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VALUABLE TERRESTRIAL ORCHIDS- AN OVERVIEW

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ABSTRACT

Globally, out of 25,000-30,000 orchid species, 20% are terrestrial and grow on the ground level in the soil. These orchids are rich in starch and alkaloids and medicinally important. Terrestrial orchid often grow from rhizomes and have hairy roots. They may be either creeping or erect type based on their growth habit. In the present review, botanical description, medicinal use and culture of some important genera of terrestrial orchids*viz. Calanthe, Eulophia, Phaius, Pleione, Habenaria, Malaxis* and *Orchis* are discussed.

KEYWORDS: Terrestrial Orchid Often Grow From Rhizomes And Have Hairy Roots

INTRODUCTION

Orchids are monocot plants, belonging the family orchidaceae and comprise of 25,000-30,000 species in the world. They may be epiphytic, terrestrial and litophytic. About 70% of the worlds orchids are epiphytic and/or litophytic, 25% are terrestrial and 5% of the worlds orchids grow in mixed substrates (both litophytic, epiphytic and terrestrial) (Arditti, 1992).

Terrestrial orchids grow on the ground level in the soil. Most of these can be found in North America, Europe, and cooler regions of Asia. In India, they are mostly distributed in western Himalayan regions. There are a great number of species even among the terrestrial orchids. They are either found on the forest floor under shade (for example *Calanthe, Acanthephippium, Eulophiamacrostachya, Tainia, Phaius*etc.) or in open grasslands and meadows like *Habenaria, Peristylus, Pachystoma, Ipsea, Eulophianuda*etc. These orchids are rich in starch and alkaloids and medicinally important.

Based upon growth habit, terrestrial orchids are either creeping or erect type and can be divided into two types: the solitary type and those growing in clumps or tufts. Within the solitary type group of terrestrial orchids there are two kinds of growth habit; one with plants producing single, erect, leafy stems arising from underground tubers or corms which are terminated by an inflorescence. They are deciduous after fruiting and seeding are completed. The tubers or corms continue their life cycle after completion of an annual period of dormancy. Orchids with the second type of solitary growth habit produce a flowering shoot and leafy shoot from separate buds on the rhizome. Genera such as *Nervilia*, *Eulophia* and *Pachystoma* are examples of this type. The erect terrestrials are usually evergreen, retaining their leaves for more than a year. Each new growth starts from the base of the leafy pseudobulbs as in the genera *Liparis, Acanthephippium*, *Calanthe* and *Phaius*.

The creeping terrestrial orchids have mostly slender, smooth, fleshy rhizomes with elongated internodes and several short or long roots at the nodes. Axillary buds, formed below the apex of the rhizomes produce and ascending leafy and flowering shoot. New annual growth is repeated at the end of flowering, fruiting and, in most cases, after leaf fall. The mother ascending shoot gradually becomes prostrate and becomes an additional part of the rhizome. Examples of orchid

genera in New Guinea with this type of growth habit are *Erythrodes, Eurycentrum, Eucosia, Hetaeria, Macodes, Vrydragzynea*and *Zeuxine.*

Terrestrial orchids generally prefer (De *et al*, 2014) :

- A potting medium that retains moisture
- Even watering
- Moderate humidity
- Less air movement
- Less fertilizer
- Cooler temperature
- Lower light levels

DESCRIPTION, MEDICINAL USE AND CULTURE OF IMPORTANT TERRESTRIAL ORCHIDS

Calanthe

Calanthe is a genus of about 200 terrestrial species that are widespread throughout all tropical areas but are highly concentrated in Asia. The first man-made orchid hybrid created was a *Calanthe* Dominii, back in 1853, and *Calanthe* were very popular hot-house plants during the Victorian Era.

There are two types of *Calanthe*, the deciduous ones which generally have large, silvery pseudobulbs, drop their leaves in winter, and require less water during winter; and the evergreen *Calanthe* which have either no pseudobulbs or very inconspicuous ones, usually keep their leaves for several seasons, and require even moisture year round. The scape is axillary, terminal or lateral from a leafy pseudobulb. The racemes are long, bearing few to 20 flowers, which are subtended by leafy bracts. The flowers are basically white, red or mauve, medium sized and attractive.

GENETIC RESOURCES (DE, 2011)

Calanthetriplicata: This species is native to the Philippines, Pacific Islands and Australia. An evergreen species with hairy long inflorescence. The flowers are white coloured with reddish and yellow tinge turning black with age and produced during summer and autumn.

Calanthemasuca: An evergreen species of Sikkim Himalaya and Western Ghat with elliptic–ovate to lanceolate leaves. Inflorescence is 90 cm tall and crowded with 12 to 15 small blue violet flowers.

CalantheRegnieri: A deciduous species from Vietnam. The inflorescence is 45 cm long, pubescent with 8-10 flowers. The flowers are white tinged with pink and produced during winter season.

Calantherosea: A deciduous species from Burma. The pseudobulbs are spindle shaped. The leaves are broadly lanceolate. The inflorescence is raceme and many flowered. The flowers are long lasting and rose pink to white or dark rose in colour and produced in autumn and winter.

Calantheveratrifolia: This species is native to India and Australia. The leaves are elliptic and distinctly folded

light green in colour. The inflorescence is 150 cm tall, erect and many flowered. The flowers are long lasting, white and produced during May.

Calanthevestita: A deciduous species from India, Malay Peninsula, Burma and Thailand. The pseudobulbs are conical, egg shaped carrying 3-4 leaves. The inflorescence is 150 cm tall, arching and arranged with large white flowers.

Calantheveitchii: It is a hybrid of *Calantherosea* and *Calanthevestita*. The pseudobulbs are elongated with deciduous leaves. The inflorescence is 75 cm tall with rich rose flowers. The flowers are long lasting and suitable as cut flower and produced in January –February.

Calanthesylvatica: A terrestrial tropical and subtropical orchid from North East India. Flowers are large lilac to deep purple with a prominent spur and produced in August-September.

Calanthealasmifiolia: Native to Bhutan, India, Sikkim, West Bengal, Arunachal Pradesh and Nepal. The inflorescence is corymb. The flowers are white and produced in May-June.

Calanthebiloba: Native to Bhutan, India and Nepal. Pseudobulbs are elongated. The flowers are yellow-ochre spotted with violet or purple brown and produced in September-November.

Calanthebrevicornu: Native to Bhutan, India and Nepal. Pseudobulbs are round. The inflorescence is terminal and arranged with 8 to 15 flowers. Flowers are brick red to purple red colour striped with white or yellow and produced in May-June.

Calanthechlorleuca: Native to Bhutan and India. Pseudobulbs are conical cylindric. The flowers are yellow green, fragrant and produced in April-May.

Calanthepuberula: Native to India, Bhutan and Nepal. The pseudobulbs are ovoid-conical. The flowers are loosely arranged with inflorescence. The flowers are pale-lavender and produced in June to August.

Calanthediscolor: An evergreen species. Flowers are pure white.

Calanthearistulifera: A rarest endemic species of Japan. An evergreen species, 45 cm tall spikes bearing light pink flowers.

Hybrids: During the 1850's, Mr. Dominy developed first hybrid, *Calanthedominyi*, which is a cross bettwen*Calanthemasuca*and *Calanthefurcata*.

Inter-specific Hybrids: Hizen = *Calanthediscolor x Calanthearistulifera*; GhitaNorby = *Calanthetriplicata x Calanthemadagascariensis*; Egg Drop = *Calanthearisamensis x Calanthestriata*; TydaresSieboca = *Calanthestriata x Calanthemasuca*; CalantheSieboldii 'Takane' hybrids, CalantheKozu 'Spice' hybrids

Bigeneric Hybrids: Phaiocalanthe = *Phaius x Calanthe*; Gastrocalanthe = *Gastrorchis x Calanthe*

Inter-varietal Hybrids: 'Elegance', 'Tsiku Flamingo', 'Tsiku Honolulu', 'Narita', Urayasu', 'Pink Champagne', 'Mont Nicholle', 'Kitayama', 'Koriyama', 'Ranyu', 'Bouvet', 'Mac's Gold', 'Mont Isaac', 'Mont Couchon', 'Mont Remon'.

Medicinal uses: These species are used as cut flowers. Calanthe orchids are rich in linalool, methyl benzoate,

methyl salicylate, carvone and cinnamic aldehyde. *Calanthemasuca*is used for the treatment of acnes and inflammatory sebaceous cysts.

Cultivation: Basically they grow terrestrially in deep patches of forest humus, on rotting logs, and among rocks with crevices filled with leaf litter. In cultivation one should practice in pots in order to get the best growth and blooming from the plants. The plants grow well in a temperature range of 15-25°C, light intensity of 1800-2500 foot candles and relative humidity of 50-70%. They require ventilated, well lighted and airy conditions for proper growth and flowering. The compost mixture should consist of charcoal, tree bark, sphagnum moss, pea nut shells, cow dung, perlite and sandy soil. Dilute liquid manure is to be applied at monthly intervals. Propagated by the division of bulbs.

EULOPHIA

Eulophia consists of 300 species of sympodial terrestrial orchids from Africa, Madagascar, Malayasia, Sri Lanka, China, America and India. The pseudobulbs are subterranean topped by 3 to 5 linear-lanceolate leaves. The leaves are leathery or soft, 1.8 m tall and 10-12.5 cm wide. The inflorescence is simple or branched and bears few to many attractive flowers which are long lasting. The flower spikes are 1-2 m tall and arranged with diverse types of flowers, which are yellowish or greenish in colour with some brown and purplish markings.

GENETIC RESOURCES

Eulophiaalata: Native to South Florida, Brazil and West Indies. The pseudobulbs are corm like, subterranean and borne in a long creeping series and 7.5 cm across. Leaves are dark green and arise from pseudobulbs, 1.2 m tall and 7.5 cm across. The inflorescence is 1.5 m tall, raceme, and bearing attractive flowers. The flowers are 4 cm indiameter; scented, long lasting, greenish bronze yellow or dull yellow, green purple or maroon in colour with cup shaped maroon purple lip and produced in autumn and winter.

Eulophiaandamanensis: Native to Andaman Islands. The stems are tuberous at base.

Eulophiaovalis: Native to tropical Africa. Plants are 70 cm tall with purple and white or cream to lilac in colour.

Eulophiaexplanata: A tall robust species from Garhwal, Kerala, Chhotanagpur and Kumaon with a short pseudostem covered by sheathing bases. The inflorescence is 60 cm tall with lemon yellow flowers. The flowers are produced during June-July.

Eulophiaguineensis: Native to West tropical Africa. The pseudobulbs are clustered, furrowed, and irregular with stalked narrowly elliptic leaves. The inflorescence is raceme like, erect, 90 cm tall and has 10-15 flowers. The flowers are fragrant, long lasting, waxy, greenish brown with a white lip.

Eulophiamackinnonil: A tropical and subtropical species from Western Himalayas. Pseudobulbs are flat, triangular with acuminate and lanceolate leaves. The inflorescence is a raceme and 8 to 12 flowered. The flowers are yellow to reddish brown and produced in July-August.

Eulophiaspectabilis: A terrestrial species from Bhutan, India and Nepal. Pseudobulbs are spherical and subterranean with 3 to 4 pleated leaves. The inflorescence is 5-15 flowered. Flowers are purple brown to pure green in colour and produced in April-July. *Eulophianuda*: A tuberous plant with smooth spherical leaves. Leaves are elliptic. Flowers are lax-raceme, 9-20 flowered and rose-pink in colour.

Eulophiaparviflora: Native to Eastern Cape and grown in grassland and rocky slopes. Flowers are pleasantly scented with brown and yellow flowers.

Eulophiaaculeata: Native to south-western Cape to Mpumalanga. Plants are rhizomatous, 50 cm tall with ivory to greenish, pink or purple flowers.

Eulophiaclavicornis: Native to tropical Africa. Plants are rhizomatous, 80 cm tall with white to purple or yellow petals.

Eulophiafoliosa: Native to South Africa. Plants are 60 cm tall with dense elongated clusters of lime green flowers.

Hybrids: *Eulophia x burundiensis*(*Eulophiacucullata x Eulophiaflavopurpurea*), an inter-specific hybrid is native to South Africa. Flowers are large and bright yellow in colour. Popular as pot plants. Another hybrid available in these genera is 'John Davison'.

Medicinal uses: Tubers of *Eulophiaochreata*are used for the treatment of earache and toothache. In India, the tubers of *Eulophianuda*are used to treat tumours, scrofulous glands, blood disorders, bronchitis, tuberculosis and as a vermifuge. Raw tubers are eaten in rheumoid arthritis. *Eulophiaspeciosa*, a native to Africa is used as food sources, for medicinal purposes and in superstition. The attractive flowers are used on letter stamps.

Cultivation: Eulophias prefer humid and well lighted location, exposure to direct sun should be avoided. The sympodial terrestrial species prefer a temperature range of 10 to 15°C, relative humidity of 40-60% and light intensity of 3000-5000 foot candles depending upon the species. The pot mixture comprising of leaf mould, sandy soil, tree bark, sphagnum moss and perlite mixture is good. Application of dilute liquid form of well rottedcowdung manure at monthly intervals is beneficial. Epiphytic species should be grown on osmunda fibre or tree fern block with sphagnum moss.

PHAIUS

Phaius consists of 30 species of terrestrial orchids distributed in East Africa to Tropical Asia, Pacific Islands, Himalayas, New Caledonia, Indonesia and Fiji Islands. The pseudobulbs are stocky and thickened and arranged with 2 to 8 large, thin, deeply grooved, and long and lance shaped leaves. The individual leaf is 1.2 m long and 20-25 cm wide. The inflorescence is 90 to 120 cm long, arises from the rhizome base between the points of attachment of two leaves. The flowers are large, showy, 10 cm across, long lasting and of various colours.

GENETIC RESOURCES

Phaiustankervilleae: Native to tropical Asia, Australia and Pacific Islands. The pseudobulbs are lightly clustered, dull green with very large folded and heavy leaves. Inflorescence is stout longer than leaves, tipped by a spike of 15-20 flowers. The flowers are 11 cm across, long lasting, sweet smelling. The fragrant flowers are silvery on the outside and have yellowish throats. Commonly known as 'Nun's Orchid'. Flowers are produced during December-March.

Phaiushumboltii: Native to Madagascar. The leaves are 50 cm long and broadly lanceolate. Inflorescence is 15 to 20 flowered, erect and thick. The flowers are 6.5 cm across and rose coloured. Flowers are produced during June-July.

Phaiusflavus: Flowers are 45 cm tall and are usually produced during April-June. The species is native to Japan

and Asia. Commonly known as 'Rock Orchid'. Flowers are yellow with a reddish brown banded lip. Pseudobulbs are conical, topped with 50-60 cm long plicate variegated leaves.

Phaiusmishmensis: Plants are40-140 cm tall. Pseudobulbsare stemlike, cylindric. Leaves are 4-7; blade green, elliptic or obovate-lanceolate, glabrous, apex acute. Inflorescences arising from middle nodes of pseudobulb or axils of upper leaves above middle, as tall as or taller than height of leaves, 35-45 cm, sparsely 2-10-flowered, glabrous; floral bracts caducous, oblong-lanceolate, 3-4 cm, glabrous. Flowers are 5-6 cm in diam.; pedicel and ovary 2-3 cm, glabrous; sepals and petals pale pink to dark red or purple-brown. Sepals similar, elliptic, glabrous, apex subacute. Petals oblanceolate, apex obtuse; lip white to pink, densely reddish brown spotted, obovate-triangular, 3-lobed; lateral lobes ovate, margins flat or slightly undulate, apex obtuse or rounded; mid-lobe subsquare or broadly obovate, margin undulate, apex emarginate to retuse; disk with 3 or 4 densely hirsute-pubescent ridges extending to mid-lobe; spur slightly curved, yellow-green, narrowly cylindric, apex obtuse. Column yellow or whitish.

Hybrids: 'Masako', 'Morningstar', 'Spring Fever'

Medicinal uses: Paste of pseudobulbs of *Phaiustankervilliae*is used to heal swellings of hand and legs, and in poultices to soothe pain of abscess.

Cultivation: Phaius should be grown in a temperature range of 16°C to 24°C night to day. However, the plants will tolerate lower temperatures to 10°C or higher to 32°C. They enjoy bright light or light shade. Plants are grown in pots with a mixture of 2 parts coarse peat moss, 2 part sandy loam and 1 part each perlite and fine bark and watering with good drainage. Fertilize the plants at every third watering with a balanced Orchid fertilizer, such as 18-18-18, diluted to half the strength recommended. Repotting of phaius orchids is required every two or three years. They are propagated by flower stalk cuttings or divisions.

PLEIONE

Pleione consists of 20 species of cool growing terrestrial or lithophytic orchids distributed in China, Formosa, the Himalayas and South East Asia. These deciduous orchids are known as 'Indian Crocus'. The psedubulbs are angular, one clustered, small and sometimes mottled with black. These pseudobulbs are topped by a solitary folded leaf. Pseudobulbs arise from the base of each pseudobulb, one or two flowered and attractive. The flowers are delicate and frilled.

GENETIC RESOURCES

Pleionehumilis: This species is native to Sikkim and grown in high altitude. The pseudobulbs are egg shaped and clustered with solitary, folded and deciduous leaves. The flowers are 12.5 cm across, fragrant, white and produced during September-October.

Pleionemaculata: A dwarf orchid from India. The pseudobulbs are flask shaped or almost conical, compressed and tuberculate at base. The leaves are folded, two and deciduous. The flowers are solitary, fragrant, 5 cm across, long lasting, white and produced during October-November.

Pleione praecox: Distributed in South China, India, Burma and Himalayas. The pseudobulbs are egg shaped, lightly clustered, bottle shaped and depressed at the apex. The leaves are 2, folded, deciduos and elliptic to lanceolate. The flowers are solitary, fragrant, long lasting, 12.5 cm across, magenta red in colour and produced during December.

Inter-specific Hybrids: 'Io', 'Mandrill', 'Gelada', 'Kima', 'Langur', 'Polto', 'Dr. Mo Weatherhead', 'Bonobo', 'Mariemonda', 'Lucey', 'Muriel', 'Orangutan', 'Nozomi', 'Spring', 'Renate', 'Lilac Wonder', 'Umpqua Jan Shan', 'Yeti', 'Zottel', 'Sinope', 'Kyoto', 'Confirmation'.

Inter-varietal Hybrids: 'Darwin', 'Gorilla', 'Wahakari', 'Jake Butterfield', Helen Brownsword', 'Vicky', 'Michael Butterfield', 'Snow Monkey', 'Adabra', 'St. Helens', 'Badaling', 'Fan Jiang', 'Kiku', 'Mikado', 'Trask', 'Ashmore', 'Calypso', 'Titan'.

Variety – species Hybrids: 'Aye-Aye', 'Austice Harris', 'Sifaca', 'Tai Pan', 'Kong', 'Mardin', 'Leda', 'Bo Pan', Little Goose Pagoda', 'Yokata', 'Sakura', Floor Shan', Hazlebury'.

Medicinal uses: Pseudobulbs of *Pleionemaculata* are used in liver complaints and stomachache. Pseudobulbs of *Pleioneformosana* are rich in dihydrophenanthrene, pleioanthrenin, bibenzyls, pleiobibenzynin and cyclomargenyl -p-coumarate. The pseudobulbs are used to treat tumors.

Cultivation: Pleiones prefer bright filtered light with the intensity of 1000-1500 foot candles. Most Pleiones require cool to intermediate temperatures. Maximum day temperatures should be between 22-25°C, and night minimums between 15-18°C. During the winter months, the plants benefit from a night minimum between 10-15°C.Plants are grown in shallow clay pots or pans. The potting mixture should consist of tree bark, peat and sphagnum moss. Plenty of fresh air movement and watering are essential. Plants are propagated by divisions of bulbs.

HABENARIA

Habenaria comprises of 750 species widely distributed in India, Europe and North and South America. These are terrestrial leafy herbs. The plants possess undivided or lobed tubers and fleshy radical fibres. The stem is erect, bear few to many leaves. The leaves are not plaited, bases sheathing and rarely stalked. The flowers are spicate or raceme. The inflorescence is terminal, fairly long with many small to large flowers. The sepals are subequal or dorsal is shortest, the lateral sepals are ascending, spreading or deflexed. The petals are small or large, simple or cleft. Lip is spurred; the blade is variously shaped, trilobed or simple, continuous with base of column. The anther is adnate to the very short column. Pollinia 2, clavate or pyriform (Bhattacharjee and Das, 2008).

GENETIC RESOURCES

Habenariaplantaginea: It is distributed in subtropical Himalayas and Peninsular India. The inflorescence is lax flowered, up to 40cm long, bracts half long as the beaked ovary. The flowers are white.

Habenariaroxburhii: It is distributed in Orissa and South India. The inflorescence is densely flowered. The flowers are white, scented.

Habenariaintermedia: It is a semi-terete orchid of 25cm length. The leaves are rounded at the base, long acuminate to 10cm long and 5 to 7 nerved. The inflorescence is 4 to 6 flowered. The flowers are 5cm across, white or greenish.

Habenariaedgewothii: The plants are 75cm tall with hairy twisted leafy stems. Leaves are sheathed, ovate to lance shaped. Flowers are yellowish green, deflexed in bud, in cylindrical spikes. Lip is bright yellow, entire, strap-shaped, base forming slightly channeled claw, spur longer than ovary, spreading and directed upwards usually hooked downwards

towards the tip, column 2-3 mm in height. Edgeworth'sHabenaria is distributed the Himalayas, from Uttarkhand to Nepal, at altitudes of 2500-3000 m.

Medicinal uses: The drug from *Habenariaintermedia* and *H. edgeworthii* belong to the group of the "Eight Tonic Herbs", known as Ashtavarga, which is rejuvenating and age sustaining. It is an ingredient of 'Chywanaprasha'.

Cultivation: The mean annual rainfall is 100 to 150 cm and means annual temperature is between 10-15^{0}C. Tubers are recommended for the propagation of this species. The compost consisting of rich loamy soil, well rotten manure and one sixth each of shredded osmunda and chopped tree fern fibre is ideal for the growth and flowering of these plants. Direct raising of plant from tubers either by half or full tuber with apical portion intact gives the best results. Planting is done on raised beds in rows at an optimum spacing of 20X20 cm.

MALAXIS

Malaxis comprises of 300 terrestrial or lithophytic orchid species having soft and tender texture of leaves. The pseudobulbs are well developed. The leaves are often pair, fleshy. The inflorescence is erect, terminal, few to many flowered. The flowers are small, highly complex and are borne in compact umbel like, condensed raceme. The flower colour is greenish to white. The sepals are free and spreading. The petals are ovate-lanceolate. The lip is erect or spreading, sessile, superior, entire or tri-lobed. The column is very short and terete.

GENETIC RESOURCES

Malaxismuscifera: It is a terrestrial orchid; pseudobulbs are stem like, rather small, clustered. The leaves are paired, sessile or short stalked upto 10cm long. The inflorescence is up to 45cm long, many flowered raceme. The flowers are very small, yellowish green in colour.

Malaxisversicolor: It is distributed in Chota Nagpur and Western Ghats of India, blooms during July-August. The stems are erect, 25cm tall. The leaves are 3-5, petiolate, ovate-lanceolate up to 20cm long. The inflorescence is upto 35cm long, dense or lax. The bracts are erect and green in bud. The flowers are very small, yellow with a pale purple tinge when young, changes to deep purple with ages. The lip is purple and round.

Medicinal uses: *Malaxismuscifera* is used as tonic. The root is traded in the name of "Rsabhakah" or "Jeevak". In Ayurvedic texts, Chyawanprash is classified under the group of Rasayana, used to maintain the body's integrity for delaying the ageing process, enhancing longevity and improving digestion. It is a polyherbal formulation comprising of more than 50 medicinal plants ingredients. Rsabhaka *(Malaxismuscifera)* is one of the important ingredients of 'Chywanaprasha'.

Cultivation: They grow in loose sandy loam soil, rich in humus, chiefly on upper stratum of organic layer, in the wet localities. The requirement of mean annual rainfall ranges between 1000 mm and 1500 mm, and the optimal mean annual temperature range is 10–15 °C. Mature bulbs may be collected from the wild sources in the rainy season. About 250 000 nodal segments or 125 000 bulbs are required for planting as a sole crop in 1 hectare of land at a spacing of 20 cm × 20 cm. Mycorrhizal association is necessary for increasing nutrient uptake efficiency in this orchid. Application of FYM and leaf mould @ 40–50 tonnes per hectare is optimum for the crop growth. The crop matures in five months and the tubers are ready to be harvested when dormancy sets in during the last week of October or first week of November.

ORCHISLATIFOLIA

Description: These are herbaceous perennial, leafy terrestrial orchids. The tubers are entirely oblong or palmately lobed. The stems are fistular up to 90cm long. The tubers are paired, lobed and palmate. The leaves are 15cm long. Spike is cylindrical, densely flowered, up to 15cm long. The flowers are 2cm long, variable in colour from pink to purple to almost pure white.

Medicinal uses: Tubers are rich in starch, mucilage, sugar, phosphate, and loroglossin. Tuberous roots are cooling, emollient, aphrodisiac, and rejuvenating and nervine tonic. These root are used to cure dysentery, diarrhoea, chronic fever, cough, wounds, cuts, burns, fractures and general weakness.

Cultivation: This species is distributed in the western Himalayas and Kashmir between 3000-4000 m altitudes. In temperate region, they are grown in the open field. Otherwise, they grow well in full sun or partial shade. Rich and porous compost is suitable. Division of the tubers is done as the flowers fade out. Division can also be done when the plant has a fully developed rosette of leaves but before it comes into flower.

CONCLUSIONS

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