

A review on ethnomedicinal, phytochemical and pharmacological studies of *Geodorum densiflorum* (Lam.) Schltr. - an endangered orchid

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ABSTRACT:

From the primitive period, medicinal plants have been used in treating human diseases and the traditional herbal medicines have owned its distinct place in medication because of their pharmacological importance. *Geodorum densiflorum* is a medicinally important endangered orchid which is widely used in the orient. Flavonoids, alkaloids and terpenoids, the primary constituents of *G. densiflorum* are mainly believed to be responsible for its wide therapeutic actions. The orchid was traditionally recommended for various ailments such as wound healing, skin diseases, dysentery, diabetes, improving fertility in men, to cure carbuncles and to regularize menstrual cycle in women. The present review provides comprehensive information on plant, ethnomedicinal, phytochemical and pharmacology profile and current research prospects of the orchid.

Keywords:

Orchidaceae, Ethnomedicinal uses, *Geodorum densiflorum*

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INTRODUCTION

Orchids belonging to the family Orchidaceae display diversified in their floral morphology compared to other angiospermic plants. Eventhough the family is characterised as highly advanced group, they are at risk for slight changes in environmental conditions will cause the orchids as endangered one. Approximately 25,000 to 35,000 species within 600 – 800 genera of Orchidaceae were distributed throughout the world (Chugh *et al.*, 2009). In India, Orchidaceae form 9% of our flora and about 1,300 species with 140 genera was found in Himalayas as their native (Yonzone *et al.*, 2008). Orchidaceae plants will grow in variety of habitats and are mostly annual and perennial herbs and live either as epiphytes, lithophytes and terrestrial. The people are attracted by orchids because of their high ornamental value but nowadays they are known for its medicinal importance. In Chinese *Materia Medica*, a total of 365 plants including several orchids are grown primarily as ornamentals, many of which are now used as herbal medicines, food and other cultural components by tribes in different parts of the world.

Geodorum densiflorum (Lam.) Schltr. belongs to the family Orchidaceae, an endangered terrestrial orchid (Datta *et al.*, 1999) commonly known as Nodding Swamp orchid. It is a glabrous and deciduous plant which grows during spring and summer, becoming deciduous in winter (Ramirez, 2007) and is widely distributed in the tropical forests of south India (Sudhakar *et al.*, 2005) and in Bangladesh. *G.densiflorum* is a medicinal orchid plant that has been traditionally used for the treatment of various diseases. The root paste is used as an insecticide and wound healing medicine. The pseudobulb is used to regularize menstrual cycle (Dash *et al.*, 2008), for the treatment of diabetes (Patil *et al.*, 2005, Roy *et al.*, 2002), and it is applied externally to cure carbuncles (Nath *et al.*, 2011), etc. It is also possessing antimicrobial and antidiabetic property (Saleha *et al.*, 2010).

Intensive phytochemical investigations of the leaves and pseudobulb of orchid have resulted in the presence of flavonoids, terpenoids, alkaloids and steroids. The isolated compounds display some of the interesting pharmacological activities, such as antibacterial, cytotoxicity, antioxidant, thrombolytic, analgesic, sedative and anxiolytic properties. Despite number of studies were reported on the evaluation of biologically active components and their pharmacological action, yet these studies were still inadequate. Although there have been several claims regarding the bioactive compounds which involved in the biological actions of the plant, more scientific research are needed to justify the therapeutic value of this orchid. The present review gives a detailed account of the plant, ethnomedicinal uses, phytochemical and pharmacology profile along with the current research potential of the orchid.

Systematic Description

Kingdom - Plantae

Division - Tracheophyta

Class - Magnoliopsida

Order - Asparagales

Family - Orchidaceae

Genus - *Geodorum*

Species - *densiflorum* (Lam.) Schltr. (ITIS Report, www.itis.gov)

Plant Description

Terrestrial herb forming small clumps, 33-50 cm tall. Pseudobulbs subglobose, crowded, subterranean to partially emergent, erect, ovoid, 2-4 x 3-3.6 cm, fleshy, often yellowish, enclosed by scarious sheaths. Stem erect, 8 cm long, slender. Leaves 3-5, erect to prostrate, apical; enclosed in sheathing bracts forming a pseudostem; 10-32 x 4-9 cm, suberect, lanceolate, lanceolate-elliptic, or oblong-elliptic, acute to acuminate, petiolate, blade; petiole 5-22 cm long, dark green to yellowish, pleated, margins entire to undulate

margins entire to undulate, apex acute to acuminate. Inflorescence: shorter than the leaves, compact, subglobose axillary raceme, 200-300 mm tall, nodding in flower, erect in bud and at seed dispersal; pendent, 8-10 flowered; pedicels 5-10mm long. Flowers: 0.9-1.2 cm long, white to pale green with yellow and purple markings. Sepals and petals similar, gaping, linear-oblong, ovate-elliptic, acute, 5 to 7 veined. Dorsal sepal lanceolate, lateral sepals free, lanceolate. Petals similar to lateral sepals. Lip 1-1.3 x 0.8-1.1 cm, pink with dark red veins boat shaped; apex obscurely 2- rounded lobes, margins weakly undulate; Column 3-4 mm long, weakly curved, with a foot. Capsules dehiscent, obovoid, pendant. Fruit elongated. (Figure 1, 2 and 3).

Ethnobotanical Uses

- To regularize menstrual cycle in women, the root paste of *G. densiflorum* was taken orally by mixing along with two drops of ghee and 5 ml of honey (Dash *et al.*, 2008).
- Australians use the gum obtained from root stock for joining parts of musical instruments. Fresh root stocks were crushed and rubbed on cattle to kill flies (Yonzone *et al.*, 2011).
- Tuber powder mixed with cow ghee is employed to treat dysentery (Mohammad, 2011).
- Tuber is used to treat impotency in men. Dried tubers

are made into powder and 5 gm of the powder mixed with 200 ml cow milk is given orally twice a day for 15 days or till it is cured (Tiwari *et al.*, 2012).

- Tubers are cleaned, powdered and taken with honey to increase sperm density (Rahmatullah *et al.*, 2010).
- Rhizomes are consumed along with honey for two to three months as a treatment for impotency (Patil *et al.*, 2004).

Phytochemical profile

G. densiflorum was investigated for the phytochemical chemical constituents of methanol, ethyl acetate and petroleum ether extracts of the roots which revealed the presence of carbohydrate, alkaloid, glycoside and steroid (Habib *et al.*, 2011). Phytochemical screening of *G. densiflorum* shows presence of alkaloids, steroids, carbohydrates, flavonoids, tannin and saponins in different extract such as water, ethanol and chloroform and were reported having various pharmacological activities (Keerthiga *et al.*, 2014).

Various major, minor and trace elements concentration of *G. densiflorum* were studied for determining pharmacological action against various diseases. Among the twenty six vital elements, the plant had maximum concentration of phosphorus. As stated by Hossen *et al.* (2014), Phosphorus participates in DNA



Figure 1. Habit of *Geodorum densiflorum*



Figure 2. Vegetative stage of *Geodorum densiflorum*



Figure 3. Flowers of *Geodorum densiflorum* (Lam.)

synthesis, energy metabolism and calcium absorption and utilization.

Pharmacological profile

Antibacterial activity

In vitro antibacterial study of three different extracts using water, ethanol and chloroform solvents with various concentrations was tested for their bioactivity. Maximum antibacterial activities were recorded for ethanolic extract against *Staphylococcus aureus* followed by *Klebsiella pneumoniae* but water extracts didn't show any significant antibacterial activity (Keerthiga *et al.*, 2014)

The antibacterial screening of extracts revealed that methanolic extract showed significant activity against both Gram positive and Gram negative bacterium than other extracts (Akter *et al.*, 2010). Previous investigation on the antibacterial activity of *G. densiflorum* against thirteen pathogenic bacteria was reported that ethyl acetate extract displayed the highest inhibitory actions (Habib *et al.*, 2011).

Antioxidant activity

G. densiflorum (Lam) Schltr. was investigated for the antioxidant property of methanol, ethyl acetate and petroleum ether extracts of the roots. *In vitro* antioxidant activity of the extracts was performed using various methods. DPPH radical scavenging and Nitric

Oxide (NO) scavenging activity showed that the petroleum ether extract had high antioxidant capacity than other extract. Reducing power and CUPRAC assay revealed that ethyl acetate extract was having high reducing activity (Habib *et al.*, 2011).

Cytotoxic Activity

In vivo cytotoxicity studies were subjected and a concentration dependent increase in percent mortality was produced by the extracts. The study revealed the presence of cytotoxic principles in these extractives (Habib *et al.*, 2011).

The cytotoxic activities of crude extract were determined using brine shrimp lethality bioassay and on comparison to vincristine sulfate as standard, ethyl acetate extract showed a significant cytotoxic activity (Hossain *et al.*, 2012).

Thrombolytic activity

Thrombolytic activity of five traditional medicinal plants was evaluated from which *G. densiflorum* whole plant with different solvents viz: ethanol, petroleum ether and ethyl acetate shows moderate to negligible amount of clot lysis, i.e. 25.31%, 29.82%, and 19.06% (Hossen *et al.*, 2014).

Analgesic activity

Khatun *et al.* (2013) evaluated peripheral analgesic activity by conducting acetic acid induced writhing test. The n-hexane and dichloromethane soluble extract of the root of *G. densiflorum* was used for analgesic activity in mice. At higher dose (400mg/kg, p.o.), both extracts exhibited significantly ($p < 0.001$) moderate analgesic property compared to that of diclofenac sodium which might be due to interaction with the central and/or peripheral opiate system.

Sedative activity

Extracts from *G. densiflorum* using n-hexane and dichloromethane was assessed by hole cross and open field tests. Both extracts at doses of 200mg/kg and 400mg/kg, p.o. showed statistically significant ($p < 0.001$)

and $p < 0.01$) suppression of locomotor and exploratory behaviours of mice compared to that of diazepam in the hole cross test. In the open field test, all test samples except 400mg/kg dose of dichloromethane soluble root extract showed same results that were observed in the hole cross test. The study done by Khatun *et al.* (2013) revealed the sedative activity of the medicinal orchid.

Anxiolytic property

The root of *G. densiflorum* was reported to possess anxiolytic activity in both n-hexane and dichloromethane extracts as confirmed by the hole board test (Khatun *et al.*, 2013).

CONCLUSION

It is concluded that the plant extract possesses antibacterial and antioxidant property and it can be used effectively as a natural tool for treating different infectious diseases. The orchid is also reported to possess cytotoxic, thrombolytic, sedative, analgesic and anxiolytic activities. The present review provided combined information about ethnomedicinal, phytochemical and pharmacological studies on *G. densiflorum*. It is necessary to carry out more clinical and pharmacological studies by the researchers to exploit the potential of this plant. Further investigations to find out novel drug lead compounds of industrial importance could be a new platform for future researchers.

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