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RESEARCH ARTICLE

MEDICINAL AND AROMATIC ORCHIDS -AN OVERVIEW

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ABSTRACT

There are about 25,000 species of orchids estimated to occur in the world. In India, about 1350 species belonging to 186 genera represent approximately 5.98% of the world orchid flora and 6.83% of the flowering plants in India. The Eastern Himalayas and North Eastern, North West Himalayas, Peninsular India and Andaman & Nicobar Islands are the major orchid regions of India. Some orchid species like *Dendrobiumnobile*, *Eulophiacampestris*, *Orchislatifolia*, *Vanda roxburghii* and *Vanda tessellate* have been documented for their medicinal value. Phytochemically, orchids have been reported to contain alkaloids, triterpenoids, flavonoids and stilbenoids. Ashtavarga, a group of eight medicinal plants, is a vital part of Ayurvedic formulations like Chyvanprasha and four of these plants viz,Riddhi, Vriddhi, Jivaka and Rishbhaka belong to the family Orchidaceae. In the present study, medicinal parts and properties of more than 30 orchid species and importance of a number of aromatic orchids have been reviewed.

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INTRODUCTION

Orchids are the most diverse group among the angiosperms and phytochemically, orchids have been reported to contain alkaloids, triterpenoids, flavonoids and stilbenoids. Orchids are widely used in traditional Chinese medicines. In India, work has been carried out on chemical analysis of some medicinally important orchids like *Eulophiacampestris, Orchislatifolia*, *Vandaroxburghii*. Throughout the ages, several health-promoting benefits, including diuretic, anti-rheumatic, anti-inflammatory, anti-carcinogenic, hypoglycemic activities, antimicrobial, anticonvulsive, relaxation, neuroprotective, and antivirus activities have been reported to the use of orchids extracts. Orchid fragrance is a relatively volatile substance found in plants. It is stored as essential oils in special cells (osmopheres) at the periphery of flowers, leaves or roots.It has been estimated that as many as 75% of all orchids are 'fragrant'. They emit detectable chemical compounds - some extremely fragrant while in some instances they are extremely repulsive smells.

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Medicinal orchids

Orchids are the most diverse group among the angiosperms and are cultivated for attractive flowers. There is no doubt that the Chinese were the first to cultivate and describe orchids, and they were almost certainly the first to describe orchids for medicinal use. Reinikka in 1995 reports a Chinese legend that Shên-nung described *Bletillastriata*and a *Dendrobium*species in his MateriaMedica of the 28th century BC.Some species like *Dendrobiumnobile, Eulophiacampestris, Orchislatifolia, Vanda roxburghii* and *Vanda tessellata* have been documented for their medicinal value (Bhattacharjee and De, 2005).Phytochemically, orchids have been reported to contain alkaloids, triterpenoids, flavonoids and stilbenoids. Ashtavarga, a group of eight medicinal plants is vital part of Ayurvedic formulations like Chyvanprasha and four plants viz, Riddhi, Vriddhi, Jivaka and Rishbhaka belong to family Orchidaceae (Table1).Orchids are widely used in traditional Chinese medicines. In India, work has been carried out on chemical analysis of some medicinally important orchids like *Eulophiacampestris*, *Orchislatifolia*, *Vandaroxburghii. Dendro biummacraei* is another important orchid used in Ayurvedic medicine as it is reported to be source of Jivanti. *Cypripedium*

parviflora is widely used as aphrodisiac and nervine tonic in Western herbal medicines.Many medicinal orchids are reported to contain alkaloids and have antimicrobial activities. Recently, studies have indicated on isolation of anthocyanins, stilbenoids and triterpenoids from orchids. Orchinol, hircinol, cypripedin, jibantine, nidemin and loroglossin are some important phytochemicals extracted from orchids. Some of the medicinal orchids along with distribution, parts used, and medicinal properties have been tabulated below (Gutierrez, 2010; Singh and Duggal, 2009; Rao, 2004) (Table 2).

Pharmacological Profile of Orchids

Throughout the ages, several health-promoting benefits, including diuretic, anti-rheumatic, anti-inflammatory, anti-carcinogenic, hypoglycemic activities, antimicrobial, anticonvulsive, relaxation, neuroprotective, and antivirus, activities have been reported to the use of orchids extracts. Orchid species attributed to medicinal properties of various ailments are given below (Gutierrez, 2010):

Anti cancer/Anti-tumor

- *Anoectochilusformosanus*
- *Bletillastriata*
- *Bulbophyllumkwangtungense*
- *Dendrobiumchrysanthum*
- *Dendrobiumfimbriatum*
- *Dendrobiumnobile*
- *Ephemeranthaionchophylla*
- *Gastrodiaelata*
- *Spiranthesaustralis*
- *Bulbophyllumodoratissimum*

Convulsive diseases

- *Gastrodiaelata,*
- *Goodyeraschlechtendaliana*
- *Anoectochilusformosanus*

Anti-microbial

- *Vanilla planifolia,*
- *Galeolafoliata,*
- *Cypripedium macranthosvar. Rebunense,*
- *Spiranthesmauritianum,*
- *Gastrodiaelata*

Anti-inflammatory

- *Anoectochilus formosanus*
- *Gastrodia elata*
- *Dendrobium moniliforme*
- *Pholidota chinensis*

Antioxidant

- *Anoectochilus formosanus*
- *Anoectochilus roxburghii*
- *Dendrobium amoenum*
- *Dendrobium moniliforme*
- *Gastrodia elata*
- *Pholidota yunnanensis*

Antidiabvetic

- *Anoectochilus formosanus,*
- *Dendrobiumcandidum*

Diuretic

- *Cymbidium goeringii*

Antihepatotoxic

- *Anoectochilusformosanus*
- *Goodyeraschlechtendaliana*
- *Goodyeramatsumurana*
- *Goodyera discolor*

Neuroprotective

- *Coeloglossum viride*
- *Gastrodia elata*

Pain treatment

- *Maxillaria densa*
- *Scaphyglottis livida*
- *Epidendrum mosenii*

Anti-viral

- *Epipactis helleborine*
- *Listera ovata*
- *Gastrodia elata*
- *Cymbidium spp*

Relaxation

- *Scaphyglottis livida*
- *Gastrodia elata*
- *Maxillariadensa*

Antiplatelet aggregation

- *Dendrobiumloddigesii*
- *Dendrobiumdensifiorum*
- *Ephemeranthaionchophylla*
- *Gastrodiaelata*

Anti-allergic: *Gymnadeniaconopsea*
Antipyretic: *Dendrobiummoniliforme*
Antimutagenic activity: *Dendrobiumnobile*
Endurance capacity: *Anoectochilusformosanus*
Ameliorative: *Anoectochilusformosanus*
Anthelmintic: *Bletillastriata*
Anti-aging: *Coeloglossumviride* var. *bracteatum*
Gastric: *Dendrobiumnobile, Gastrodiaelata*
Herbicidal agent: *Epidendrumrigidum*
Maturation: *Anoectochilusformosanus*
Phytoalexin: *Coelogynecristata*
Skin blood flow: *Calanthe discolor*
Wound healing:*Vandaroxburghii*

Table 1. Medicinal plants used in Ashtavarga, composite Ayurvedic formulation (Singh and Duggal, 2009)

S.No.	Ayurvedic name	Botanical name	Family	Part used
1.	Jivaka	*Malaxismuscifera*	Orchidaceae	Bulb
2.	Rishbhaka	*Malaxisacuminata*	Orchidaceae	Pseudo-bulb
3.	Meda	*Polygonumverticillatum*	Polygonaceae	Rhizome
4.	Mahameda	*Polygonumcirrhifolium*	Polygonaceae	Rhizome
5.	Kakoli	*Roscoeaprocera*	Zingiberaceae	Root
6.	KshiraKakoli	*Fritillariaroyeli*	Liliaceae	Root
7.	Riddhi	*Habenariaintermedia*	Orchidaceae	Root
8.	Vriddhi	*Habenariaedgeworthii*	Orchidaceae	Root

Table 2.Medicinal orchids and their medicinal properties

S.No.	Botanical Name	Distribution	Parts used	Medicinal properties
1.	*Acampepapillosa*	North Eastern India	Roots	Root is used for rheumatism, sciatica, neuralgia, syphyllis and uterine diseases.
2.	*Acampepraemorsa*	Western Ghat of India	Roots	Anti-rheumatism
3.	*Aeridescrispum*	Western Ghat of India	Whole plant	Its plants are powdered, boiled in neem oil, filtered, 2-3 drops of oil are put into the ear once at night as a cure for earache.
4.	*Aeridesmultiflorum* Roxb	Himalaya (Garhwalto Sikkim), Assam, India and Burma	Tubers	Antibacterial
5.	*Anoectochilusformosanus* Hayata	Taiwan	Tubers	Chest and abdominal paints, diabetes, fever, nephritis, hypertension, impotence, liver spleen disorders, and pleurodynia, anti-inflammatory agent
6.	*Arundina graminifolia* (D. Don) Hochr.	Himalayas of Nepal, Sri Lanka, Thailand, Laos, Cambodia, Vietnam, southern China, Japan, Taiwan and south to Malaya and Java	Rhizome	Antibacterial
7.	*Bletilla striata* (Thunb.) Rchb.f.	Taiwan, Nepal, Tibet, China	Tuber	Treatment of sores, ulcers and chappedskin, heal wounds, reduce swelling, and promote regeneration of tissue
8.	*Calanthe triplicata*	North East India	Roots, flowers & pseudobulbs	Roots are ingredient of local medicine to treat swollen hands; with other ingredients roots chewed for diarrhea, Flowers as a painkiller in caries, Pseudobulbs as a masticatory, gastrointestinal disorders.
9.	*Coelogyne ovalis*	Western Ghat of India	Whole plant	The whole plant is used in Western and Southern parts of India for cough, urinary infections and eye disorders.
10.	*Cypripedium calceoluspubescens* (Willd.) Correll	N. America to E. Asia - Japan	Roots	Antispasmodic, diaphoretic, hypnotic, nervine, sedative, tonic
11.	*Dendrobiumchrysanthum*	China	Leaves	Antipyretic, eyes-benefiting, immuno-regulatory purposes, skin diseases
12.	*Dendrobiumjenkisii*	North East India	Stems	Fresh and dried stems used in preparation of Chinese drug Shih-hu
13.	*Dendrobiummacraei* Auct	Himalayas	Tubers	Tonic for general debility
14.	*Dendrobiumnobile* Lindl.	Himalayas and China	Stems	Antiphlogistic, pectoral, sialogogue, stomachic and tonic
15.	*Dendrobiumovatum*	Western Ghat of India	Stems	Juice obtained by hand crushing the stems is used on patients suffering from constipation and stomachache
16.	*EpidendrumMosenii*	China&Korea	Stems	Analgesic
17.	*Eulophianuda* Lindl.	Himalayas	Tubers	Demulcent and anthelmintic
18.	*Gastrodiaelata*	Asia	Whole plant	Treatment of epilepsy
19.	*Goodyeraschlechtendaliana*	India	Whole plant	Tonic for internal injuries and to improve circulation
20.	*Habenaria edgeworthii* Hook.f. ex Collett.	E. Asia - Himalayas	Leaves & roots	Cooling and spermopiotic
21.	*Habenaria pectinata* D.Don	Himalayas	Leaves &tubers	The leaves are crushed and applied in snake bites. Tubers mixed with condiments are used in arthritis
22.	*Malaxisacuminta* D.Don	Himalayas 1800 m to 3500 m eastwards to Sikkim	Pseudobulb	Cooling, febrifuge and spermopiotic
23.	*Malaxismuscifera* (Lindl.) Kuntze	Himalayas 1850 m to 2300 m Himachal Pradesh to Arunachal Pradesh	Bulb	Cooling, febrifuge and spermopiotic

24.	*Maxillariadensa*	Mexico	Whole plant	Treatment of painfulcomplaints. Relaxant agent
25.	*Orchislatifolia*L.	Western Himalayas, Afghanistan a nd Iran	Roots	Treatment of diabetes, diarrhea, dysentery, paralysis, convalescence, impotence and malnutrition
26.	*Orchislaxiflora* Lam.	South Europe, North Africa and West Asia.	Bulb	Treatment of diarrhea, bronchitis and convalescence
27.	*Satyriumnepalense*	North East India	Tubers	Tubers eaten by Monpa tribe for Malaria, dysentery, also aphrodisiac
28.	*Spathoglotisplicata*	North East India	Whole plant	Decoction of the boiled plant used for rheumatism and used in hot as a foment.
29.	*Spiranthessinensis*var. *amoena*	Nepal, China & Taiwan	Roots	Aphrodisiac, treatment of hemoptysis, epistaxis, headache, chronic dysentery and meningitis
30.	*Vanda roxburghii*	India	Leaves & roots	The paste applied to the body to bring down fever. The juice is dropped in the ear for the treatment of otitis. The roots are used in dyspepsia, bronchitis, rheumatim and sciatica
31.	*Vanda tessellata* (Roxb.) Hook. Ex Don	India, Sri Lanka and Burma	Whole plant	Paste of leaves is used as application in fevers. It is ingredient of *Rasna Panchaka Quatha*, Ayurvedic formulation used in the treatment of arthritis and rheumatism. Expressed juice of the leaves is sued in the treatment of otitis media. The root is used as antidote against scorpion sting and remedy for bronchitis
32.	*Vanilla planifolia*	Mexico	Sheath	Used as for the treatment of hysteria, fever, impotence, rheumatism, and to increase the energy, of muscular system

Table 3. Aromatic chemicals and fragrant orchids

Aromatic chemicals	Aromatic species
cineole medicinal (citronellol rose- like)	*Brassavola nodosa, Brassavola digbiana*
benzyl acetate (jasmine)	*Stanhopea tricornis, S. Grandiflora, S. Reichenbachiana, Cycnoches ventricosum, C. Warscewizii, C. Loddigesii, C. Chlorochilon*
d-carvone (rye bread)	*Catasetum discolor*
methyl salicilate(wintergreen)	*Catasetum collare, Catasetum gnomus, Catasetum candida*
Methyl cinnimate	*Catasetum roseum, Stanhopea saccata, Gongora quinquenervis*
Eugenol	*Gongora quinquenervis*
1,8-cineole	*Stanhopea cirrhata*
Linalool	*Brassovola digbiana, Gongora quinquenervis*

Aromatic Orchids (De, 2014)

Orchid fragrance is a relatively volatile substance found in plants. It is stored as essential oils in special cells (osmopheres) at the periphery of flowers, leaves or roots. Only small amounts are present as the substance can be toxic to the plant. These fragrant oils can consist of volatile compounds (Table 3). Being volatile, it readily changes into vapour at ordinary temperature, allows us to smell them.

Scent Production

It has been estimated that as many as 75% of all orchids are 'fragrant'. They emit detectable chemical compounds - some extremely fragrant while in some instances they are extremely repulsive smells. Only some of the odoriferous compounds released by a flower are detectable by the human sense of smell, since these are complex substances closely related to the body chemistry of the pollinator they are 'supposed' to attract. Fragrances are produced in specialized glands (osmopheres) which can be located anywhere on a flower or bud, depending on function. These are glands of intense physiological activity and are a large drain on the plant's energy. When non-fragrant flowers become isolated geographically fragrance may evolve as a pollinator attractant.

There is, for example, a fragrant form of *Phalaenopsisamabilis* from New Guinea, although all other known forms of the species from other locations are without scent.All flower parts can produce odours, from sepals and petals to calluses and basal spurs. Osmopheres in orchids may be diffuse and function only in very general attraction, or they are confined to certain regions of the flower so that pollinators are attracted to these specific areas and collect or deposit pollinia in the process. Scent glands are most often situated on the lip e.g. *Stanhopea, Herschelia* and *Catasetum.* Members of the *Catasetinae* and *Gongorinae* subtribes produce the most voluminous quantities of scent known amongst orchids. The fragrance of *Catasetum* flowers is interrupted within a few hours of pollination to conserve energy by limiting osmophericactivity. The intricate flowers of the scented *Gongoras* last only for two or three days but compensate for this by several opening in succession. It is found that if the lip (where the scent is produced) is removed, the flower lasts for two to three weeks. A urine-like smell is produced at the tips of the long tepals in *Phragmipediumcaudatum* and could this be to attract the ants who aid in pollination. The long tails of the sepals of *Cirrhopetalumornatissimum* give rise to an odour of whale oil, while the lip smells of fresh herring.

Orchid floral fragrances are produced in a daily cycle with the time of maximum fragrance production generally being during the time when the pollinator of that species would be active. Fragrance production requires energy. Therefore the timing of scent production often coincides with the time of visitation of

pollinators to use the least energy to achieve the maximum effect. Lady of the Night orchid (*Brassavolanodosa*) will perfume a warm Summer's evening with its heavy fragrance. The medicinal sweet odour is released shortly after sunset, reaching maximum strength around midnight, and fading quickly after sunrise.

The scent release is strictly a light-controlled phenomenon and regulated by a photochrome trigger. Fragrances may change throughout the day both quantitatively and qualitatively as well as from day to day:

Clowesiarosea smells of Vicks Vapo rub in the morning and cinnamon in the afternoon. *Catasetumexpansum* smells of turpentine in the morning and rye bread in the afternoon.Bee-pollinated flowers are fragrant early in the day. *Cattleyaluteola*, for example, is very fragrant between 4:00 and 8:00 am. Some orchids such as *Epidendrumdifforme* are moderately fragrant throughout the day with a peak fragrance production at night. Others such as *Epidendrumfalcatum*, change fragrance quality and intensity during the day, from the delicate, haunting scent of jasmine in the morning to a stronger note resembling that of Easter lilies or narcissi during the afternoon.

Fragrant compounds can be manufactured synthetically and used to attract pollinators in the field. This helps to identify pollinators where field observations may be lacking. *Rhyncolaelia (Brassavola) digbiana* is a wonderfully fragrant and handsome parent producing a strong lemon-like perfume. *Rhyncolaeliaglauca* emits a rosy-floral scent. *Neofinetiafalcata*, which is fragrant during the day and night, awards most of its progeny with fragrance.

Other Examples of Aromatic Orchids

Maxillariatenuifolia, Lycastearomatica, Lycastecruenta, Lycastelocusta, Thuniamarshalliana, Eriahyacinthoides, Masdevalliatriangularis, Masdevalliaglandulosa, Angraecum distichum, Zygopetalumintermedium, Calauthronbicornutum, Cycnocheschlorochilon, Dendrobiumanosmum, Diaphanant efragrantissima, Cyrtorchisarcuata, Pterygodiumcaffrum, alatum and catholicum, Disacooperi, Satyriumneglectum, Satyriumodorum, stenopetalumlupulinum, bracteatum, muticumand erectum,Mystacidiumcapense and Mystacidiumvenosum, Aeridesmultiflorum, Aeridesodoratum, Aeranthes ,Bulbophyllumodoratissimum, Cattleya maxima, Coelogynecristata, Coelogyneochracea, Cymbidium ensifolium, Dendrobiumnobile, Epidendrumcristatum, Epidendrumfloribundum, Epidendrumnocturnum, Lycaste, Oncidiumspaceolatum, Phaiustankervilleae, Rhyncostylisretusa, Vanda cristata, Vanda tessellata.

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