Review Article

www.ijrap.net (ISSN:2229-3566)

BIOACTIVE MOLECULES PRESENT IN ORCHIDS AND ITS MEDICINAL PROPERTIES: AN OVERVIEW

Pratima Debnath *

Ph.D. Scholar, Plant Gene Expression Laboratory, Department of Plant Molecular Biology,
CSIR- National Botanical Research Institute, Lucknow 226001, India

Received on: 05/04/20 Accepted on: 15/05/20

*Corresponding author

E-mail: pratimabotany15@gmail.com

DOI: 10.7897/2277-4343.110365

ABSTRACT

Orchids are generally cultivated for ornamental purposes. They are widely known for their economic importance in floriculture. Cut flowers have high demand across the world due to many reasons including a wide range in flower color, long flower life span, size and shape. Apart from these orchids are also known for their medicinal values. The chemical constituents present in different parts of orchids are used in many activities. These chemicals belong to the specialized class of metabolites like alkaloids, flavonoids and terpenoids. Phytochemicals extracted from orchids possessed antimicrobial, antitumor, anti-inflammatory and antiviral activities. In this review, we are presenting the study of Orchids which will include its chemical constituents, traditional uses and pharmacological activities.

Keywords: Orchids, secondary metabolites, antioxidant, bioactive, antibacterial

INTRODUCTION

Orchids belong to the largest family of angiosperms Orchidaceae. More than 25000 species of orchids are found and distributed throughout the world from tropics to high alpine¹. In India 2500 species and 167 genera are reported². Which are found in Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura of north eastern region of India and considered as biodiversity hot spot due to the presence of low temperature and high humidity. High humidity and low temperature along with sufficient rainfall has made this region a hot spot for orchids³. Some of the Orchids are also distributed in Eastern Himalayas and Western Ghats⁴. Orchids are generally cultivated for ornamental purposes and are widely known for their economic importance in floriculture. Cut flowers have high demand across the world for wide range in flower color, long flower life span, size and shape⁵. Orchid flowers are of different patterns, sizes and colors. These are considered as one of the highly evolved angiosperms. Orchids are classified into four categories based on their natural habitat which are Epiphyte orchids (*Dendrobium*, *Vanda*, etc.), Saprophyte orchids (*Gastrodia*, *Aphyllorchis*), Terrestrial orchids (*Cymbidium*, *Arundina*, etc) and Lithophyte orchids (*Eria*, *Pholioda*, etc). Orchids are generally known for their beautiful flower and grown for ornamental value. These are also used as food and herbal medicine^{6,7}. But their role in herbal medicine is really significant. Chinese were the first to present evidence of medicinal uses of orchids. The first report of the medicinal use of orchids from 28th century B.C. *Bletilla striata* and a *Dendrobium* species are used in Materia Medica formulated by Shen-Nung². Medicinal orchids belong to *Calanthe*, *Coelogyne*, *Cymbidium*, *Cypripedium*, *Dendrobium*, *Ephemerantha*, *Eria*, *Galeola*, *Gastrodia*, *Gymnadenia*, *Habenaria*, *Ludisia*, *Luisia*, *Nevilia* genera^{8,9}. The presence of important phytochemicals such as phenanthrenes, bibenzyl, alkaloids, flavonoids and their derivatives have been reported from these Orchids. These phytochemicals are responsible for medicinal properties.

ORCHIDS USED IN TRADITIONAL MEDICINE

Evidence of the medicinal value of orchids is as early as 250 – 300 B.C. and was recorded in Vagbhata and Susruta. Many orchids are used in traditional medicine to treat various kinds of diseases like fever, skin disease, an intestinal infection, and also in sore treatments. Boiled leaves extract of *Nervilia aragoana* are used in many northeastern region parts of India to prevent the sickness after the childbirth¹⁰. Many orchids are also used to treat malaria-like *Corymborchis longiflora*, *Tropidia curculigoides*. Extract preparation from *Epidendrum bifidum* has been used to prevent intestinal parasite infection¹¹. *Grammatophyllum scriptum* is used to cure sores in Indonesia. *Dendrobium macraei* and *D. nobile* are the important orchids in Ayurvedic^{12,13}.

PHYTOCHEMICALS PRESENT IN ORCHIDS AND MEDICINAL PROPERTIES

Orchids are generally cultivated for ornamental purposes and widely known for their economic importance in floriculture as well for their medicinal use. Orchids are able to synthesize biochemically active chemical compounds which belong to the secondary metabolites' classes (table 1) and show various kind of pharmacological activity like antimicrobial, antitumor, anti-inflammatory, antiviral activities. Some other orchid genera like *Eulophia*, *Cypripedium*, *Gastrodia*, *Bletilla*, *Bulbophyllum*, *Anoectochilus*, *Arundina*, *Eria*, *Malaxis*, *Habenaria*, *Vanda*, and *Vanilla* are enriching with different important phytochemicals.

Anti-inflammatory Activity

Orchids possess the anti-inflammatory, the extract of *Venda roxburghii* showed the anti-inflammatory action activity in rats and mice due to the presence of Heptacosane and Octacosanol Phytomolecules¹⁴. Leaves extract of *Anoectochilus formosanus* also showed the Anti-inflammatory activity¹⁵. *Dendrobium monoliforme* contains many compounds

with anti-inflammatory activity. The plant is a good source of compounds 7-hydroxy-5,6-dimethoxy-1,4-phenanthrenequinone. The stem of *D. nobile* accumulates the dendroside A and dendronobiloside A which display immunomodulatory effect and stimulates the proliferation of murine T and B lymphocytes^{16,17}. *Gastrodia elata* accumulates many phenolic compounds such as 4-hydroxybenzaldehyde, 4-hydroxybenzyl alcohol, benzyl alcohol, bis-(4 hydroxyphenyl) methane, 4(4'-hydroxybenzyloxy) benzyl methyl ether, 4-hydroxy-3-methoxybenzyl alcohol, 4-hydroxy-3-methoxybenzaldehyde and 4-hydroxy-3-methoxybenzoic acid with anti-inflammatory as well as analgesic activity¹⁸. *Pholidota chinensis* contains triterpenes, cyclopholidonol and cyclophlidos which have an inhibitory effect on nitric oxide production in RAW264.7 cell line¹⁹.

Antioxidative Property

Orchids contain several kinds of phytochemicals which have antioxidant properties. Leaves ethanolic extract of *Ephemerantha lonchophylla* showed antioxidative property *in-vitro* inhibition of human low-density lipoprotein, due to the presence of Ephemeranthone in the extract²⁰. Phytochemical dihydrostilbene

isoamoenylin present in *Dendrobium amoenum* root showed the antioxidative property²¹. Stems of *Dendrobium aurantiacum* contains Cis-melilotoside, dihydromelilotoside and trans-melilotoside have potent leaf extract of *Gastrodia elata* was also reported to have antioxidative properties²⁴.

Antimicrobial Activity

Many members of Orchids plant extract showed the inhibitory effect of microorganisms and also have the potent antimicrobial agent, gram-positive bacteria are more sensitive rather than gram-negative and Fungi²⁵. Protein Gastrodianin obtained from *Gastrodia elata* has antifungal activity⁸. The methanolic extract of *Spiranthes mauritanium* showed an inhibitory effect against bacteria²⁶. *Acanthephippium bicolor* leaves extract showed antibacterial activity against various bacteria like *Bacillus cereus*, *Staphylococcus aureus*, *Streptococcus faecalis*, *Proteus vulgaris*, *Proteus mirabilis*, *Shigella dysenteriae*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Escherichia coli*, *Candida albicans*, *Microsporium audouinii*, *Trichophyton rubrum*, and *Microsporium fulvum*²⁵.

Table 1: Some of the important phytomolecules isolated from medicinal Orchids.

S.No	Secondary metabolites	Compound
1	Alkaloid	Dendrobine, N6-(4-hydroxybenzyl) adenine riboside, Shihunidine, Shihunine
2	Terpenoid	Dendroside A; Dendroside D, Dendroside E, Dendroside F, Dendroside G, Dendronobiloside A, Lonchophylloid A and Lonchophylloid B, Dendromonilide A, Dendromonilide B, Dendromonilide C
3	Flavonoid	5-Hydroxy-3',4',7-trimethoxyflavonol-3β-D-rutinoside, Isorhamnetin-3-O-D-glucopyranoside, Isorhamnetin-7-O-D-glucopyranoside, Homoeriodictyol, Chrysin
4	Bibenzyl derivative	Alkyl ferulates, Aloifol, Gigantol, Nobiletin D, Nobiletin E, Isoamoenylin, Moscatilin, Moscatilin diacetate

CONCLUSION

Orchids are generally cultivated for ornamental purposes and are widely known for their economic importance in floriculture as well for their medicinal use. Cut flowers have high demand across the world for wide range in flower color, long flower life span, size and shape. They are also used for breeding purposes to generate a new variety of flowers. Flowers of *D. nobile* are aromatic and often used in perfumes. The presence of important phytochemicals such as phenanthrenes, bibenzyl, alkaloids, flavonoids and their derivatives have been reported from many Orchids. Phytochemicals extracted from orchids possessed antimicrobial, anti-inflammatory, antiviral activities. Though their medicinal properties were tested in the animal model but there is need of clinical trials of these phytochemicals obtained from beautiful plant Orchids.

ACKNOWLEDGEMENT

This work was supported by fellowship from CSIR-NBRI, project fund.

REFERENCES

- White K, Sharma B. Wild orchids in Nepal: the guide to the Himalayan orchids of the Tribhuvan Rajpath and Chitwan Jungle: Bangkok, Thailand: White Lotus Co Ltd; 2000; 12, 307.
- Stewart J, Griffith M. Manual of Orchids. Timber Press Portland, Oregon;1995.
- Medhi RP, Chakrabarti S. Traditional knowledge of NE people on conservation of wild orchid. Indian J. Traditional Knowledge 2009; 8(1),11-16.
- Jalal JS, Jayanthi J. Endemic orchids of peninsular India: A review. J. of Threatened Taxa; 2012, 4(15), 3415–3425
- Noman A, Aqeel M, Deng J, Khalid N, Sanaullah T, Shuilin H. Biotechnological Advancements for Improving Floral Attributes in Ornamental Plants. Front Plant Sci. 2017; 8, 530-545.
- Khasim S, Rao PRM. Medicinal importance of orchids. The Botanica 1999; 49, 86-91.
- Kasulo V, Mwabumba L, Munthali C. A review of edible orchids in Malawi. J. Hortic. For. 2009; 1(7),133-139.
- Gutiérrez RMP. Orchids: A review of uses in traditional medicine, its phytochemistry and pharmacology. J. Med. Plants. Res. 2010; 4(8), 592- 638.
- Szlachetko DL. Genera ET species Orchidarium. Polish Bot. J. 2001; 46(1),11-26
- Hossain MM. Therapeutic orchids: traditional uses and recent advances-An overview. Fitoterapia. 2011, 82(2), 102-140.
- Minh TN, Khang D, Tuyen PT, Minh LT, Anh LH, Quan NV, et al. Phenolic Compounds and Antioxidant Activity of Phalaenopsis Orchid Hybrids. Antioxidants. 2016; 5(3), 31-43.
- Kasera PK, Shukla JK. Eco-physiological studies of Jivanti (Leptadaenia reticulata) - an endangered medicinal plant of Thar desert, India. Ecoprint. 2001, 8(1), 91-94.
- Meitei AL, Kiran BP, Singh DR. Orchids of India: The Silent Treasure Distribution, Utilization and Conservation. In Wild Ornamental Plants of India – Khuraijam JS (Ed.) Astral International Publishing Company, New Delhi 2019; 277-292
- Chawla AS, Sharma AK, Handa SS, Dhar KL. Chemical studies and anti inflammatory activity of Vanda roxburghii roots. Indian J. Pharm. Sci 1992; 54(2), 159-161.
- Lin JM, Lin CC, Chiu HF, Yang JJ, Lee SG. Evaluation of the anti-inflammatory and liver-protective effects of

- Anoectochilus formosanus, Ganoderma lucidum and Gynostemma pentaphyllum in rats. Am. J. Chin. Med. 1993; 21(1), 59-69.
16. Lin TH, Chang SJ, Chen CC, Wang JP, Tsao LT. Two phenanthraquinones from Dendrobium moniliforme. J. Nat. Prod. 2001; 64(8), 1084-1086.
 17. Bae EY, Oh H, Oh WK, Kim MS, Kim BS, Kim BY, et al. A new VHR dual-specificity protein tyrosine phosphatase inhibitor from Dendrobium moniliforme. Planta Medica 2004; 70(9), 869-870.
 18. Gutierrez, RMP. Orchids: A review of uses in traditional medicine, its phytochemistry and pharmacology. J. of Medicinal Plant Research 2010; 4(8), 592-638.
 19. Wang J, Matsuzaki K, Kitanaka S. Stilbene derivatives from Pholidota chinensis and their antiinflammatory activity. Chem. Pharm. Bulletin 2006; 54(8), 1216-1218.
 20. Chen HY, Shiao MS, Huang YL, Shen CC, Lin YL, Kuo YH, Chen CC. Antioxidant principles from Ephemerantha Ionchophylla. J. Nat. Prod. 1999; 62(9), 1225-1227.
 21. Venkateswarlu S, Raju MS, Subbaraju GV. Synthesis and biological activity of isoamoenylin, a metabolite of Dendrobium amoenum. Biosci. Biotechnol. Biochem. 2002; 66(10), 2236-2238.
 22. Yang L, Han H, Nakamura N, Hattori M, Wang Z, Xu L. Bioguided isolation of antioxidants from the stems of Dendrobium aurantiacum var. denneanum. Phytotherapy Res. 2007; 21(7), 696-698.
 23. Zhang X, Xu JK, Wang J, Wang NL, Kurihara H, Kitanaka S, Yao XS. Bioactive bibenzyl derivatives and fluorenones from Dendrobium nobile. J. Nat. Prod. 2007; 70(1), 24-28.
 24. Jung TY, Suh SI, Lee H, Kim IS, Kim HJ, Yoo HS, Lee SR. Protective effects of several components of Gastrodia elata on lipid peroxidation in gerbil brain homogenates. Phytother. Res. 2007; 21(10), 960-964.
 25. Kala S, Senthil KS. Antimicrobial activity of Acanthephippium bicolor Lindley. Malaysian J. of Microbiol. 2010; 6(2), 140-148.
 26. Matu EN, van Staden J. Antibacterial and antiinflammatory activities of some plants used for medicinal purposes in Kenya. J. Ethnopharmacol. 2003; 87(1), 35-41.

Cite this article as:

Pratima Debnath. Bioactive molecules present in orchids and its medicinal properties: An overview. Int. J. Res. Ayurveda Pharm. 2020;11(3):75-77 <http://dx.doi.org/10.7897/2277-4343.110365>

Source of support: CSIR- National Botanical Research Institute, Lucknow, India, Conflict of interest: None Declared

Disclaimer: IJRAP is solely owned by Moksha Publishing House - A non-profit publishing house, dedicated to publishing quality research, while every effort has been taken to verify the accuracy of the content published in our Journal. IJRAP cannot accept any responsibility or liability for the site content and articles published. The views expressed in articles by our contributing authors are not necessarily those of IJRAP editor or editorial board members.