Boehmeria glomerulifera Miq. Exhibits *in vivo* Antidepressant and Antidiarrhoeal Activities

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ABSTRACT: *Boehmeria glomerulifera* Miq., is medicinal herb belongs to the family Urticaceae. It is used for treating various diseases by folk practitioners and rural people. The CNS antidepressant and antidiarrhoeal activities of the crude extract were investigated at 200- and 400-mg/kg bw in Swiss Albino mice model. The crude methanolic extract revealed significant ($p < 0.05$) antidepressant activity in mice at 400 mg/kg bw. On the other hand, in the castor oil-induced antidiarrhoeal assay, the extract demonstrated significant ($p < 0.05$) antidiarrhoeal activity at 400 mg/kg bw.

Key words: *Boehmeria glomerulifera*, cytotoxic, sedative, anti-diarrheal.

INTRODUCTION

Plants have been used by the people as remedies for diversified diseased conditions since ancient time. At the beginnings, the uses of medicinal plants were instinctive, as is the case with animals.[1] Plants remain to be the source of treatment and prophylaxis before the advent of iatrochemistry in 16th century.[2] Nonetheless, the decreasing efficacy of synthetic drugs and the increasing contraindications have made the usage of plant-based medicines significantly.[3]

In the developing world, estimated four billion people (representing 80% of the world's population) rely on herbal medicinal products as primary source of healthcare and traditional medical practice. These involves the use of herbs which is viewed as an integral part of the culture in those communities.[4-6]

According to the estimation of World Health Organization (WHO), the present global herbal market is of about US$ 83 billion per year.[7] The sale of herbal medicines is expected to get higher with about at 6.4% average annual growth rate. Due to the contribution of numerous significant factors, the market of herbal medicines has grown at an expressive rate worldwide.[8]

Boehmeria glomerulifera, commonly known as false nettle, is a flowering plant belonging to the Urticaceae family. It is a deciduous shrub or small trees with spreading branches.[9] The plant is widely distributed in Bangladesh, Bhutan, India, Indonesia, Laos, Myanmar, Sikkim, Sri Lanka, Thailand, and Vietnam. Traditional healers use the fresh leaves of this plant to treat anaemia in combination with *Amomum aromaticum* Roxb.[10] The bath with boiled leaf-water is prescribed in case of fever of babies.[11] It is also used as ornamental plants.

The biological activities of *B. glomerulifera* have not been explored extensively. As a part of our ongoing research program[12-14] the present study has been undertaken and we, herein, report the antidepressant and anti-diarrheal activities of the leaf extract of *B. glomerulifera* for the first time.

MATERIALS AND METHODS

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Collection of plant materials and extraction. The leaves of *B. glomerulifera* were collected in December, 2014 identified by the taxonomist of Bangladesh National Herbarium, Dhaka, Bangladesh where a voucher specimen (DACB Accession no: 39726) has been maintained.

After proper washing, the leaves were sun dried for several days, and then oven dried for 24 hours at considerably low temperature (not more than 40ºC) to facilitate better grinding. The dried plant materials was then ground to a coarse powder using high capacity grinding machine. The powdered material (350 gm) was taken in a clean, amber color reagent bottle (5 liters) and soaked in 2 L of methanol for 15 days accompanying occasional shaking and stirring. The whole mixture was then filtered through a fresh cotton plug and finally Whatman No. 1 filter paper. The filtrate was dried using a vacuum rotary evaporator at 40ºC to obtain the gummy crude extract of *B. glomerulifera*.

Drugs and chemicals. Tween-80 (BDH Chemicals Ltd.) was used for getting uniform dispersion of the extract in normal saline. Sterile normal saline solution (0.9% NaCl) from Beximco Infusion Ltd. (Bangladesh) was used as vehicle for standard and test samples. Chlorpromazine and loperamide were used as standard and phenobarbitone sodium and castor oil were utilized for inducing sleep and diarrhea, respectively.

Animal. Swiss-albino mice of either sex, aged 4-5 weeks were used for the experiment. They were housed in standard polypropylene cages and kept under controlled room temperature (25 ± 2.0ºC; relative humidity 55-60% and 12 hrs light-dark cycle) and fed with icddr,b formulated rodent food and water (ad-libitum). As these animals are very sensitive to environmental changes, before the test, they are kept in the laboratory environment for at least 3-4 days where the experiment will take place. The ethics for use of experimental animals were followed carefully.

Antidepressant activity. Antidepressant activity was evaluated by using phenobarbitone induced sleeping time test according to the method of Turner, 1972.[15] The animals were divided into four groups containing three mice in each group. The control group was administered normal saline water containing 1% Tween-80 solution, while the test groups were administered with test samples (standard chlorpromazine and plant extract at 200- and 400-mg/kg bw of test animals) prepared with normal saline water containing Tween-80. Thirty minutes later phenobarbitone sodium (25 mg/kg bw) was administered intraperitonially to all the groups to induce sleep. The onset of sleep and total sleeping time were recorded for both control and treated groups.

Antidiarrhoeal activity. Antidiarrhoeal activity was evaluated by using castor oil induced diarrhoea in mice.[16] The animals were divided into negstive control, positive control and two test groups containing three mice in each group. Control group received vehicle (1% Tween 80 in normal saline) at dose 10 ml/kg bw orally. The positive control group received loperamide at the dose of 50 mg/kg bw orally. The test group mice received methanolic extract of *B. glomerulifera* at 200- and 400-mg/kg bw. Each mouse was placed in an individual cage and the floor lining was changed at every hour. Diarrhea was induced by oral administration of castor oil to each mouse after the above treatment. During an observation period of 5 hours the number of diarrhoeic faeces excreted by the animals was recorded.

Statistical analysis. For all bioassays, the values are values are reported as mean ± standard error of mean (SEM) and standard t-test was used to determine the significance between the control group and experimental groups, the *p* values ($p < 0.05$) considered to be statistically significant.

RESULTS AND DISCUSSION

Table 1 comprises of the time of onset of sleep and total sleeping time of the test group mice of phenobarbitone-induced sleeping time test (antidepressant activity). Total sleeping time of the test animals were 29.70 and 106.3 min for the doses of 200- and 400-mg/kg bw, respectively. For the

standard chlorpromazine, total sleeping time for the treated mice was 172.0 min.

In the castor oil-induced diarrheal experiment, the methanol extract of *B. glomerulifera* produced marked antidiarrhoeal effect in mice, as shown in table 2. Inhibition of diarrhea for the animals of test group found to be 62.50 at 200 mg/kg bw and 54.56 at 400 mg/kg bw. Standard loperamaide also exhibited potent inhibition (65.55%) of diarrhoeal faeces but at a much lower dose than the crude extract.

Table 1. Antidepressant activity of methanolic extract of leaf of *B. glomerulifera*

Groups	Dose (ml/kg or mg/kg bw)	Time of onset of sleep (min.)	Total sleeping time (min.)
Control (normal saline)	10	17.33 ± 0.512	86.0
Chlorpromazine (standard drug)	25	16.33 ± 0.324	172.0*
Crude extract of *B. glomerulifera*	200	58.33 ± 0.441	29.7
	400	55.33 ± 0.323	106.3*

All values are expressed as mean ± SEM; n = 3, * $p < 0.05$ indicates significant compared to control.

Table 2. Antidiarrhoeal activity (in terms of % inhibition) of *B. glomerulifera* extract.

Groups	Dose (ml/kg or mg/kg bw)	Number of diarrhoeal faeces (Mean) ± SEM	Inhibition of diarrhoea (%)
Control (normal saline)	10	6.0 ± 0.52	--
Loperamide (standard drug)	50	1.97 ± 0.77	65.55*
Crude extract of *B. glomerulifera*	200	2.25 ± 0.43	62.50
	400	2.75 ± 0.56	54.56*

All values are expressed as mean ± SEM; n = 3, * $p < 0.05$ indicates significant compared to control

Phenobarbitone-induced sleeping test was carried out for the evaluation of CNS antidepressant effect. After administration of the crude extract at 400 mg/kg bw, total sleeping time of the test animals increased in comparison to control which was found to be statistically significant. By potentiating the phenobarbitone-induced sleep, the extracts seem to possess sleep inducing properties.[17] The effects found to be dose dependent, possibly through CNS antidepressant action or tranquilizing action.[18-19]

On the other hand, the methanolic crude extract of *B. glomerulifera* demonstrated potent antidiarrheal activity at both doses of 200- and 400-mg/kg bw of test animals in castor oil-induced diarrhoea. However, anti-diarrheal effect observed at 400 mg/kg bw was found to be statistically significant. The inhibition of diarrhea by the plant extract may be due to inhibition of excessive peristaltic movement by the plant extract which was induced by oral administration of castor oil.[20]

CONCLUSION

On the basis of our results, it may be concluded that methanolic extract of *B. glomerulifera* exhibited dose dependant antidepressant as well as antidiarrhoeal activities. However, further studies are necessary to examine the underlying mechanisms of these effects and to isolate the active compound(s) responsible for these pharmacological activities.

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