

Review Paper

Dendrobium longicornu orchid has potential pharmaceutical properties in Nepal

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Abstract— Plants provide shelter, clothing, food, flavours and fragrances. Today more people take medicine from medicinal plant. According to World Health Organization (WHO) 80% of medicine, is produced from medicinal plants. Globally, the herbal medicines market was valued at USD 170 billion in 2022, and it will reach USD 600 billion by 2033, growing 15% annually from 2023 to 2033. *Dendrobium longicornu* is one of the most important medicinal plants in the world. *D. longicornu* belong Orchidaceae family and it is largest genera in Ochidaceae. It grows on tree trunks in mountain forests as an epiphytic orchid. Commonly *D. longicornu*, known as the ‘Long-horned Dendrobium. It is an important traditional medicinal plant that used various disease in Asia. Mainly *D. longicornu* is found in the mountainous regions of Northeast India, Bhutan, Nepal, Tibet, Myanmar, and southern China. It has many bioactive compounds such as 14 - methyl- pentadecanoic acid (6.39 %) and 8 - Methyl-6-nonenic acid 9-Hexadecyn-1-ol, 3-Heptadecanol and Pentafluoropropionatetrans-2-dodecen-1-ol. In this paper, the main aim of the study is demonstrating the antioxidant, anticancer and antibacterial activities of *D. longicornu*.

Keywords— Orchid, Traditional medicine, Antibacterial, Phytochemical, *D. longicornu*.

1. Introduction

In the Ayurvedic system of medicine, Astvarga, a rejuvenating herbal formulation, is derived from a group of eight herbs, of which jivak (*Microstylis wallichii*), kakoli (*Habenaria acuminata*), riddhi (*H. intermedia*) and vriddhi (*H. edgeworthii*) are orchids. Orchids are beautiful flowering plants. They may be either saprophytes, leafy terrestrials, epiphytes or lithophytes. Variation in the shape, size, and color of the flower, most of them have wonderful fragrance, are attractive as well as long lasting flower and wonderful vegetative body. Orchids are one of the world's largest, most diverse, and distinctive flowering plant families, with an estimated 20,000 to 35,000 species [1]. A major plant family in Nepal, Orchidaceae is comprised of 502 taxa in 108 genera, which represent about 8% of the plant variety [2]. They are aesthetically and medicinally important, and regarded as ecological indicators. Orchids are well known for their purposes in herbal medicine in addition to their decorative appeal [3]. Chinese and Indian herbal medicine began using orchids as medicinal plants thousands of years ago [4]. As a medicine, orchids are valuable due to their phytochemical composition with alkaloid, glycoside, and flavonoids [5]. *Dendrobium longicornu* synthesizes a variety

of chemical compounds of pharmaceutical importance, such as alkaloids, polyphenols, anthocyanins, and carotenoids [6]. It has to be found as threatened species in Appendix II of the Convention on International Trade in Endangered Species (CITES ([www.cites.org/eng/cop/12/doc/E 12 -64.pdf](http://www.cites.org/eng/cop/12/doc/E%2012-64.pdf))) and are categorized as critically endangered and rare [8,6,7].

In Nepal the maximum medicinal orchids were found at an elevation of 1700 msl might be due to the optimum water energy dynamics [7]. Many terrestrial species have thrived on the moist deciduous forest floor, while epiphytic orchid species have flourished on large trees with fissured bark covered in moss [8].

The most endangered orchid species are those whose habitats are lost, whose forests are degraded, and who have been encroached upon by humans [9,10]. A significant portion of biodiversity, especially epiphytic orchids, is being lost to tree cutting for timber [11].

Taxonomic Classification:

Kingdom - Plantae

Phylum - Tracheophyta

Class - Liliopsida

Order - Asparagales
Family- Orchidaceae
Subfamily- Epidendroideae
Genus - *Dendrobium*
Species - *longicornu*
Botanical name - *Dendrobium longicornu*
Synonym:
Common name - Long-Horned Dendrobium Lindl.
Nepali - Sunakhari (Bawar)
Hindi – Hatajori
Sanskrit: Jiwanti
Chinese: Shi-Hu

2. Geographical source:

This plant is found in humid, mossy, mixed, coniferous forests at elevations of 1200 to 3000 meters in the eastern Himalayas, Bangladesh, India, Assam, Nepal, Sikkim, Myanmar, Bhutan, southern China, Thailand and Vietnam on mossy branches of old, dwarf trees and primary montane forests [12, 13, 14, 15, 16, 17, 18, 19].

3. Morphology

3.1. Habitat: There are five species of *Dendrobium longicornu* (Long-horned Dendrobium) found in coniferous forests, oak forests and broad leaf mixed forests between 1720 and 2400 meters above sea level (Figure 1).

3.2. Host plants: The host species were *Quercus leucotrichophora*, *Q. lanuginosa* with an association of other tree species (*Lyonia ovalifolia*, *Myrica esculenta*, *Pinus roxburghii*, *Pyrus pashia*), *Schima wallichii*, *Daphniphyllum himalense* and *Rhododendron arboretum* [20,8].

3.3. Height 10-40 cm tall.

3.4. Root: Its roots are fasciculate.

3.5. Stem: Stems slightly rigid, erect, wavy, clustered, pendulous, cylindric, 7-35 cm, 2-4 mm thick, unbranched, with many nodes, internodes yellow, 2.5-4cm long [20].

3.6. Leaves: The plant carries 5 -12 obliquely pointed linear lanceolate deciduous, apex acuminate, base a tubular clasping sheath, leathery, both surfaces with blackish brown rigid hairs including leaf sheaths, sessile, 2.4 - 8 × 1- 2.1 cm [20].

3.7. Inflorescence: Inflorescence 5-7.5 mm, axillary and terminal racemes on a stem without leaves, with 1-3 pedicellate [20].

3.8. Flower: Usually 1-5 flowered peduncle attenuate, smooth, enveloped by 2-4, 0.4-1.5 cm long, ovate to lanceolate, acute, imbricate scarious sheaths, with black hairs, sepals and petals white, lip veined white to pale brownish white, veined with yellow or red orange, flushed with yellow; pedicel and ovary slender, 2.2-3.5cm flowering time is September – November (Figure 2) [20,8].

3.9. Calyx: The sepals are sub similar, oblong-lanceolate, acuminate, and keeled; the dorsal sepal is ovate, Sepals sub-similar, ovate-lanceolate, acuminate, keeled; dorsal sepal ovate, 1.6-2.0 × 0.5-0.6 cm, 7-veined, with a mid-vein that is slightly keeled abaxially and an acute apex; the lateral sepals are obliquely ovate-triangular [20].

3.10. Corolla: Lip 3- lobed, broadly triangular when spread, 2.2-3.0 × 2.4-2.9 cm; lateral lobes rounded, margins entire to weakly undulate, 2.2-2.4 × 1.0-1.2 cm; mid-lobe small, suborbicular, fimbriate-lacerate, 6 - 8 mm wide; disc with a broad central ridge from base to mid-lobe where it divides into 2 or 5 branches. Foot is 1.0–1.2 cm long and has triangular teeth. Column has two stelidia at the apex that are 4–8 mm long [20].

3.11. Filament: Pollinia are four, 1.6-2.1 mm long, in two appressed pairs, ovoid or oblong, without caudicle, and measure 1.6-2.1 mm in length on the anther cap [20].

3.12. Fruits: Fruit is capsule shape, usually opening laterally.

3.13. Seed: Seeds of *D. longicornu* are numerous and dust-like.

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Figure 1: Whole Plant of *D. longicornu*.



Figure 2: Flower of *D. longicornu*.

4. Traditional use

Medicinal plant extracts are used in traditional medicine to treat infectious diseases [21]. "Shi-Hu", a Chinese medicine remedy for throat problems and improvement of the immune system, is made from the stems of several *Dendrobium* species [22]. *Dendrobium* species can treat some conditions associated with yin deficiencies in the kidneys, lungs, and stomach-such as fever, thirst, tongue redness, faucitis, atrophic gastritis, and diabetes [23]. Using *Dendrobium* leaves as an antipyretic and for treating certain mild skin diseases, the final powdery product can be used as a treatment for mild skin diseases [24].

Dendrobium is used as an effective tonic for the treatment of flatulence, fever, night sweats, anorexia, tuberculosis, and dyspepsia; it also helps moisturize and nourish the skin and prevents dryness and flaky skin. It can be consumed for quick relief and to moisten the passageways. It can ease cramping and pain in the stomach, stop vomiting, treat eye issues, strengthen the immune system, and aid the body in fending off diseases [25].

In Nepal, it is widely used for treating fever and cough as well as giving roots to livestock when they are coughing. It is an epiphytic orchid widely used for the treatment of fever and cough [16].

5. Phytochemical studies of *Dendrobium longicornu*:

Diuretic, anti-rheumatic, anti-inflammatory, anti-carcinogenic, hypoglycemic, antibacterial, anticonvulsant, relaxing, neuroprotective, and antiviral capabilities are only a few of the health advantages of *D. longicornu* extracts [28].

Currently, various *D. longicornu* are used to produce and trade an orchid product known as "Shihu." It is advised for indigestion, rehydration, as an antipyretic, to boost white blood cells in the blood and lessen "fidgets," and for indigestion. It's interesting that the Chinese use it for stomach and lung cancer, and moscatilin made from *D. loddigesii* exhibits anti-cancer efficacy for those cell lines [29]. Extract of *D. loddigesii* contains twenty-two compounds. The major compounds present in *D. loddigesii* are (z)-7-Hexadecenoic acid (12.99 %), Hydroxyacetic acid (6.78 %), 14 - methyl-pentadecanoic acid (6.39 %) and 8 - Methyl-6-nonenic acid (5.71 %), α -Cadinol (2.71 %), 6,10-Dimethyl-4-undecanol (2.95 %), 9-Hexadecyn-1-ol (3.27 %), 3-Heptadecanol (3.36 %), Nonadecatriene-5-14-diol (4.76 %) and Pentafluoropropionatetrans-2-dodecen-1-ol (7.05) [30].

Alkaloids have many pharmacological activities, like antimalarial (e.g., quinine), antiasthmatic (e.g., ephedrine), anticancer, analgesic, and antibacterial properties. Quinine is a bitter-tasting natural white crystalline alkaloid with antipyretic (feverreducing), antimalarial, analgesic (painkilling), and antiinflammatory properties [31].

The extract containing flavonoids suggests that the plant might have an antioxidant, antiallergic, anti-inflammatory, antimicrobial, anticancer activity. Terpenoids and steroids have anti-carcinogenic properties and can help prevent cancer [33].

6. Pharmacological use:

D. longicornu is a tremendously significant medicinal orchid plant having a extensive usage in several traditional herbal medication. *D. longicornu* Contain various secondary component that protect various desise.

6.1. Anticancer effect:

Anticancer effect of the methanol extract of *D. longicornu* protocorms against HeLa and U251 cell lines, percentage of cancer cells growth inhibition by the action of extract. The study shows that extract has shown less percentage of HeLa cells growth inhibition (4.67–25.38 %) and U251 cells growth inhibition (4.13–27.81 %) which had moderate anticancer effect of protocorms extract toward the cancer cell lines. Antiproliferative effects are present in *D. longicornu* extracts on diverse human cancer cell lines. Chemotherapy and radiotherapy are the modern cancer treatment methods which are costly and cause adverse effects. Conventional treatment is less potent, selective and more toxic than plant based anticancer drugs. The cytotoxic activity showed by ethanolic extract on HeLa cells and acetonic extract on U251 cells at the concentration from 100 – 800 $\mu\text{g/ml}$ [34].

6.2. Antibacterial effect:

Previous study showed that, in the case of different bacterial strains, the well-diffusion method can be used to show antimicrobial effect of methanol extract of *D. longicornu* protocorms, extract as 4, 2 and 2 mm showed region of inhibition of *Escherichia coli*, *Klebsiella pneumonia* and *Escherichia cloacae* growth respectively. The protocorms extract has moderate antimicrobial activity towards the bacterial strains [34,35]. The growth of *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumonia*, *Salmonella typhi* and *Acinetobacter baumannii* were distinctly inhibited by some extracts of *Dendrobium amoenum*, *Dendrobium crepidatum*, *Dendrobium moniliforme* and *Dendrobium longicornu*. Bacteria may be inhibited by the antibacterial compounds extracted from *Dendrobium species* via a different mechanism and may have therapeutic value against bacterial strains as antibacterial agents with multiple drug resistance [35,36,37].

The development of *Escherichia coli*, *Klebsiella pneumonia* and *Enterobacter cloacae* are inhibited by Methanolic extracts of *D. longicornu* with the inhibition of zone respectively of 4-, 2- and 2- mm [30].

6.3. Antioxidant effect:

The study showed methanol extract of *Dendrobium longicornu* protocorms for its antioxidant effect by rummaging the DPPH free radicals it had capacity of scavenge 94.32 % of DPPH free radicals, scavenging capacity of ascorbic acid 96.19 % at 1000mg/mL concentration. The flavonoid compound and polyphenol compound in acetonic

extract had high antioxidant properties [36,37,38]. There has a strong relationship between the antioxidant activity of the extracts and the solvent that employed, mainly due to diverse antioxidant potential of crude extracts with different polarities. *D. longicornu* acetonetic extract had higher DPPH radical rummaging activity [34]. Phenolic compounds are responsible for antioxidant properties. Antioxidants can treat cancer, AIDS, neurodegenerative disorders, aging, inflammation, malaria, rheumatoid arthritis, diabetes and atherosclerosis. [39,40,41,42,43,44].

7. Conclusion

As a popular traditional herbal medicine, the extract of *D. longicornu* has been reported to possess antioxidant, anti-tumour, anti-bacterial effect, and anti-inflammatory activities. *D. longicornu* contain (z)-7-Hexadecenoic acid, Hydroxyacetic acid, 14 - methyl- pentadecanoic acid and 8 - Methyl-6-nonenoic acid, α - Cadinol, 6,10-Dimethyl-4-undecanol, 9-Hexadecyn-1-ol, 3-Heptadecanol, Nonadecatriene-5-14-diol and Pentafluoropropionatetrans-2-dodecen-1-ol that showed that showed various phytochemical property.

Data Availability

Not applicable.

Conflict of Interest

The author declares no conflict of interest.

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Contributions

During the development of the manuscript, the authors actively participated in concept and design, data collection, interpretation, drafting, critical review, and final approval.

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