: Ferrous sulfate; FRAP: Ferric reducing anti-oxidant power; NO: Nitric oxide; O^{2-}: Superoxide radical scavenging

4. Conclusion

This work analyzed, recapped, and documented the bioactivities associated with the works published using *N. pubescens*. This review will be helpful for future pharmacological and phytochemical studies using this plant species. In addition, this review provides a foundation for future research on this plant species.

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