

Blechnum orientale Linn.: An Important Edible Medicinal Fern

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ABSTRACT

Blechnum orientale Linn. (Family: Blechnaceae), commonly known as ‘Centipede fern’ is an important edible medicinal fern in Malaysia. In addition to its use as a vegetable, the plant is documented in ethnomedicine to possess several medicinal benefits in treating cuts and wounds, stomach pain and urinary bladder complaints, typhoid fever and inflammatory diseases. The pharmacological studies have shown that the plant possesses numerous notable biological activities such as antioxidant, anticancer, antidiabetic, antimicrobial and wound healing activities. A few phytoconstituents have been reported from the plant. Preliminary phytochemical screening reveals that the plant is rich with polyphenolic compounds which are responsible for its potential antioxidant activity. Further studies on this plant may bring out some new and interesting findings on its pharmacological activity.

Key words: *Blechnum orientale* Linn., antioxidant, cytotoxic, edible fern

INTRODUCTION

The use of plants for medicinal purposes is as old as human civilization. Plants have become the major source of medication for preventive, curative, protective or primitive purposes. Several studies have been shown that vegetables provide a good source of remedy against several diseases and ailments. Many plants contain flavonoids and polyphenols, as secondary metabolites that serve as a source of natural antioxidants. Thus, dietary antioxidants have attracted the attention of the researchers since they can protect the body from oxidative stress, which is regarded as prime cause of several deadly diseases including ageing, cardiovascular diseases and cancer.

Taxonomy¹:

Kingdom - Plantae
Phylum/Division - Filicophyta
Class - Pteridopsida
Order - Polypodiales
Family - Blechnaceae
Genus - Blechnum
Species – *B. orientale*

Description: *Blechnum orientale* L. (Family: Blechnaceae) commonly known as the ‘Centipede fern’, is an evergreen tropical fern with arching fronds up to 200 cm height originating from a thick rhizome that rises to an erect trunk^{2,3}. The fronds are pinnate and rarely simple. Pinnae are linear, entire or dentate. Sori are on the underside of the pinnae, linear and aligned to the midrib. The indusia are narrow and open towards the midrib. The rhizome is densely covered with narrow, dark brown scales¹.

Habitat: Terrestrial at middle to high elevations, usually found in exposed, drier areas, often in colonies.

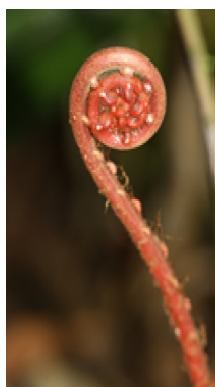
Distribution. The plant is common along road sides in rainforest or dry areas. The fern is sometimes cultivated as an ornamental plant^{2,3}.

Traditional Uses

The entire plant is reported to be used orally for sterilization of women⁶. Complete sterility is claimed by women after eating the top new leaves for three days, followed by repeating the treatments after giving a gap for two weeks⁷. The leaves are applied externally to treat blisters, boils, carbuncles and sores in Malaysia,^{8,9}. Leaves are also reported to be used in treating stomach pain and urinary bladder complaints^{10,11}. The rhizomes are believed to be anthelmintic and also recommended in the treatment of typhoid¹². In India, the paste of young frond and rhizome together with dried ginger powder is applied over fresh cuts and wounds to reduce pain and stop bleeding¹³. Young fronds are boiled and eaten as vegetable by the natives^{14,15}. The fresh fronds are also used to cure intestinal worm infestations and as diaphoretic¹⁶.

Phytochemistry

A few phytochemicals have been reported from this plant. Blechnic acid, 8-epiblechnic acid and brainic acid are reported from the fronds¹⁷. Other studies demonstrated presence of 22-dehydrocampesterol, 24- α -ethyl-cholest-5-en-3-beta-ol, 24- α -ethyl-methyl-cholest-5-en-3-beta-ol, 24- β -methyl-cholest-5-en-3-beta-ol, 24- α -cholest-5, 22-dien-3-beta-ol and cholesterol in the entire plant¹⁸. Presence of chlorogenic acid¹⁹ and tannins²⁰ have been identified in the plant, but alkaloids are reported to be absent in leaf and stem²¹.

*Blechnum orientale* Linn.⁴New frond unfurling⁵

Pharmacology

B. orientale has been screened scientifically for various pharmacological activities and found to possess significant antioxidant, cytotoxic, antidiabetic, antimicrobial and wound healing activities.

Antioxidant activity

A study was undertaken to evaluate the antioxidant and tyrosinase inhibiting activities of the methanol extracts of the leaves of five selected ferns such as *Acrostichum aureum*, *Asplenium nidus*, *Blechnum orientale*, *Cibotium barometez* and *Dicranopteris linearis* using ferrous ion chelating power, ferric ion reducing power, DPPH radical scavenging activity and β -carotene bleaching assays. Folin-Ciocalteu method was used to measure the total phenolic contents in the extracts. The results of the study revealed highest amount of total polyphenols in *B. orientale* and promising antioxidant and tyrosinase inhibiting activity²².

In another experiment, the petroleum ether, chloroform, ethyl acetate, butanol and aqueous solvent fractions from the methanol extract of the leaves of *B. orientale* were evaluated for antioxidant activity. The total phenolic content was assessed using Folin-Ciocalteu's method. The antioxidant activity was determined by measuring the scavenging activity of DPPH radicals. The results revealed that the ethyl acetate, butanol and aqueous fractions possessed strong radical scavenging activity. Preliminary phytochemical analysis revealed the presence of terpenoids, flavonoids and tannins in the extracts. The ethyl acetate and butanol fractions showed highest amount of total phenolic content²³.

The antioxidant activities of the methanol extracts of the leaves of five selected ferns such as *B. orientale*, *Cyathea latebrosa*, *Cibotium barometez*, *Drynaria quercifolia*, and *Dicranopteris linearis* using ferric reducing power, ferrous ion chelating activity, DPPH radical scavenging activity and β -carotene bleaching assays were reported. All tested ferns exhibited promising antioxidant activity²⁴. Naik et al.²⁵ studied the antioxidant potential of the methanol extract of the fronds of *B. orientale* by measuring the scavenging activity of DPPH radicals, nitric oxide radicals and lipid peroxidation inhibitory activity. The total antioxidant capacity and reducing power assay of the extract were also performed. Results of the study indicated that the methanol extract showed good antioxidant properties against DPPH and lipid

peroxidation activity but failed the activity against nitric oxide radicals.

Cytotoxicity

In a study, the in vitro cytotoxic activity of methanol-methylene chloride (1:1) extract of the leaves, roots and stem against human breast cancer cells (MCF-7wt) was reported. Screening for cytotoxicity activity was performed using microculture followed by tetrazolium assay for 72 h. The root extracts exhibited highest cell mortality at 100 μ g/ml, but the leaves and stem did not induce any cytotoxicity on the cells²⁶.

In another study, the petroleum ether, chloroform, ethyl acetate, butanol and aqueous solvent fractions from the methanol extract of the leaves of *B. orientale* were evaluated for cytotoxic activity on human colon cancer cells HT-29. The ethyl acetate, butanol and aqueous fractions were reported to possess promising cytotoxic activity towards human colon cancer cells²³.

Following above cytotoxic studies, the aqueous extracts of five selected medicinal ferns, namely, *B. orientale*, *Davallia denticulata*, *Diplazium esculentum*, *Nephrolepis biserrata* and *Pteris vittata* were evaluated on myelogenous leukaemia cell line (K562) through MTT assay. The phenolic, hydroxycinnamic acid, flavonoid and proanthocyanidin contents of the extracts were also determined. Results of the study revealed promising cytotoxic activity of *B. orientale* with highest proanthocyanidin content in the extract²⁷.

Antidiabetic activity

The antidiabetic potential of the aqueous extracts of five selected ferns, such as *B. orientale*, *D. denticulata*, *D. esculentum*, *N. biserrata* and *P. Vittata* was evaluated through α -glucosidase inhibitory assay. The aqueous extract of *B. orientale* showed significant α -glucosidase inhibitory activity²⁷.

Antimicrobial activity

Following the folk claim, the antibacterial activity of the acetone extract of the leaves were evaluated on *Staphylococcus aureus*, *Bacillus subtilis*, *Klebsiella pneumonia*, *Salmonella typhi*, *Streptococcus pyogenes*, *Proteus vulgaris*, *Pseudomonas sp.* and *Serratia sp.* using cup plate method. The minimum concentration of the extract was 0.025mg/ml that showed maximum inhibition of zone against *P. vulgaris* and minimum zone of inhibition against *B. subtilis* and *S. aureus* respectively¹¹.

A study was undertaken to evaluate the antibacterial activities of the methanol extracts of the leaves of five selected ferns such as *A. aureum*, *A. nidus*, *B. orientale*, *C. barometez* and *D. linearis* on three Gram positive bacteria namely *Micrococcus luteus*, *Bacillus cereus* and *S. aureus* and five Gram negative bacteria, viz. *Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella choleraesuis*, *Enterobacter aerogens* and *K. pneumonia* respectively. The methanol extract showed antibacterial activity against *B. cereus*, *M. luteus* and *S. aureus* respectively²².

In another study, the antibacterial activity of petroleum ether, chloroform, ethyl acetate, butanol and aqueous solvent fractions from the methanol extract of the leaves

were evaluated on few selected bacteria. The results of the study revealed that the ethyl acetate, butanol and aqueous fractions were active against *B. cereus*, *M. luteus*, methicillin-susceptible *S. aureus* (MSSA), methicillin-resistant *S. aureus* (MRSA) and *Staphylococcus epidermidis*²³.

Deepa et al.²⁸ reported the antimicrobial activity of the petroleum ether, chloroform, methanol and aqueous extracts of the fronds of *B. orientale* on clinically isolated bacterial pathogens such as *B. subtilis*, *S. aureus*, *S. typhi*, *P. Aeruginosa*, *Mycobacterium luteus*, and *E. coli*. The antifungal activity was assessed on *Aspergillus flavus* and *Candida albicans*. Results indicated that all test extracts were effective against *E. coli*,

P. aeruginosa and *C. albicans*. The aqueous extract demonstrated relatively higher zone of inhibition against *P. Aeruginosa*, *E. coli* and *C. albicans* while *B. subtilis*, *S. aureus*, *S. typhi*, *M. luteus* and *A. flavus* were not sensitive to tested extracts.

Wound healing activity

The wound healing activity of the aqueous extracts of the leaves using excision wound model in rats is reported by Lai et al.²⁹. Healing of the wounds was assessed by measuring the reduction of wound size, epithelisation time, hydroxyproline content and changes observed through histopathological examination. There was significant reduction in wound size and mean epithelisation time, and higher collagen synthesis in the 2% extract-treated group compared to the normal group. These findings were supported by histopathological examination which demonstrated improved tissue regeneration, more fibroblasts and angiogenesis.

Acute toxicity

The acute toxicity studies of the ethanol water (1:1) extract of the entire plant was performed on swiss albino mice. The LD₅₀ value of the extract has been reported to be 600 mg/kg, i.p.³⁰.

CONCLUSION

Search for antioxidant factors from plants always remained a potential area of investigation. *B. orientale* is an important edible medicinal fern in Malaysia. The inhabitants of Kuching in Malaysia use the plant as a vegetable in their traditional salads '*Ulam*'³¹. Following its folk use, the plant has recently attracted several researchers to evaluate its possible pharmacological activities. The plant has been found to possess promising antioxidant, anticancer, antidiabetic, antimicrobial and wound healing activities. Preliminary phytochemical screening reports that the plant is rich with polyphenolic compounds which are responsible for its potential antioxidant activity. Further studies on this plant may bring some new and interesting findings on its pharmacological activity.

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