Chapter 3

Bruguiera gymnorhiza (L.) LAM. EX SAVIGNY: A MEDICINAL TREE OF MANGROVES

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Abstract: Mangrove forests are highly threatened worldwide. Due to a lack of understanding of mangrove plants' ecosystem processes and their pharmacological importance, conservation efforts face several threats day by day. *Bruguiera gymnorhiza* is one such species with high nutritional and medicinal values but is less explored. Therefore, to document its scientific validation, an attempt has been made to investigate its phytochemical profile through phytochemical screening of nine various phytoconstituents. The results revealed the presence of different bioactive compounds in the aqueous extract of *B. gymnorhiza,* like tannins, followed by saponins, flavonoids, phenolic compounds, and reducing sugars. The present study also revealed that this species can be a good pharmaceutical agent for the future production of novel therapeutics.

Key words: Threatened, less explored, nutritional, scientific validation, phytoconstituents

INTRODUCTION

Mangroves are a group of woody plants that are highly salt tolerant and have a high-water use efficiency in saline condition (Musara et al. 2020). They are also known as halophytes and grow in tropical and subtropical intertidal regions. They are ecologically important plant that thrive in extreme biotic and abiotic stressful conditions which produce unique compound having pharmacological values (Sadeer et al. 2023). This character of these plants can be used to reduce the negative impacts of antimicrobial resistance and will be helpful to formulate new therapeutic agents against contemporary health problems. The most common genus of mangrove plants is *Avicennia*, *Bruguiera*, *Kandelia*, *Rhizophora*, *Sonneratia*, *Nypha* and *Ceriops etc*. (Quadros and Zimmer 2017). The species from

these genera have ecological, medicinal, and economic values, still they are unexplored. Keeping this in view, an attempt has been made to detect the secondary metabolites available in the flowers of *B. gymnorhiza*. It is a primary work but it brings attention towards the medicinal use of mangrove species.

MORPHOLOGY

B. gymnorrhiza is a mangrove tree that grows usually 7-20 metres high, but sometimes up to 35 m, and belongs to the family Rhizophoraceae. It has a glabrous, smoothish trunk with reddish- brown bark. The bark is sometimes fibrous, lightish brown or grey (Singh et al. 1991). The green elliptic leaves are 5- 15 cm long (Figure 1). The flowers are solitary, with white or cream petals, that soon turn brown, up to1.5 cm long, with pinkish green to reddish brown calyx. The fruits are turbinate, 2 cm long, when mature (Figure 2). The seeds, when still on tree, have a hypocotyl up to 11 cm long (Xiao et al. 2010).

METHODOLOGY

The flowers of *B. gymnorhiza* were collected from the Jehy Ghat, in Kultali of Sunderban areas, West Bengal. The plant was identified by the authors. The Soxhlet method of extraction of aqueous extract was carried out for phytochemical analysis. Detection of nine secondary metabolites was carried out using standard methods (Kumar et al. 2013; Das et al. 2019; Devi et al. 2023).

Qualitative phytochemical analysis

Test for Tannin

One ml of the filtrate of flower extract was taken. About 3-5 drops of 10% lead acid solution was added into it. The appearance of gelatinous precipitate confirmed the presence of Tannin.

Test for saponin

One ml of the filtrate of flower extract of *B. gymnorhiza* was taken. About 1 ml of distilled water was added into it and allow it to shake well. The persistent froth formation after shaking provides the evidence of the saponin.

Test for flavonoids.

One ml of the filtrate of the fruit extract was taken and 2 ml of 2% NaOH solution and 3 drops of dilute HCL were added. The colour initially turned to an intense yellow colour with NaOH solution and later became colourless. This change in colour confirmed the positive result for the presence of flavonoids.

Test for terpenoids

About 2 ml of the filtrate was added with 6 drops of chloroform and placed it in the water bath for few minutes. Then 6 drops of concentrated H_2SO_4 were added. The reddish-brown interface confirmed the positive result for the presence of terpenoids.

Test for phenolic compounds

One ml of the filtrated flower extract was taken. Few drops of 5% ferric chloride solution were added. The bark bluish black colour provides the positive result of the test of phenolic compounds.

Test for reducing sugars

One ml of the filtrate of the flower extract was taken and 2 drops of Fehling's solution A followed by Fehling's solutiom B were added and kept it in water bath for some time. The presence of red orange precipitate confirmed the positive result of the test for reducing sugars.

Test for steroids

One ml of the filtrate of *B. gymnorhiza* flower extract was taken. One ml of chloroform and sulphuric acid were added into it. The appearance of upper red and lower yellowish layer with green fluorescence indicates the presence of steroids.

Test for alkaloids

One ml of the filtrate of flower extract was taken. 3-5 drops of Dragendroff's reagent were added into it. The appearance of orange red precipitate in the lower surface indicates the presence of alkaloids.

Test for carbonyl compounds

One ml of the filtrate of *B. gymnorhiza* flowers was taken. Three to four drops of Dragendroff's reagent were added to it. The formation of yellow crystal confirmed the presence of carbonyl compounds.



Figure 1: Leaves of *B. gymnorhiza*



Figure 2: Flowers and Fruits of *B. gymnorhiza*

RESULTS AND DISCUSSION

Field survey revealed that mangrove plants, also known as halophytes, are ecologically important plants. These plants produce unique chemical compounds with promising pharmacological potentials. Among them, *B. gymnorhiza* is such species with rich and diverse source of bioactive metabolites and the aqueous extract of flowers of *B. gymnorhiza* confirms presence of tannin, saponin, flavonoids and many more (Table 1; Figure 3), which have wide applications in pharmaceutical and medicinal sectors. Some researchers have also reported about the nutritional

profile, ethnomedicinal uses, with its pharmacological potentials for the value addition of its medicinal significance which are discussed below.

Food values

In 2009, Musara and his team reviewed that the seedlings of *B. gymnorhiza* are sliced, soaked to leach out the tannins, and then grounded into a paste to make a sweet meat (Musara et al. 2020). In 2013, Musara and his team members studied the nutritional constituents of *B. gymnorhiza* and reported that the leaves have highest crude protein and fibre which is an indication that it could be an important source of dietary calorie (Patil and Chavan 2013). The fruits, leaves and peeled seedlings are soaked, boiled and eaten during periods of severe food shortages (Musara et al. 2020).

Ethnomedicinal uses

From the reported studies regarding ethnomedicinal survey, it was found that in 2011, Haq and his team reported that the stems are useful for the treatment of viral fever (Haq et al. 2011). The leaves, fruits and barks are used in the treatment of diarrhoea, burns and intestinal worms (Sur et al. 2016; Mahmud et al. 2017). In 2018, Roy and his co-workers reported that the fruit of *B. gymnorhiza* has antiviral properties and also play a role in the treatment of eye diseases (Roy et al. 2018).

Pharmacological potentials

Several studies were reported on the pharmacological activities of *B. gymnorhiza*. In 2011, Haq and his co-workers reported that the ethanol extract of *B. gymnorhiza*, antimicrobial activity against the common bacterial pathogens (Haq et al. 2011). The leaves of *B. gymnorhiza* have potentials to treat hepatic disorders coupled with the ability of antioxidant effect (Sur et al. 2016). The leaves and stem extracts of *B. gymnorhiza* possess antidiarrheal activity (Rahman et al. 2011).

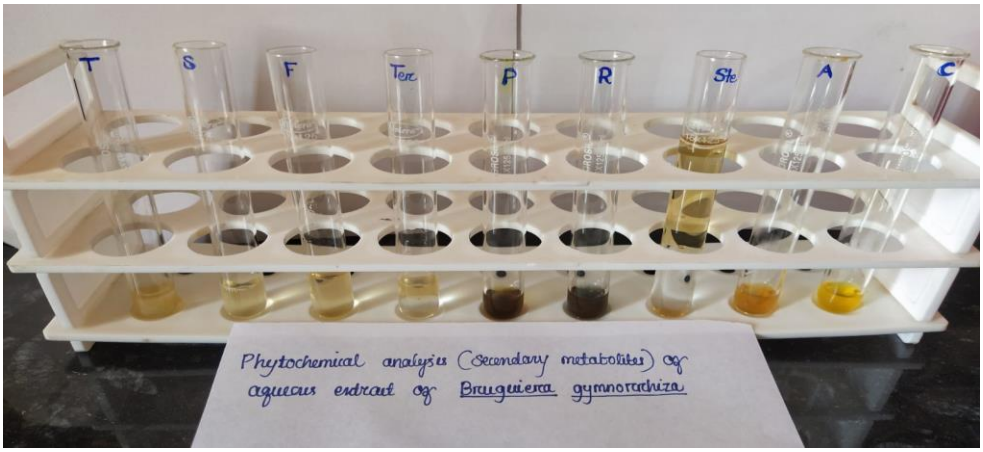


Figure 3: Phytochemical analysis of aqueous extract of flowers of *B. gymnorhiza*

Table 1: Phytochemical analysis of aqueous extract of *Bruigera gymnorrhiza* flowers

Bioactive compounds	Aqueous
Tannin	+
Saponin	+
Flavonoids	+
Terpenoids	-
Phenolic compounds	+
Reducing sugars	+
Steroids	-
Alkaloids	-
Carbonyl compounds	-

CONCLUSION

Mangrove plants are considered the most essential bioresources among the most productive and biologically complex ecosystems. The different plant parts of *B. gymnorhiza* have essential nutritional components, and it could be one such species for future emergency food or famine food in coastal areas. The flowers of *B. gymnorhiza* have shown the presence of several phytoconstituents, like tannins, saponins, flavonoids, phenolic compounds, etc. Therefore, it can be concluded that this plant contains chemical constituents of pharmacological importance, which could play a vital role in the production of novel therapeutic products. Further studies are required to scientifically evaluate its medicinal significance.

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