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## **Unveiling the therapeutic potential of orchids through molecular approaches**

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Orchids are one of the largest groups of plants with therapeutic uses documented in ancient texts since times immemorial. Numerous studies have elucidated the medicinal properties of compounds derived from orchids. The beautiful flowers of orchids are popular in the floriculture industry. However, due to their immense therapeutic and ornamental values, these plants are being exploited at an alarming rate and most of the species are endangered. To ameliorate the increasing pressures on natural populations, the use of *in vitro* techniques such as asymbiotic seed germination and micropropagation using various explants, is a potent strategy. In recent times, a number of studies have reported on the molecular mechanisms associated with secondary metabolism in orchids, highlighting their therapeutic potential. With the availability of transcriptomic data, a comparative *in silico* analysis of orchids was done. This led to the identification of pivotal genes involved in alkaloid, phenolic and flavonoid biosynthetic pathways. Some of these genes such as *PAL* (*Phenylalanine ammonia-lyase*), *C4H* (*Cinnamate 4-hydroxylase*), *4CL* (*4 Coumarate: CoA ligase*), and *CHS* (*Chalcone synthase*), which are involved in the biosynthesis of phenylpropanoids, have been characterised using *in-silico* approaches in various orchids. Such studies act as a precedent and lay the groundwork for functional characterisation. Hence, selected orchid species were functionally characterised for their phytochemical profile and biological activity using antioxidant and cytotoxicity assays. Such studies can further lead to the alteration of phytochemical content by boosting secondary metabolism through various means, such as stress and elicitors. Thus, the potential of these plants can be tapped under *in vitro* conditions thereby ensuring the therapeutic equivalence of plants under culture. Orchids illustrate excellent potential for scientific studies that can lead to the identification of novel compounds of therapeutic interest thereby benefitting the pharmaceutical industry.

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