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Integrating Phytochemical Profiling and DNA Barcoding to Explore Medicinal Potential in Selected *Dendrobium* species

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Introduction & Aim

The extensive morphological variation and broad distribution of *Dendrobium* species often hinder accurate identification, leading to potential misapplication and supply challenges in medicinal use[1]. Some medicinal *Dendrobium* species are geographically inaccessible and have low propagation efficiency, leading to limited discoveries and possibly inadequate production to meet consumer demand. Hence, using other species of *Dendrobium* as substitutes is an exciting option for conserving and exploring new resources for bioactive substances with similar properties[2].

This study aimed to investigate the interplay between phytochemical composition and DNA barcoding markers based on ITS and *mat*K to improve identification in twenty-one medicinal *Dendrobium* species.

Results & Discussion

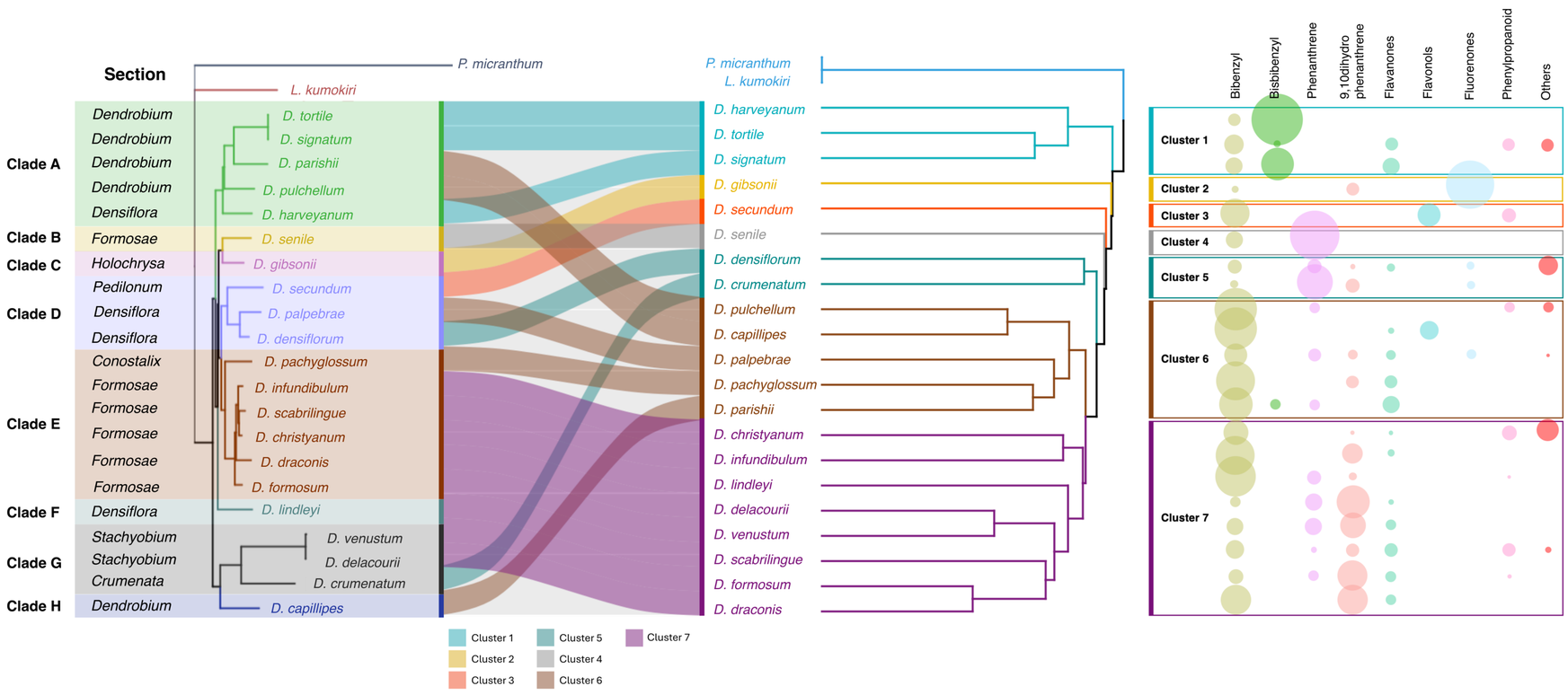


Figure 1. The summary illustrates the correlation of ITS-based phylogenetic tree (left) and phytochemical dendrogram (right) using an alluvial plot in *Dendrobium* species. The color within each clade on the dendrogram represents the phylogenetic clade and chemical cluster in the phylogenetic tree and phytochemical dendrogram. Also, the color of the alluvial plot linked between the phytochemical dendrogram and ITS-based phylogenetic tree represents chemical clusters. Additionally, the phytochemical dendrogram is linked with a proportional circle area chart, displaying distinct chemical profiles in each cluster.

(a)

Level of correlation		Section	Scientific name	Chemical cluster	Chemical signature
Strong	Clade E	*Formosae*	*D. christyanum*	Cluster 7	Bibenzyl 9,10-dihydrophenanthrene
		Formosae	*D. infundibulum*		
		Formosae	*D. scabrilingue*		
		Formosae	*D. draconis*		
		Formosae	*D. formosum*		
	Clade F	*Densiflora*	*D. lindleyi*		
	Clade C	*Holochrysa*	*D. gibsonii*	Cluster 2	Fluorenone
	Clade B	*Formosae*	*D. senile*	Cluster 4	Phenanthrene
Moderate	Clade A	*Dendrobium*	*D. tortile*	Cluster 1	Bisbibenzyl
		Dendrobium	*D. signatum*		
		Densiflora	*D. harveyanum*		
		Dendrobium	*D. pulchellum*	Cluster 6	Bibenzyl
		Dendrobium	*D. parishii*		
	Clade G	*Stachyobium*	*D. delacourii*	Cluster 7	Bibenzyl
		Stachyobium	*D. venustum*		9,10-dihydrophenanthrene
		Crumenata	*D. crumenatum*	Cluster 5	Flavonols Phenanthrene
Mild	Clade D	*Pedilonum*	*D. secundum*	Cluster 3	Fluorenone
		Densiflora	*D. densiflorum*	Cluster 5	Flavonols Phenanthrene
		Densiflora	*D. palpebrae*	Cluster 6	Bibenzyl
	Clade E	*Conostalix*	*D. pachyglossum*	Cluster 6	Bibenzyl
	Clade H	*Dendrobium*	*D. capillipes*	Cluster 6	Bibenzyl

(b)

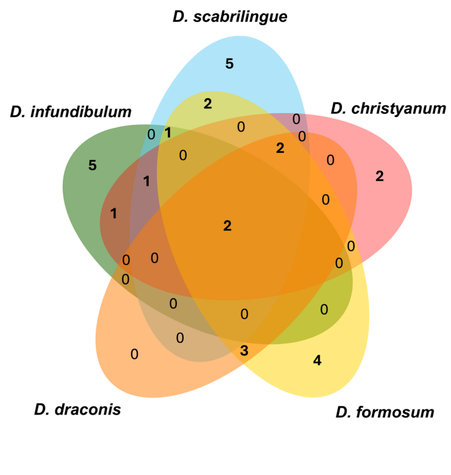
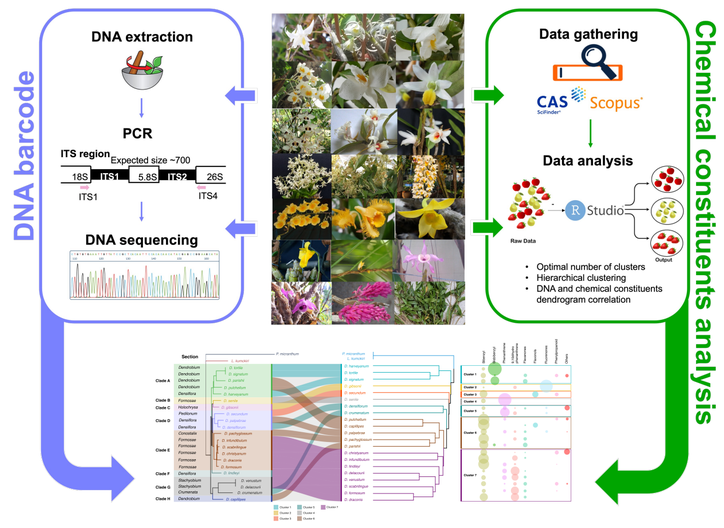


Figure 2. The correlation between phylogenetic clade and chemical cluster conclusion (a) level of correlation and (b) Venn diagram elucidates the intersections and differences in chemical constituents among *Dendrobium* species within clade E for plant substitution.

Materials & Methods



- The recorded phytochemical data of selected medicinal *Dendrobium* species were reorganized into seven distinct chemical clusters in a phytochemical dendrogram.
- The ITS-based phylogenetic tree exhibits higher consistency in discriminating *Dendrobium* sections than *mat*K.
- The ITS-based phylogenetic tree shows a high correlation with the phytochemical dendrogram.
- Utilizing the ITS sequence may forecast chemical constituents and identify suitable plant substitutes.

Conclusion

ITS Sequences & Phytochemicals Interplay

Forecasting Chemical Profile & Plant Substitution

The interplay generates comprehensive data that supports the sustainable and efficient utilization of medicinal plant resources. Moreover, the integration of chemical and DNA information serves as a valuable platform for exploring similar relationships in other plant genera, thereby expanding its applications in plant research and pharmacology.

References

1. Moudi, M. The comparison between nuclear ribosomal DNA and chloroplast DNA in molecular systematic study of four sections of genus *Dendrobium* Sw. (Orchidaceae). *Int. J. Bioassays* **2016**, *5*, 4944–4952. https://doi.org/10.21746/ijbio.2016.03.0018
2. Luo, C.; He, T.; Chun, Z. Discrimination and chemical phylogenetic study of seven species of *Dendrobium* using infrared spectroscopy combined with cluster analysis. *J. Mol. Struct.* **2013**, *1037*, 40–48. https://doi.org/10.1016/j.molstruc.2012.10.048