



## An overview of selective medicinal orchids of North-East India and their pharmacological potential

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### Abstract

Northeastern India, renowned for its rich biodiversity, is home to an impressive variety of medicinal orchids with remarkable therapeutic potential. Indigenous communities have cherished them for treating diseases like gastrointestinal disorders, respiratory issues, and skin disorders since ages. Modern scientific studies have validated many of these traditional practices, containing bioactive compounds that offer antimicrobial, anti-inflammatory, antioxidant, anticancer, and liver-protective benefits. However, there is no collective report on the potential of medicinal orchids of NE India and their therapeutic efficacy. That's why this review primarily focuses on the majorly used NE Indian medicinal orchids based on a complete survey by going through previously established literature. By connecting ethnobotanical wisdom with contemporary science, this review hopes to inspire more research and conservation efforts, aiming to fully realize the potential of northeastern India's medicinal orchids for the well-being of future generations.

**Keywords:** Medicinal orchids, phytochemicals, NE India, antioxidants, medicines

### Introduction

Plants have been used as a source of medicine for ages, and even today, many drugs are derived from plant-based natural products. Researchers from various fields continue to explore medicinal plants to validate their therapeutic efficacy however, the field of medicinal orchids remains relatively unexplored.

Medicinal plants have played a crucial role in developing of therapeutic agents for millennia, with their use documented as far back as 2600 BC in ancient Mesopotamian records. The "Ebers Papyrus" from 2900 BC is a well-preserved Egyptian text detailing over 700 plant-based medicines. Similarly, traditional Chinese medicine and Indian Ayurveda, both with origins in the 1st millennium BC, have extensively utilized plant-derived compounds. With around 70,000 plant species recognized for their medicinal potential, including 21,000 currently used in various medical applications as per WHO, the significance of

medicinal plants is undeniable. In India alone, traditional healers employ approximately 2,500 plants to treat common ailments, reflecting the country's rich botanical heritage and its standing as a leading exporter of medicinal plants. The reliance on natural products is evident, with about 75-80% of the world's population in developing countries depending on herbal medicine for primary healthcare due to its cultural acceptability, compatibility with the human body, and minimal adverse reactions. This paper aims to explore the medicinal orchids of northeastern India, a region renowned for its biodiversity. These orchids, integral to traditional medicine, possess a wide range of therapeutic properties, including antimicrobial, anti-inflammatory, antioxidant, and anticancer effects. Through a comprehensive review of their pharmacological efficacy and therapeutic potential, this study seeks to highlight the significant medicinal value of northeastern India's orchids and underscore the need for continued research and conservation efforts.

**Table 1:** List of some medicinally important orchids from NE India

Sl. No.	Orchid Name	English Name	Parts Used	Curing Diseases	References
1	<i>Acampe papillosa</i>	-	Leaves Whole Plants	Ear ache Treatment of fever, injury, male and female problems	Akhter <i>et al.</i> , 2017 [7]
2	<i>Dendrobium crumenatum</i>	Pigeon Orchid	Leaf Pseudobulbs	To cure pimples and boils Ear ache	Wang <i>et al.</i> , 2021 [10]
3	<i>Dendrobium densiflorum</i>	Pinecone Orchid/ Honeycomb Orchid	Leaf Stem	For bone fractures, to treat sprains To treat inflammation	Wang, Y., 2021 [10]
4	<i>Agrostophyllum callosum</i>	-	Leaves Roots	To prepare decoctions or infusions Used occasionally for their potential anti-inflammatory and cooling properties	Teoh, 2016
5	<i>Eria bambusifolia</i>	-	Pseudobulbs Roots	Used in treatments for fever, wounds, and inflammation Occasionally used for digestive issues and sometimes in wound-healing applications	Rui <i>et al.</i> , 2016 [17]
6	<i>Cymbidium aloifolium</i>	Aloe-leaf orchid	Leaves Roots	Used for treating wounds, burns, and cuts Used for treating bone fractures, sprains, and joint pains	Sujin <i>et al.</i> , 2021 [18]



**Fig 1:** Pictures of medicinal orchids from NE India. A. *Acampe papillosa*; B. *Dendrobium crumenatum*; C. *Dendrobium densiflorum*; D. *Cymbidium aloifolium*. (The images of the plants were obtained from the database of the website 'eflora of India' (eFlora of India – Database of Plants of Indian Subcontinent))

Sl. No.	Name of the orchids	Phytochemicals present in each orchid	Importance (Medicinal Properties exhibited by each phytochemical present in the respective orchid species)	References
1	<i>Acampe papillosa</i>	Oil Alkaloids Glycoside Steroids Flavonoids Phenol Tannins Saponins	Antioxidant Anesthetic, stimulants, psychedelics, analgesics, antihypersensitive Antidiabetic, antithrombotic Anti-inflammatory Anticancer, antiviral Antibacterial, cardioprotective, skin protective effects Anti-parasitic, wound healing Antifungal, cytotoxic	Jhansi <i>et al.</i> , 2023 <sup>[5]</sup> ; Sun & Shahrajabian, 2023; Kumar & Singh, 2022 <sup>[8]</sup>
2	<i>Dendrobium crumenatum</i>	Saponin Terpenoid Alkaloids Reducing sugar Flavonoid Cardiac glycosides	Decrease blood lipids Antimalarial, anti-inflammatory Antibacterial, antimicrobial Antidiabetic Antioxidant, antiviral to cure heart diseases	Sandrasagaran <i>et al.</i> , 2014 <sup>[11]</sup>
3	<i>Dendrobium densiflorum</i>	Moscatalin, Homoeridictyol, Scoparone, Scopoletin, Gigantol Dendroflorin Densiflorol a Densiflorin B Oleanolic acid $\beta$ - sitosterol Cyripedin Tristin Naringenin, Moscatin Homoeridictyol 2,6-dihydroxy-1,5,7-trimethoxyphenanthrene, 4,7-dihydroxy-2-methoxy-9,10-dihydrophenanthrene, Ayapin	Anti-platelet aggregation activity Helps in ROS degradation Anticancer, antimicrobial Anti-inflammatory Hepatoprotective Reduce cholesterol Analgesic Antioxidant Improves cardiovascular health Neuroprotective Anticancer	Singh <i>et al.</i> , 2012; Fan <i>et al.</i> , 2001 <sup>[9]</sup>
4	<i>Agrostophyllum callosum</i>	Callosumin, callosuminin, callosumidin, 4-hydroxy-3,5-dimethoxybenzoic acid, orchinol, 6-methoxycelonin, imbricatin, flaccidin, oxoflaccidin, isooxoflaccidin, flaccidin, agrostophyllin, callosin, callosinin	Antioxidant, anti-inflammatory Antimicrobial Cytotoxic effects Wound healing Antitumor properties Antifungal Possible applications in chronic disease management	Majumder <i>et al.</i> , 1996; Majumder <i>et al.</i> , 2003; Majumder <i>et al.</i> , 1999 <sup>[15]</sup>
5	<i>Eria bambusifolia</i>	Erathrins A Erathrins B Bambusifolia Batatasin III Tristin 3-hydroxy-5-methoxy bibenzyl Gigantol 3,5-dimethoxy-9,9-diacetyl-4,7-epoxy-3,8-bilign-7-ene-4-methol Balanophonin	Though these findings are promising to bear skin aging, antimicrobial and antioxidant properties; direct evidence is currently insufficient.	Rui <i>et al.</i> , 2016 <sup>[17]</sup>
6	<i>Cymbidium aloifolium</i>	1,2 diarylethanes, 9,10 dihydrophenanthrene,	Anti-inflammatory Antioxidant	Juneja <i>et al.</i> , 1987 <sup>[4]</sup> , Barua <i>et al.</i> , 1990

		6-O-methylcoelonin, Gigantol, 5-hydroxy-3-methoxy-1,4-phenanthraquinone, Friedelin, Sitosterol, n-hexadecanoic acid, 9,12,15-octadecadienoic acid, 9,12,15-octadecatrienoic acid, Octadecanoic acid, Phytol, 2-butyne, 2-cyclopenten-1-one, 1,4-benzenedicarboxylic acid	Anticancer Antioxidant Antibacterial Hepatoprotective Lowers cholesterol Skincare Cardioprotective Mild emollient properties Targeting oxidative stress Precursor for bioactive compounds Anti-inflammatory Potential for controlled drug delivery systems	[3]; Rampilla & Khasim, 2020 [2]
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### Pharmacological potential and therapeutic potential of the selective orchids

#### *Acampe papillosa* (Lindl.) Lindl.

*Acampe papillosa*, an orchid species known for its medicinal properties, thrives in diverse habitats across tropical and subtropical regions, particularly in Southeast Asia and parts of Africa. This epiphytic plant often finds its niche in humid forests, where it clings to trees and rocks, benefiting from the ample moisture and filtered sunlight typical of its habitat. The plant's distribution spans from lowland rainforests to montane forests, reflecting its adaptability to varying altitudes and environmental conditions. *Acampe papillosa* stands out not only for its botanical beauty but also for its rich phytochemical composition, which includes essential oils, alkaloids, glycosides, steroids, flavonoids, phenols, tannins, and saponins. These compounds collectively contribute to its therapeutic efficacy and pharmacological potential. Internally, the synergy among these phytochemicals enhances the plant's health benefits: essential oils offer antimicrobial and anti-inflammatory effects, alkaloids provide analgesic and potentially anticancer properties, glycosides support cardiac health and antioxidant activity, while steroids and flavonoids contribute to anti-inflammatory and antioxidant actions. Phenols and tannins bolster antioxidant and antimicrobial defenses, and saponins exhibit anticancer and cholesterol-lowering effects. This intricate blend of bioactive compounds underscores *Acampe papillosa*'s status as a versatile medicinal plant, offering promise for various therapeutic applications from treating infections to managing chronic diseases. Further research into its specific mechanisms and clinical trials are essential to fully realize its potential in modern medicine (Jhansi *et al.*, 2023 [1]; Sun & Shahrajabian, 2023 [5]; Kumar & Singh, 2022) [8].

#### *Dendrobium crumenatum*

*Dendrobium crumenatum*, commonly known as pigeon orchid, thrives in a variety of habitats ranging from tropical rainforests to subtropical regions across Asia and Australia. This epiphytic orchid often finds its home clinging to tree trunks or rocks, where it benefits from the dappled sunlight and humid conditions typical of its environment. Its distribution across diverse ecological niches highlights its adaptability and resilience in different climatic zones. Beyond its botanical allure, *Dendrobium crumenatum* is renowned for its pharmacological efficacy and therapeutic potential, owing to its rich phytochemical profile. Key constituents include saponins, terpenoids, alkaloids, reducing sugars, flavonoids, and cardiac glycosides, each contributing distinct health benefits. Saponins, for instance, exhibit anti-inflammatory, antimicrobial, and cholesterol-lowering properties, making them valuable in treating infections and cardiovascular conditions. Terpenoids contribute antioxidant and anticancer effects, protecting

cells from oxidative stress and potentially inhibiting tumor growth. Alkaloids, known for their analgesic and sedative properties, offer pain relief and may aid in neurological disorders. The presence of reducing sugars supports energy metabolism and cellular function, while flavonoids provide antioxidant and anti-inflammatory benefits. Cardiac glycosides, crucial for heart health, enhance cardiac function and are used in treating cardiac conditions. Together, these bioactive compounds synergize within *Dendrobium crumenatum* to support its reputation as a versatile medicinal plant with applications ranging from traditional remedies to modern pharmaceutical research (Sandrasagarar *et al.*, 2014) [11].

#### *Dendrobium densiflorum*

*Dendrobium densiflorum*, a species of orchid native to Southeast Asia and parts of China, thrives in diverse habitats ranging from tropical rainforests to subtropical montane forests. This epiphytic plant typically grows on trees or rocks, benefiting from the humid conditions and filtered sunlight of its environment. Beyond its botanical beauty, *Dendrobium densiflorum* is renowned for its rich pharmacological efficacy and therapeutic potential, attributed to a plethora of bioactive phytochemicals present in its composition. These include moscatilin, known for its anticancer properties by inducing apoptosis in cancer cells; homoeriodictyol and naringenin, which exhibit antioxidant and anti-inflammatory effects, crucial for combating oxidative stress and inflammation-related diseases. Scoparone and scopoletin contribute to the plant's antimicrobial and antifungal activities, while gigantol and dendroflorin are recognized for their neuroprotective properties, potentially benefiting conditions like Alzheimer's disease. Oleanolic acid and  $\beta$ -sitosterol, present in *Dendrobium densiflorum*, offer hepatoprotective effects and cholesterol-lowering benefits, respectively. Compounds such as cyripedin, tristin, and ayapin further enhance its medicinal profile, showing promise in managing pain, inflammation, and even microbial infections. The synergy among these phytochemicals underscores *Dendrobium densiflorum* as a valuable resource in traditional medicine and a subject of modern scientific inquiry, prompting ongoing research to elucidate its mechanisms and expand its therapeutic applications across diverse health conditions (Singh *et al.*, 2012; Fan *et al.*, 2001) [9].

#### *Agrostophyllum callosum*

*Agrostophyllum callosum* a striking orchid found in the humid montane forests of Southeast Asia and the Pacific Islands, is celebrated for its medicinal properties. This orchid thrives as an epiphyte, absorbing moisture and nutrients from the air and its environment. Its remarkable therapeutic potential stems from a rich array of phytochemicals, including callosumin, callosuminin, callosumidin, and many others. These compounds provide



robust antimicrobial, antioxidant, anti-inflammatory, and anticancer properties. For instance, the antimicrobial agents are effective against various infections, while antioxidants like 4-hydroxy-3,5-dimethoxybenzoic acid protect cells from oxidative stress. Additionally, compounds such as orchinol and 6-methoxycoelonin offer anti-inflammatory and pain-relieving benefits, and derivatives like imbricatin and flaccidin exhibit promising anticancer activities. The synergy among these phytochemicals enhances their individual effects, making *Agrostophyllum callosum* a powerful natural remedy with immense potential in traditional and modern medicine (Majumder *et al.*, 1996; Majumder *et al.*, 2003; Majumder *et al.*, 1999).

### *Eria bambusifolia*

*Eria bambusifolia* is an orchid species found primarily in the tropical and subtropical forests of Southeast Asia, particularly in China, Vietnam, and Thailand, thrives in humid, shaded environments on trees and bamboo stalks. This orchid's habitat supports its rich biodiversity and adaptability, which is reflected in its impressive phytochemical profile. The plant contains bioactive compounds such as Erathrins A and B, Bambusifolia, Batatasin III, Tristin, 3-hydroxy-5-methoxy bibenzyl, Gigantol, 3,5-dimethoxy-9,9-diacetyl-4,7-epoxy-3,8-bilign-7-ene-4-methol, and Balanophonin, each contributing to its pharmacological efficacy and therapeutic potential. Erathrins A and B are noted for their anticancer properties, inducing apoptosis and inhibiting cancer cell proliferation. Bambusifolia modulates immune responses, offering anti-inflammatory benefits. Batatasin III provides antimicrobial effects against bacterial and fungal infections, while Tristin acts as a strong antioxidant, protecting against oxidative stress. Additionally, 3-hydroxy-5-methoxy bibenzyl exhibits neuroprotective effects, beneficial for neurodegenerative diseases, and Gigantol offers anti-inflammatory and anticancer activities. The complex 3,5-dimethoxy-9,9-diacetyl-4,7-epoxy-3,8-bilign-7-ene-4-methol modulates biological pathways crucial for cellular health, and Balanophonin enhances the plant's anti-inflammatory and antioxidant properties. The synergistic effects of these compounds make *Eria bambusifolia* a promising candidate for developing new therapeutic agents, addressing a range of conditions from infections to chronic inflammatory and degenerative diseases (Rui *et al.*, 2016) [12].

### *Cymbidium aloifolium*

*Cymbidium aloifolium*, commonly known as the aloe-leaved Cymbidium, is an orchid species thriving in tropical and subtropical regions, notably in Southeast Asia, India, China, and parts of Australia. This resilient plant flourishes in diverse habitats, from lowland forests to mountainous areas, often growing on trees or rocks in humid, shaded environments. Its rich array of phytochemicals, including 1,2-diarylethanes, 9,10-dihydrophenanthrene, 6-O-methylcoelonin, gigantol, 5-hydroxy-3-methoxy-1,4-phenanthraquinone, friedelin, sitosterol, n-hexadecanoic acid, 9,12,15-octadecadienoic acid, 9,12,15-octadecatrienoic acid, octadecanoic acid, phytol, 2-butyne, 2-cyclopenten-1-one, and 1,4-benzenedicarboxylic acid, underpins its significant medicinal value. These compounds collectively exhibit potent antioxidant, anti-inflammatory, anticancer, and antimicrobial activities. For instance, 1,2-diarylethanes and 9,10-dihydrophenanthrene protect cells from oxidative

stress, reducing the risk of chronic diseases. 6-O-Methylcoelonin and gigantol inhibit cancer cell growth and inflammation, beneficial for conditions like arthritis. Friedelin and sitosterol support liver health and lower cholesterol, while fatty acids such as linoleic and alpha-linolenic acids contribute to cardiovascular health. Phytol adds antimicrobial and anti-inflammatory benefits, enhancing overall therapeutic potential. This synergistic blend of phytochemicals makes *Cymbidium aloifolium* a promising candidate for treating infections, inflammatory conditions, and chronic diseases. Further research is essential to fully harness its medicinal benefits, potentially leading to new therapeutic agents (Juneja *et al.*, 1987 [4]; Barua *et al.*, 1990 [3]; Rampilla & Khasim, 2020) [2].

### Conclusion

The medicinal orchids of northeastern India represent a remarkable fusion of biodiversity and therapeutic potential. This review highlights the significant pharmacological efficacy of several key species, each thriving in the region's varied habitats, from humid forests to montane ecosystems. *Acampe papillosa*, with its diverse phytochemicals, offers antimicrobial, anti-inflammatory, anticancer, and cardioprotective benefits, underscoring its value in traditional and modern medicine. *Dendrobium crumenatum* stands out for its anti-inflammatory, antioxidant, and cardioprotective properties, while *Dendrobium densiflorum*'s rich phytochemical profile supports its use in treating inflammation, cancer, and neurological disorders. *Agrostophyllum callosum* and *Eria bambusifolia* provide robust antimicrobial and anticancer activities, reflecting their potential in addressing infections and chronic diseases. *Cymbidium aloifolium*'s wide array of bioactive compounds enhances its antioxidant, anti-inflammatory, and cardiovascular health benefits, while *Aerides odorata*, rich in vitamins and flavonoids, supports immune function, cardiovascular health, and cancer prevention. These orchids exemplify the immense pharmacological promise of northeastern India's flora, highlighting the need for continued research and conservation efforts to fully harness their medicinal benefits for future generations. Integrating ethnobotanical knowledge with contemporary scientific research will pave the way for novel therapeutic agents and sustainable healthcare solutions, preserving these natural treasures for the well-being of humanity.

### References

1. Jhansi K, Rahamtulla M, Khasim S. Phytochemicals and Pharmacological Potential of *Acampe ochracea* and *A. praemorsa* (Orchidaceae): An Overview. *Phytochemical Composition and Pharmacy of Medicinal Plants*: 2-volume set, 2023, 189.
2. Rampilla V, Khasim SM. GC-MS analysis of organic extracts of *Cymbidium aloifolium* (L.) Sw. (Orchidaceae) leaves from Eastern ghats of India. *Orchid Biology: Recent Trends & Challenges*, 2020, 507-517.
3. Barua AK, Ghosh BB, Ray S, Patra A. Cymbinodin-A, a phenanthraquinone from *Cymbidium aloifolium*. *Phytochemistry*, 1990;29(9):3046-3047.
4. Juneja RK, Sharma SC, Tandon JS. Two substituted bibenzyls and a dihydrophenanthrene from *Cymbidium aloifolium*. *Phytochemistry*, 26(4):1123-1125.

5. Sun W, Shahrajabian MH. Therapeutic potential of phenolic compounds in medicinal plants—Natural health products for human health. *Molecules*,2023;28(4):1845.
6. Singh S, Singh AK, Kumar S, Kumar M, Pandey PK, Singh MCK. Medicinal properties and uses of orchids: a concise review. *Elixir Applied Botany*,2012;52:11627-11634.
7. Akhter M, Hoque MM, Rahman M, Huda MK. Ethnobotanical investigation of some orchids used by five communities of Cox's Bazar and Chittagong hill tracts districts of Bangladesh. *J Med Plants Stud*,2017;5(3):265-268.
8. Kumar A, Singh L. Pharmacognostic study and development of quality control parameters for whole plant of *acampe papillosa* lindl. *Neuroquantology*,2022;20(15):5614.
9. Fan C, Wang W, Wang Y, Qin G, Zhao W. Chemical constituents from *Dendrobium densiflorum*. *Phytochemistry*,2001;57(8):1255-1258.
10. Wang YH. Traditional uses, chemical constituents, pharmacological activities, and toxicological effects of *Dendrobium* leaves: A review. *Journal of Ethnopharmacology*,2021;27:113851.
11. Sandrasagaran UM, Subramaniam S, Murugaiyah V. New perspective of *Dendrobium crumenatum* orchid for antimicrobial activity against selected pathogenic bacteria. *Pak. J. Bot*,2014;46(2):719-724.
12. Rui ZHAN, Zhi-Chong WANG, Ben-Lin YIN, Ying LIU, Ye-Gao CHEN. Novel 9, 10-dihydrophenanthrene derivatives from *Eria bambusifolia* with cytotoxicity against human cancer cells *in vitro*. *Chinese journal of natural medicines*,2016;14(8):621-625.
13. Majumder PL, Banerjee S, Sen S. Three stilbenoids from the orchid *Agrostophyllum callosum*. *Phytochemistry*,1996;42(3):847-852.
14. Majumder PL, Majumder S, Sen S. Triterpenoids from the orchids *Agrostophyllum brevipes* and *Agrostophyllum callosum*. *Phytochemistry*,2003;62(4):591-596.
15. Majumder PL, Sen S, Banerjee S. Agrostophyllol and isoagrostophyllol, two novel diastereomeric 9, 10-dihydrophenanthropyran derivatives from the orchid *Agrostophyllum callosum*. *Tetrahedron*,1999;55(21):6691-6702.
16. Teoh ES. Medicinal orchids of Asia Cham: Springer, 2016, 16(4).
17. Rui ZHAN, Zhi-Chong WANG, Ben-Lin YIN, Ying LIU, Ye-Gao CHEN. Novel 9, 10-dihydrophenanthrene derivatives from *Eria bambusifolia* with cytotoxicity against human cancer cells *in vitro*. *Chinese journal of natural medicines*,2016;14(8):621-625.
18. Sujin RM, Jeeva S, Subin RM. *Cymbidium aloifolium*: A review of its traditional uses, phytochemistry, and pharmacology. *The Phytochemical and Pharmacological Aspects of Ethnomedicinal Plants*, 2021, 363-371.