Rare Orchids in Traditional Medicine: "An Ethnobotanical and Pharmacological Review of Therapeutic Potential Worldwide and Conservation"

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Abstract*—Orchidaceae, one of the largest and most diverse families of flowering plants, is renowned for its importance in ecology, medicine, and decoration. Because of their rich phytochemical makeup and medicinal capabilities, some orchid species have long been used in many medical systems. This review's objective is to compile and analyze the pharmacological and ethnobotanical significance of specific orchid species that are members of the Orchidaceae family. A systematic literature review was undertaken in accordance with PRISMA 2020 criteria, using books, peer-reviewed journals, and electronic databases. Six orchid species from six distinct genera—Coryanthes, Corallorhiza, Diuris, Arethusa bulbosa, Calypso bulbosa, and Dactylorhiza viridis—were included in this study. Orchids contain a variety of bioactive compounds, including alkaloids, flavonoids, terpenoids, phenanthrenes, and bibenzyl derivatives. Alkaloids are found in about 64 genera and 214 species in concentrations of 0.1% or more, making them extensively distributed among these. Orchids have historically been used to treat fever, inflammation, epilepsy, infections, and digestive issues, according to ethnobotanical data. The therapeutic potential of orchids is highlighted in this study, along with the necessity of additional pharmacological research and conservation measures to guarantee sustainable use.

***Index Terms*—Orchidaceae; medicinal plants; chemical constituents; medicinal uses; ethnobotany; traditional medicine.**

I. INTRODUCTION:

Orchidaceae, commonly known as the orchid family, is one of the largest and most diverse families of flowering plants, characterized by brightly coloured, structurally complex, and often fragrant flowers [1,2]. Along with Asteraceae, Orchidaceae is regarded as one of the two largest families of angiosperms. The family comprises approximately 28,000 recognized species distributed among 763 genera [3,4]. Due to continuous taxonomic revisions and ongoing discoveries, precise estimates of species diversity remain dynamic, and the determination of the largest angiosperm family continues to be debated.

Orchids exhibit remarkable species richness, with numbers nearly comparable to bony fish species, more than twice those of birds, and almost four times those of mammals. It is estimated that approximately 6–11% of all seed plants belong to the Orchidaceae family [5]. The largest genera include *Bulbophyllum* with about 2,000 species, *Epidendrum* with nearly 1,500 species, *Dendrobium* with approximately 1,400 species, and *Pleurothallis* with around 1,400 species. The family also includes the type genus *Orchis* and several widely cultivated ornamental genera such as *Phalaenopsis* and *Cattleya* [6].

Since the introduction of tropical orchids into cultivation during the nineteenth century, extensive hybridization efforts have resulted in the development of more than 100,000 hybrids and cultivars, highlighting the horticultural importance of this family [7]. Certain orchid species, such as *Corallorhiza maculata*, are capable of natural hybridization with closely related species, including *C. striata* and *C. odontorhiza* in overlapping habitats [8]. Orchids are highly valued for their prolonged floral longevity and extraordinary variation in flower shape, size, colour, fragrance, and texture.

The commercial production of orchids has expanded substantially, developing into a highly profitable

global industry. Species such as *Cymbidium*, *Paphiopedilum*, and *Phalaenopsis* are extensively cultivated for ornamental purposes. Notably, *Cymbidium* species have been cultivated in China for over 1,000 years. At present, orchids constitute a significant share of the global floriculture market, generating annual revenues exceeding USD 4 billion [9].

In addition to their ornamental value, orchids possess significant ethnomedicinal importance in various traditional healthcare systems. In traditional Chinese medicine, *Dendrobium nobile*, *Gastrodia elata*, and *Bletilla striata* are among the most extensively studied medicinal orchids. These species were documented in classical medicinal texts such as *Shennong Bencao Jing* and *Bencao Gangmu* by Li Shizhen [10]. *Gastrodia elata* is one of the earliest recorded medicinal orchids and has been traditionally used for the treatment of headaches, dizziness, tetanus, and epilepsy [11].

Despite their medicinal and economic value, many orchid species are increasingly threatened due to habitat destruction, overharvesting, and environmental changes [12]. Several orchid groups are recognized for their bioactive constituents and pharmacological potential. Bucket orchids, although not directly used in traditional medicine, are known to contain alkaloids and other biologically active compounds [13]. Coralroot orchids have been traditionally used by Native American communities for treating fevers and muscle cramps and are reported to possess diaphoretic and sedative properties [14]. Donkey orchids are noted for their anti-inflammatory and antimicrobial activities [15]. *Arethusa bulbosa* (Dragon's Mouth Orchid) has been cited in folklore for mild topical applications and exhibits potential antifungal and antibacterial properties, although its medicinal use remains poorly documented [16]. *Calypso bulbosa* (Fairy Slipper Orchid) has traditionally been used by indigenous populations for treating mild epilepsy; however, its rarity limits widespread medicinal application [17]. In contrast, the medicinal uses of Frog orchids are not well documented.

Overall, orchids play a vital role in horticulture, traditional medicine, and pharmacological research, emphasizing their multidisciplinary significance [18]. In the present study, a pie chart illustrates the distribution of six orchid species and their traditional applications, providing insights into their therapeutic relevance and ecological roles. Additionally, the PRISMA 2020 flow diagram has been employed to ensure transparency, clarity, and reproducibility in the identification, screening, and inclusion of studies for this systematic review [19].

II. MATERIALS AND METHODS

The present review is based on secondary data collected for six orchid species representing six different genera belonging to the family Orchidaceae. A systematic literature search was conducted using major scientific databases and search engines, including Google, Google Scholar, PubMed, ScienceDirect, ResearchGate, and other accessible online repositories. Appropriate keywords related to Orchidaceae, medicinal orchids, ethnobotany, pharmacological activities, and traditional uses were employed to retrieve relevant literature.

III. DIAGNOSTIC FEATURES, ECOLOGICAL AND ECONOMIC IMPORTANCE:

The total description and the medicinal uses of the plants of the orchidaceae family are given below:

1. BUCKET ORCHID:

Scientific classification:

Table 1: Scientific classification of bucket orchid

Kingdom	Plantae
Clade	Angiosperms
Order	Asparagales
Family	Orchidaceae
Subfamily	Epidendroideae
Tribe	Cyambidieae
Subtribe	Stanhopeinae
Genus	*Coryanthes Hook*

Figure 1: Bucket orchid

Biological name: *Coryanthes macrantha*
Vernacular name: Monkey's Throat Orchid

Native:
The bucket orchid is an epiphytic orchid native to Central and South America, as well as Mexico and Trinidad [20].

History:
Some of the first investigations on *Coryanthes* were published by Cruger in 1865. Charles Darwin describes his observations and experiments on some species of *Coryanthes* in his book *The Various Contrivances by which Orchids are Fertilized by Insects*. However, Darwin thought it was the female bees that were doing the fertilizing, and it was almost 100 years before the role of the male euglossine bees was revealed in 1961[21].

Chemical constituents:
The chemical constituents that are present in the floral fragrance of *Coryanthes macrantha* plants are n-hexanal (29.45%), Nonanal (2.07%), decadienal (1.23%), Para-anisyl acetate (6.33%) [22].

Macroscopical characters:
The orchid's pendant, lateral inflorescence arises from the base of the pseudobulb, showcasing one to five fragrant, waxy flowers that are usually yellow to orange with small freckles, complemented by ovate bracts; the free sepals parallel the column while the narrower petals boast wavy margins, and the most prominent labellum is divided into three segments, all supported by a sub tubular spine with an enlarged apex that secretes a fluid exudate—pollination is facilitated by male euglossine bees, drawn by the flower's strong odour, who, upon falling into the flower's 'bucket,' collect fluid in their leg pouches and must crawl through a narrow spout where the pollinia adhere to them as they exit[23].

Uses:
The bucket orchid (*genus Coryanthes*) is primarily used as a horticultural novelty for its flowers. However, the flower's complex pollination mechanism and the mutualistic relationship between the orchid and the orchid bee make it an example of coevolution. [24]

2. CORALROOT:
Scientific classification:

Table 2: Scientific classification of coralroot

Kingdom	Plantae
Clade	Angiosperms
Order	Asparagales
Family	Orchidaceae
Subfamily	Epidendroideae
Tribe	Epidendrae
Subtribe	Calypsoinae
Genus	*Corallorhiza gagnebin*

Figure 2 Coral-root

Biological name: Coralroot orchid
Vernacular name: Early coralroot, northern coralroot, yellow coralroot, or Spotted coralroot [27].
Scientific name: Corallorhiza maculate [26]

Native:
North America and Eurasia, Southern Canada, the northern and western United States, and Mexico [28], Shady conifer forests of north-western North America, throughout most of the United States [30]

History:
Coralroot orchids, classified under the genus Corallorhiza, represent a remarkable group of mycoheterotrophic plants. Unlike most plants, these orchids forgo photosynthesis as a source of energy. Instead, they form a symbiotic association with mycorrhizal fungi, which derive nutrients from

decomposing organic material or the roots of other plants. The genus *Corallorhiza* was first documented by botanists during the 18th century, highlighting its long-standing scientific interest. The genus *Corallorhiza* derives its name from the Greek terms *korallion* (coral) and *rhiza* (root), reflecting the coral-like structure of its subterranean rhizomes [31]. Early taxonomists observed the absence of green foliage and chlorophyll in these plants, setting them apart from most other orchid species. Throughout the 19th and early 20th centuries, several species within this genus were systematically classified, particularly in North America, where many of them are native. Ground-breaking research conducted in the 20th century explored their mycorrhizal associations, uncovering their reliance on fungal partners for nutritional support [32].

Macroscopical characters:
The terrestrial plant, native to the New England states of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont, displays an inflorescence that is a raceme, with white lobed labellum flowers measuring 4–9 mm in length and sepals ranging from 4.7–15 mm, lacking nectar spurs and apparent leaves except on the reproductive stems [33].

Chemical constituents:
The plant contains a variety of biochemical compounds including alkaloids, phenols such as flavonoids and tannins, various carbohydrates like starch and simple sugars, mycorrhizal-associated metabolites comprising sugars and amino acids, organic acids, volatile organic compounds such as terpenoids and aromatic hydrocarbons, and trace minerals including potassium, phosphorus, and nitrogen [34].

Uses:
Coralroot orchids serve various purposes, from medicinal use to ecological interactions. Native Americans brewed dried coralroot stems into tea for treating colds, pneumonia, and skin irritation, while others used it to reduce fever, promote drowsiness, and manage sweating. These orchids engage in intricate pollination mechanisms with bees and wasps, ensuring their propagation. As wildflowers, coralroot orchids are mycotrophic, meaning they don’t photosynthesize but instead obtain nutrients, minerals, and water by parasitizing a mycorrhizal fungus [35].

3. DONKEY ORCHID:
Scientific classification:

Table 3: Scientific classification of donkey

Kingdom	Plantae
Clade	Angiosperms
Order	Asparagales
Family	Orchidaceae
Subfamily	Orchidoideae
Tribe	Diurideae
Subtribe	Diuridinae
Genus	*Diuris*

Figure 3 Donkey orchid

Biological name: *Diuris corymbosa* [36]
Vernacular name: Donkey orchid or wallflower orchid, bee orchid, nanny goat orchid, pansy orchid, ear-like petals [37].
Native: One species is found in Java and Timor, and the others are native to Australia.

Scientific name:
The name Diuris comes from the Greek words dis, meaning "double" and oura meaning "tail". This refers to the two narrow lateral sepals [38].

History:
In 1798, James Edward Smith first described the Diuris genus in Transactions of the Linnean Society of London. The genus name *Diuris* comes from the Greek words "dis" (two) and "oura" (tail), referring to the twin lateral sepals that often hang down like tails. Commonly called "donkey orchids" due to their floral structure resembling donkey ears. *Diuris* was first

formally described in 1800 by French botanist Étienne Pierre Ventenat. The first species to be described was *Diuris corymbosa* (commonly known as the bee orchid), which was named based on its resemblance to an insect [39].

Macroscopical characters:
The plant exhibits linear, grass-like leaves arranged in a basal rosette and features flowers ranging from 2 to 5 cm in diameter. The flowers have lateral petals resembling donkey ears and a broad central lip, with coloration in shades of yellow, purple, or orange, often adorned with dark markings or spots. The inflorescence typically presents as a raceme or spike with 2 to 15 flowers, which may emit a faint, sweet, or citrus-like fragrance. Additionally, the plant possesses underground bulbous tubers used for nutrient storage"[40].

Chemical constituents:
This orchid species contains a diverse range of chemical compounds, including benzyl iso quinoline alkaloids, common flavonoids such as quercetin, kaempferol, and rutin, phenols like chlorogenic acid and caffeic acid, terpenoids such as monoterpenes, sesquiterpenes, and diterpenes which contribute to floral scents that attract pollinators, glycosides such as saponins found in some Australian orchids, and various volatile organic compounds like esters, alcohols, and aldehydes. It also possesses organic acids such as citric acid and malic acid, along with specific compounds including 4,4-dihydroxy-3,5-dimethoxy bibenzyl, 3,4-dihydroxy -5,4-dimethoxy bibenzyl, 3-O-methy lgigantol, dendro phenol, gigantol, dendro candin A, and (R)-3,4-dihydroxy-5,4 α-trimethoxy bibenzyl (41).

Uses:
Donkey orchids use deception to attract pollinators like bees, wasps, and flies, relying on their coloration rather than nectar or scent to lure insects into thinking food is present. Their tubers are edible, consumed either raw or cooked. When planning roadworks and weed spraying, local governments should consider the presence of donkey orchids on roadsides, while private landowners should be informed if the species is found on their property. Grazing pressure at known sites should also be monitored, with grazing regimes adjusted if the species is being negatively impacted [42].

4. DRAGON'S MOUTH:
Scientific classification:

Table 4 Scientific classification of Dragon's mouth

Kingdom	Plantae
Clade	Angiosperms
Order	Asparagales
Family	Orchidaceae
Subfamily	Epidendroideae
Tribe	Arethuseae
Subtribe	Arethusinae
Genus	*Arethusa*

Figure 4 Dragon's mouth

Biological name: *Arethusa bulbosa*
Vernacular names: Bog pink, Bog rose, Calopogon, Dragon's mouth, Dragon's mouth orchid, Grass pink, Swamp pink, and Wild pink [43].

Native:
The dragon's mouth orchid (*Arethusa bulbosa)* is a native North American wildflower that is native to the eastern and central United States and Canada [44].

History:
The genus name *Arethusa* comes from Greek mythology. Arethusa was a water nymph who transformed into a fountain to escape the pursuit of the river god Alpheus. This name likely references the plant's preference for wet habitats like bogs and marshes. *Arethusa bulbosa* was first described by Carl Linnaeus in 1753 in his seminal work, *Species Plantarum*. Linnaeus named the plant due to its

elegant and nymph-like appearance, associating it with Greek mythology.

Macroscopical characters:
This wetland plant, found in the New England states of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont, has basal leaves growing only at the base of the plant with no leaves on the stem. The flowers, which lack a pouch-like shape, have a simple labellum that is lobed and ranges in color from pink to red. Each inflorescence typically bears either a single flower or a pair of flowers. The labellum measures 19–35 mm in length, and the sepals range from 20–55 mm. Additionally, the flower lacks nectar spurs [45].

Chemical constituens:
Arethusa bulbosa contains various biochemical compounds, including alkaloids and terpenoids. It often has flavonoids like quercetin and kaempferol, and phenolic acids such as caffeic acid and chlorogenic acid. The floral fragrance, which attracts pollinators like bees, is likely composed of volatile organic compounds. Additionally, anthocyanins are present and are responsible for the pink to purple coloration of the flowers [46].

Uses:
Medicine: Early Americans used the corms of the dragon's mouth to treat toothaches.
Collection: The dragon's mouth's beauty has made it a desirable plant to collect, which has led to the depletion of many populations [47].

5. FAIRY SLIPPER:
Scientific classification:

Table 5: Scientific classification of *Calypso bulbosa* [48]

Kingdom	Plantae
Subkingdom	Tracheobionta
Order	Asparagales
Family	Orchidaceae Juss.
Genus	Calypso Salisb
Species	Calypso bulbosa

Figure 5: Calypso bulbosa

Biological name: *Calypso bulbosa*
Vernacular name: Fairy slipper orchid, Venus' slipper, calypso orchid.

Native:
Calypso bulbosa is native to North America and Eurasia. It thrives in cool, undisturbed coniferous forests and bogs and requires specific mycorrhizal fungi to survive [49].

History:
The English gardener Richard Anthony Salisbury described the genus Calypso in 1806. Carl von- Linné originally assigned *Calypso bulbosa* to the genus Cypripedium in 1753, but it now belongs to a different subfamily [50].

Macroscopical characters:
This plant typically grows height of 8 to 20 cm and has a single, round basal leaf up to 6 cm long and 5 cm wide [53]. The flowers are purple-pink, hermaphroditic, zygomorphic, and threefold, with a labellum that is white to pink, adorned with pink or yellow spots [54,55].

Chemical constituents:
The specific chemical constituents of *Calypso bulbosa* are not well-documented in common sources. However, like many orchids, it may contain various alkaloids and other secondary metabolites [56].

Uses:
Calypso bulbosa has been traditionally used by some indigenous peoples for medicinal purposes, such as treating mild epilepsy [57,58].

6. FROG ORCHID:
Scientific classification:

Table 6 Scientific classification of frog orchid [59,60]

Kingdom	Plantae
Order	Asparagales
Family	Orchidaceae
Genus	Dactylorhiza
Species	*Dactylorhiza viridis*

Figure 6 Frog orchid

Biological name: Coeloglossum viride.
Vernacular name: Frog orchid, long-bracted orchid, Green-orchid [61].

History:
Coeloglossum viride, commonly known as the frog orchid, is a species of flowering plant in the orchid family Orchidaceae[62]. It has a wide distribution across the cooler parts of the Northern Hemisphere, including Europe, non-tropical Asia, Canada, and parts of the United States [63,64]. The species has been known since the early 19th century and has undergone various taxonomic revisions.

Macroscopical characters:
The plant features an angular stem that typically grows to a height of 5–20 cm. Its leaves vary in shape, with the basal leaves being obovate to elliptical, while the upper leaves are lanceolate [65]. The inflorescence is a dense raceme, resembling a spike-like cluster, and comprises 7 to 70 small flowers. These flowers are greenish, often exhibiting purple, reddish, or red-brown tinges, and are subtended by long, tapering bracts. The labellum is strap-shaped and usually splits at the tip to form two or three tooth-like divisions [66].

Chemical constituents:
The chemistry of a variety known as *bracteatum* is complex, featuring a wealth of bioactive constituents, at least seven of which are peculiar to the plant [67]. Known compounds found thus far to be present are 4-hydroxybenzaldehyde, 4-hydroxybenzyl alcohol (Gastrodigenin), 4,4'-dihydroxy dibenzyl ether, 4,4-dihydroxy diphenyl methane (see Xenoestrogen), 4-(4-hydroxybenzyloxy)benzyl alcohol, gastrodin, quercetin-3,7-diglucoside (see Flavanol glycoside), thymidine, loroglossin, militarine, dactylorhin A, dactylorhin B, β-Sitosterol, and daucosterol[68,69].

Uses:
Dactylorhiza viridis, commonly known as Frog Orchids, has been traditionally used for various medicinal purposes. Its extracts have anti-inflammatory properties, aiding in the treatment of conditions like arthritis, while its antimicrobial effects have been utilized to combat infections. The plant also serves as a natural diuretic, helping with urinary issues, and in some cultures, parts of it are used to aid digestion and treat gastrointestinal problems [70,71].

IV. RESULT AND DISCUSSION:

This study provides an in-depth evaluation of six orchid species, focusing on their utilization patterns and primary applications, as depicted in Table 1 and Figure 7. The data indicates a notable predominance of *Coral Root*, which comprises 35% of overall orchid usage [72]. Its widespread use is attributed to its medicinal properties, particularly in the treatment of skin irritations, respiratory ailments such as colds and pneumonia, and as an antipyretic agent [73].
Donkey's Orchid and *Frog Orchid* each account for 20% of usage. *Donkey's Orchid* plays a significant ecological role in pollination, whereas *Frog Orchid* is valued for its broad range of therapeutic benefits, including anti-inflammatory, anti-microbial, diuretic,

and digestive aid properties [74]. *Bucket Orchid*, which constitutes 15% of the utilization share, is primarily applied in horticulture, reflecting its ornamental value [75]. *Dragon's Mouth* and *Calypso Bulbosa* represent the lowest usage at 5% each. Despite their limited use, these species serve specialized medicinal functions; *Dragon's Mouth* is traditionally used for relieving toothaches, and *Calypso Bulbosa* is noted for its application in managing mild epilepsy [76].

Figure 7, the pie chart, visually reinforces this distribution, highlighting the relative importance of each species across medicinal, ecological, and ornamental domains. This diverse utilization underscores the multifaceted significance of orchids within ethnobotanical practices and horticultural applications.

Regarding the literature review process, a total of 123 records were initially identified from various sources. After removing 12 duplicate entries, 111 records proceeded to title and abstract screening. Of these, 30 were excluded based on the predefined inclusion criteria. Subsequently, 81 reports were sought for full-text retrieval, with 2 reports not successfully retrieved. This left 79 articles for full-text eligibility assessment, all of which met the inclusion criteria and were included in the systematic review, as illustrated in the PRISMA 2020 flowchart (Figure 8).

This study highlights the diverse applications of six orchid species, with *Coral Root* being the most utilized (35%) for its medicinal benefits, followed by *Donkey's Orchid* and *Frog Orchid* (20% each) for pollination and therapeutic uses, respectively. *Bucket Orchid* (15%) is mainly used in horticulture, while *Dragon's Mouth* and *Calypso Bulbosa* (5% each) serve niche medicinal roles. A systematic review of 127 articles identified 115 eligible studies, primarily experimental, which emphasized the medicinal and decorative value of orchids, along with a few observational studies that focused on horticultural and ecological aspects [79].

V. CONCLUSION

This review provides valuable insights that the findings reveal that orchid species are utilized for a variety of purposes, with a clear predominance in medicinal applications. *Coral Root*, *Frog Orchid*, and *Calypso Bulbosa* are particularly noted for their therapeutic properties, while *Donkey's Orchid* and *Bucket Orchid* contribute significantly to pollination and horticulture, respectively. The systematic review of 79 eligible studies confirms a research trend favoring experimental investigations into the medicinal and ornamental uses of orchids. These results underscore the ethnobotanical importance of orchids and highlight the need for further research into their pharmacological potential and ecological roles.

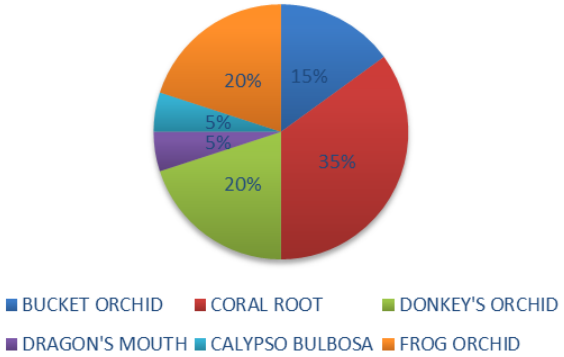

Figure 1:The Pie chart depicts the Percentage Distribution of Orchid Species Based on Their Uses.

Description:

The pie chart illustrates the percentage utilization of six different orchid species in various applications. Coral Root accounts for the largest share at 35%, followed by Donkey's Orchid and Frog Orchid, both at 20%. Bucket Orchid makes up 15%, while Dragon's Mouth and *Calypso Bulbosa* have the lowest usage at 5% each. This distribution provides insights into the varying significance of these orchids in horticulture and medicinal applications.

Table 7: Depicts the Medicinal and Horticultural Applications of Orchid Species

S. No	Plant Names	Percentage Use	Uses
1	bucket orchid	15%	horticultural use
2	coral root	35%	antipyretic, treat skin irritation, cold, and pneumonia
3	donkey's orchid	20%	pollination
4	dragon's mouth	5%	treat toothache
5	calypso bulbosa	5%	treat mild epilepsy
6	frog orchid	20%	anti-inflammatory, anti-microbial, diuretic, digestive aid

Description:
The table presents six orchid species, detailing their usage percentages and primary applications. Coral Root holds the highest percentage at 35%, mainly used for medicinal purposes such as treating skin irritation, colds, pneumonia, and acting as an antipyretic. Donkey's Orchid and Frog Orchid both account for 20% of usage. The former contributes to pollination, while the latter has multiple medicinal benefits, including anti-inflammatory, anti-microbial, diuretic, and digestive aid properties. Bucket Orchid, with 15% usage, is primarily utilized for horticultural applications. Dragon's Mouth and Calypso Bulbosa, each at 5%, serve distinct medicinal roles- Dragon's Mouth is used to treat toothaches, while *Calypso Bulbosa* is used in managing mild epilepsy.

PRISMA GUIDELINE 2020:

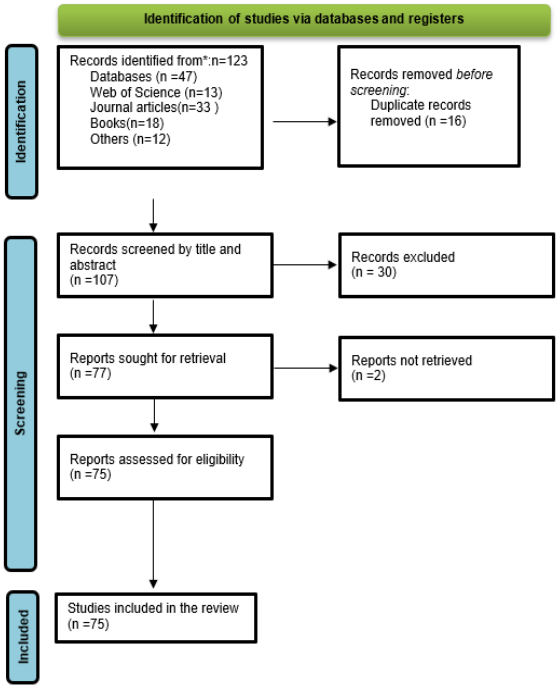

Figure 2: PRISMA 2020 flowchart detailing the study selection process for the systematic review, including identification, screening, and inclusion of studies.

Description:
The PRISMA 2020 flow diagram is intended for systematic reviews that include database and registration searches, and it visually depicts the study identification, screening, and inclusion procedure. Initially, 123 records were gathered from diverse sources, including databases, websites, journal articles, and books, with 12 duplicates eliminated prior to screening. The remaining 111 records were evaluated, 30 were excluded, and 81 reports were sought for retrieval; however, two were not found. The 79 retrieved reports were reviewed for eligibility, and none were excluded, resulting in 79 studies being included in the systematic review. This flowchart improves transparency in systematic reviews by clarifying study selection, as per the PRISMA criteria from Page MJ et al. (BMJ, 2021), and is licensed under Creative Commons.

ACKNOWLEDGEMENT:

The Authors express their sincere gratitude to the Department of Pharmacognosy, Sri Ramachandra Faculty of Pharmacy, SRIHER (Deemed to be University), Chennai, Tamil Nadu, India, for providing the necessary facilities and institutional support to carry out this research work. The authors also acknowledge the support and cooperation of faculty members and technical staff for their valuable assistance during the study. No external funding was received for this research.

REFERENCES

[1] M. W. Chase et al., "An updated classification of Orchidaceae," *Botanical Journal of the Linnean Society*, vol. 177, no. 2, pp. 151–174, 2015, doi: 10.1111/boj.12234.
[2] C. H. Dodson, "Orchids," Encyclopaedia Britannica, 2024. [Online]. Available: Encyclopaedia Britannica
[3] "Orchid," Wikipedia. [Online]. Available: Wikipedia Orchid Article
[4] "Orchidaceae: Characters, distribution and types," Biology Discussion. [Online]. Available: Biology Discussion
[5] "Orchidaceae: The largest family of flowering plants," ResearchGate. [Online]. Available: ResearchGate
[6] "Corallorhiza maculata," World Checklist of Selected Plant Families, Royal Botanic Gardens, Kew. [Online]. Available: Royal Botanic Gardens Kew
[7] "Corallorhiza maculata," North American Plant Atlas, Biota of North America Program, 2014.

[8] "Arethusa bulbosa," North American Orchid Center. [Online]. Available: North American Orchid Center
[9] S. Maitra et al., "Growing of Dendrobium orchids in a greenhouse," in Protected Cultivation and Smart Agriculture. New Delhi, India: New Delhi Publishers, 2020, pp. 270–277, doi: 10.30954/NDP-PCSA.2020.30.
[10] J. Arditti, Fundamentals of Orchid Biology. New York, NY, USA: Wiley, 1992.
[11] L. K. Magrath and J. V. Freudenstein, "Corallorhiza maculata," in Flora of North America, vol. 26. New York, NY, USA: Oxford Univ. Press, 2002.
[12] D. Sarmah et al., "In vitro cloning of orchids: A review," International Journal of Current Microbiology and Applied Sciences, vol. 6, pp. 1909–1927, 2017, doi: 10.20546/ijcmas.2017.609.235.
[13] "Arethusa bulbosa," Kew World Checklist of Selected Plant Families. [Online]. Available: Plants of the World Online
[14] K. L. Legasy, Forest Plants of Northeastern Ontario. Edmonton, Canada: Lone Pine Publishing, 1995.
[15] X. Chen, S. W. Gale, and P. J. Cribb, "Dactylorhiza viridis," Flora of China, vol. 25, pp. 115–117.
[16] "Coeloglossum viride," Flora Italiana. [Online]. Available: Flora Italiana
[17] J. V. Freudenstein and C. F. Barrett, "Fungal host utilization helps circumscribe leafless coralroot orchid species," Taxon, vol. 63, no. 4, pp. 759–772, 2014.
[18] H. Mousely, "Calypso," Journal of the New York Botanical Garden, vol. 25, pp. 25–30, 1924.
[19] M. J. Christenhusz and J. W. Byng, "The number of known plant species in the world," Phytotaxa, vol. 261, no. 3, pp. 201–217, 2016.
[20] R. J. Waterman and M. I. Bidartondo, "Deception above, deception below: Linking pollination and mycorrhizal biology of orchids," Journal of Experimental Botany, vol. 59, no. 5, pp. 1085–1096, 2008.
[21] M. Ekor, "The growing use of herbal medicines," Frontiers in Pharmacology, vol. 4, 2014.
[22] C. S. Hew and J. W. Yong, The Physiology of Tropical Orchids in the Industry. Singapore: World Scientific, 2004.
[23] D. D. Cameron et al., "Carbon acquisition in Corallorhiza trifida," New Phytologist, vol. 183, no. 2, pp. 358–364, 2009.
[24] Y. Pillon and M. W. Chase, "Taxonomic exaggeration and orchid conservation," Conservation Biology, vol. 21, no. 1, pp. 263–265, 2007.
[25] P. Lubinsky et al., "Origins and dispersal of cultivated vanilla," Economic Botany, vol. 62, pp. 127–138, 2008.
[26] C. F. Tsai et al., "Neuroprotective effects of Gastrodia elata," Journal of Ethnopharmacology, vol. 138, no. 1, pp. 119–125, 2011.
[27] Flora of North America, Missouri Botanical Garden and Harvard University Herbaria, 2019.
[28] "This strange donkey orchid uses UV light to trick bees," The Conversation. [Online]. Available: The Conversation
[29] J. P. Wearing, The London Stage 1950–1959. Lanham, MD, USA: Rowman & Littlefield, 2014.
[30] "Grass pink orchid," Ozark Bill. [Online]. Available: Ozark Bill
[31] "Dragon's-mouth orchid," Encyclopaedia Britannica. [Online]. Available: Encyclopaedia Britannica
[32] R. A. Coleman, The Wild Orchids of Arizona and New Mexico. Ithaca, NY, USA: Cornell Univ. Press, 2002.
[33] C. Caljouw, "Life history of Calypso bulbosa," Bureau of Public Lands, ME, USA, 1981.
[34] F. W. Case, Orchids of the Western Great Lakes Region. Bloomfield Hills, MI, USA: Cranbrook Institute of Science, 1987.
[35] D. S. Correll, Native Orchids of North America. Waltham, MA, USA: Chronica Botanica, 1950.
[36] H. A. Gleason and A. Cronquist, Manual of Vascular Plants, 2nd ed. New York, NY, USA: NYBG, 1991.
[37] A. M. Fuller, Studies on the Flora of Wisconsin: Orchidaceae. Milwaukee, WI, USA: North American Press, 1933.
[38] T. Mosquin, "Reproductive biology of Calypso bulbosa," Canadian Field-Naturalist, vol. 84, pp. 291–296, 1970.
[39] G. Hadley, "Non-specificity of orchid mycorrhiza," New Phytologist, vol. 69, no. 4, pp. 1015–1023, 1970.
[40] R. S. Currah, C. D. Zelmer, S. Hambleton, and K. A. Richardson, "Fungi from orchid mycorrhizas,"

in Orchid Biology. Dordrecht, Netherlands: Springer, 1997, pp. 117–170, doi: 10.1007/978-94-017-2498-2_4.

[41] S.-Y. Huang, G.-Q. Li, J.-G. Shi, S.-Y. Mo, S.-J. Wang, and Y.-C. Yang, "Chemical constituents of the rhizomes of Coeloglossum viride var. bracteatum," Journal of Asian Natural Products Research, vol. 6, no. 1, pp. 49–61, 2004, doi: 10.1080/1028602031000119826.

[42] G. Gerlach, "The genus Coryanthes: A paradigm in ecology," Lankesteriana, vol. 11, no. 3, pp. 253–264, 2011, doi: 10.15517/lank. v11i3.18280.

[43] J. V. Cazique et al., "Coryanthes macrantha (Orchidaceae: Stanhopeinae) and their floral and extrafloral secretory structures," AoB Plants, vol. 14, no. 5, 2022, doi: 10.1093/aobpla/plac039.

[44] E. Schnepf, G. Deichgräber, and W. Bartholet, "Fine structure of the liquid-producing floral gland of Coryanthes speciosa," Nordic Journal of Botany, vol. 3, no. 4, pp. 479–491, 1983.

[45] R. M. Bateman, "Evolutionary classification of European orchids: Maximizing explicit evidence and minimizing authoritarian speculation," Journal Europäischer Orchideen, vol. 41, no. 2, pp. 243–318, 2009.

[46] J. X. Yang et al., "Morphological and genomic evidence for a new species of Corallorhiza from SW China," Plant Diversity, vol. 43, no. 5, pp. 409–419, 2021.

[47] D. T. MacDougal and J. Dufrenoy, "Mycorrhizal symbiosis in Plectrum, Corallorhiza, and Pinus," Plant Physiology, vol. 19, no. 3, pp. 440–455, 1944.

[48] "Diuris," Australian Plant Census, 2023. [Online]. Available: Australian Plant Census

[49] A. Brown, K. Dixon, C. French, and G. Brockman, Field Guide to the Orchids of Western Australia. Western Australia: Simon Nevill Publications, 2013.

[50] Australian National Botanic Gardens, "Aboriginal plant use – NSW Southern Tablelands," 2007. [Online]. Available: Australian National Botanic Gardens

[51] J. E. Smith, "The characters of twenty new genera of plants," Transactions of the Linnean Society of London, vol. 4, pp. 222–230, 1798.

[52] R. D. Fitzgerald, "New Australian orchids," Journal of Botany, British and Foreign, vol. 23, pp. 137–138, 1885.

[53] A. M. Pridgeon, P. J. Cribb, M. W. Chase, and F. Rasmussen, Genera Orchidacearum, vol. 2. Oxford, UK: Oxford Univ. Press, 2001, pp. 126–131.

[54] "Orchidaceae systematics and diversity," Wiley Open Access, 2015. [Online]. Available: Wiley Online Library