DAVIS EXPEDITION FUND

REPORT ON EXPEDITION / PROJECT

Expedition/Project Title:	Exploring the Speciation Dynamics in the Megadiverse Genus *Begonia*
Travel Dates:	November 10th – November 30th (2024)
Location:	Vietnam
Group Members:	Sebastián Giraldo
Aims:	Characterize patterns of gene flow, population structure, and demographic processes linked to the divergence of endemic species and the maintenance of genetic coherence within widespread species in *Begonia.*

Photography consent form attached: (*please refer to your award letter)*

☒ Yes
☐ No

Summary

In this expedition to Vietnam, I sampled *Begonia* in the country's northern region. The collections were carried out in 7 sites distributed in 4 main localities in Nature reserves and National parks. In the province of Bac Kan I sampled the Nam Xuan Lac Nature Reserve, in the province of Hanoi I sampled the Ba Vì National Park, in the province of Tuyen Quang I sampled the Cham Chu Nature Reserve, and in the province of Vinh Phuc I sampled the Tam Dao National Park. A total of 85 individuals of *Begonia* corresponding to 14 species were collected. The main target species in this expedition was *Begonia palmata,* which was collected in all 4 main localities. In total, 27 collections were made for this species, representing about 32% of all samples collected during the field trip. Currently, only 3 of the species collected have been confidently identified at the species level, while the other 11 are yet to be identified, as these do not match with a preliminary species checklist prepared for the fieldwork. More in-depth taxonomic work will be carried out once the samples are included in the RBGE collection. Representative samples will also be sequenced through genome skimming to check where they fit in the current *Begonia* phylogeny. The data collected during this expedition will allow us to better understand the widespread and morphological variable *B. palmata*, will likely yield some taxonomic novelties for the region, and will help us address gaps in our knowledge of the *Begonia* diversity in Vietnam and Southeast Asia.

REPORT

BOTANICAL EXPEDITION TO VIETNAM

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THE UNIVERSITY of EDINBURGH

Royal Botanic Garden Edinburgh

November 2024

Table of Contents

List of Tables

List of Figures

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INTRODUCTION

Begonia is one of the most diverse angiosperm genera with 2.144 species (WFO, 2024), with predictions suggesting that this number could rise to 2.500 in the coming years (Tian et al., 2018). Thus, the striking diversity of *Begonia* offers a unique opportunity to study the underlying mechanisms essential for understanding the dynamic evolution of plants.

Most species in *Begonia* are narrow endemics and only a few are widespread (Hughes & Hollingsworth, 2008). The main target species in this expedition to Vietnam was *Begonia palmata* D. Don from section *Platycentrum* (Klotzsch) A.DC., a species widely distributed in forest understories across a range of altitudes from 100 to 3200 meters throughout Asia, from central to southern China, Taiwan, South Asia (Bangladesh, Bhutan, India, Nepal, and Sikkim), to Indochina (Myanmar, Laos, Thailand, and Vietnam) (Leong et al., 2015). The phylogenetic relationships among the varieties of *Begonia palmata,* which could be at least seven varieties with similar gross morphology, remain unexplored (Leong et al., 2015).

During this expedition, I collected samples of *Begonia palmata* from different populations to characterize patterns of gene flow, population structure, and demographic processes linked to the maintenance of genetic coherence within this widespread species. To fulfill this purpose, the samples collected will be used to generate NGS data, such as long reads from PacBio sequencing and short reads from hybrid capture and genome skimming. In addition to *Begonia palmata,* 13 species of *Begonia* were collected. Representative samples of these additional *Begonia* species will be sequenced through genome skimming to check where they fit in the current *Begonia* phylogeny.

The data gathered during this expedition will enhance our understanding of the widespread and morphologically variable *Begonia palmata*, likely uncover new taxonomic insights for the region and contribute to filling gaps in our knowledge of *Begonia* diversity in Vietnam and Southeast Asia.

METHODOLOGY

I initially proposed to sample *Begonia palmata* in China, Thailand, and Vietnam. Following the suggestions of the Davis Expedition Fund Committee, China was excluded from the field trip plans. Later, it was not possible to do fieldwork in Thailand as the local collaborator, Dr. Thamarat Phutthai, was not available to do fieldwork on the proposed dates and it was not possible to find a replacement who could help us deal with all the logistics needed for this kind of expeditions.

For these reasons, I decided to focus on Vietnam, planning a thorough and longer expedition in the northern region of the country, including the remote area of the Cao Duong village in the Cham Chu Nature Reserve, as the local collaborator, Dr. Do Van Truong -Vicedirector of

Research Centre for Life Sciences, Vietnam National Museum of Nature (VNMN)-, reported that the area was underexplored as no car roads existed five years ago.

The collections were carried out in 7 sites distributed in 4 main localities in Nature reserves and National parks (Figure 1). In the province of Bac Kan I sampled the Nam Xuan Lac Nature Reserve, in the province of Hanoi I sampled the Ba Vì National Park, in the province of Tuyen Quang I sampled the Cham Chu Nature Reserve, and in the province of Vinh Phuc, I sampled the Tam Dao National Park. Herbarium collections and silica-gel samples were sent to RBGE, with duplicates left at the VNMN herbarium.

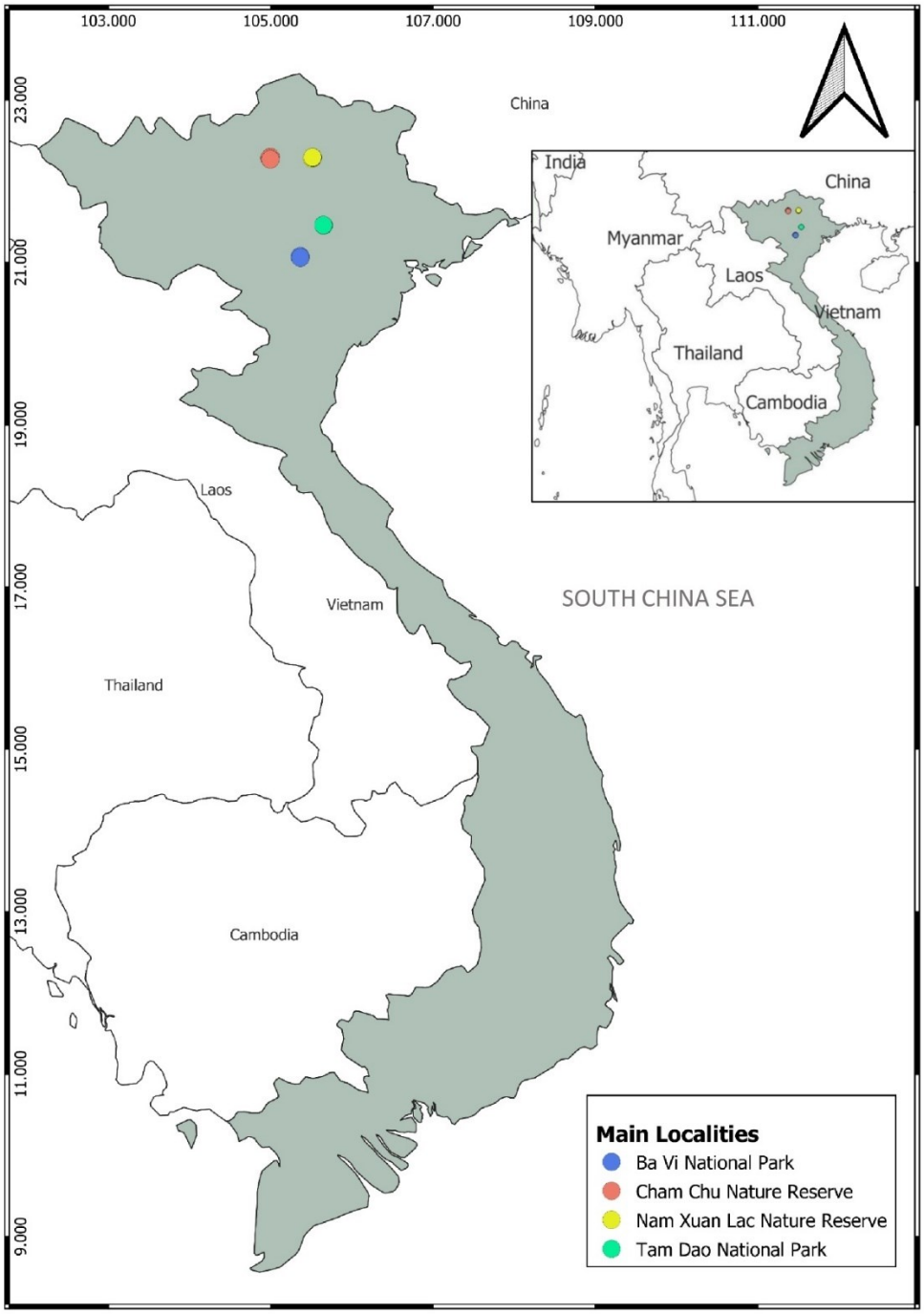

Figure 1. Main fieldwork localities in Vietnam

During the expedition, I rented an SUV car that Dr. Truong drove. At every collecting site, I was accompanied by Dr. Truong and local forest rangers who were paid for the fieldwork guidance and cooking, as no restaurants existed in most of these remote places (Figure 2, Figure 3). In some distant places, no roads were accessible by car, so motorbikes were rented to reach the collecting site (Figure 4).

Figure 2. A collection of *Begonia palmata.* Left: Dr. Truong, Center: local forest ranger at the Cham Chu Nature Reserve

Figure 3. Dinner with forest rangers at the Cham Chu Nature Reserve. Right: Local soup of *Begonia palmata* with freshwater crab

Figure 4. Motorbikes used to reach distant collecting sites

RESULTS

A total of 85 individuals of *Begonia* corresponding to 14 species were collected (Table 1, Table 2). The main target species in this expedition was *Begonia palmata,* which was collected in all 4 main localities. In total, 27 collections were made for this species, representing about 32% of all samples collected during the field trip. Currently, only 3 species have been confidently identified at the species level, while the other 11 are yet to be identified, as these do not match with a species checklist prepared for the fieldwork. Preliminarily, *Begonia sp.10* could correspond to *B. silletensis,* which would represent a new record for Vietnam. Live pictures of all collected *Begonia* species can be checked from Figure 5 to Figure 20. More in-depth taxonomic work will be carried out once the samples are included in the RBGE collection. Representative samples will be sequenced through genome skimming to check where they fit in the current *Begonia* phylogeny.

Table 1. Number of collections per site

Province	District	Site	Collections per site
Bac Kan	Cho Don	Nam Xuan Lac Nature Reserve	12
		Nam Xuan Lac Nature Reserve, Binh Trai forest station	12
Hanoi	Ba Vì	Ba Vì National Park	9
		Ba Vì National Park, trail to Ho Chi Minh Temple	10
Tuyen Quang	Ham Yen	Cao Duong village, Cham Chu Nature Reserve	22
Vinh Phuc	Tam Dao	Tam Dao National Park, trail to Bac Thai	17
		Tam Dao National Park, trail to TV station	3
TOTAL			**85**

Table 2. Number of collections per species

N	Species	Number of collections
1	*Begonia baviensis*	3
2	*Begonia palmata*	22
	Begonia palmata (variegated)	5
3	*Begonia tamdaoensis*	5
4	*Begonia sp.1 (ovate)*	6
	Begonia sp.1 (ovate variegated)	2
5	*Begonia sp.2 (hairy)*	3
6	*Begonia sp.3 (aff. fluvialis)*	6
7	*Begonia sp.4 (peltate)*	10
8	*Begonia sp.5 (horned)*	5
9	*Begonia sp.6 (aff. acetosella)*	4
10	*Begonia sp.7 (aff. oreodoxa)*	1
11	*Begonia sp.8 (glabrous)*	5
12	*Begonia sp.9 (aff. acetosella)*	3
13	*Begonia sp.10 (big leaf)*	2
14	*Begonia sp.11 (cf. satelloides)*	3
TOTAL		**85**

Figure 5. ***Begonia baviensis***

Figure 6. ***Begonia palmata***

Figure 7. ***Begonia palmata (variegated)***

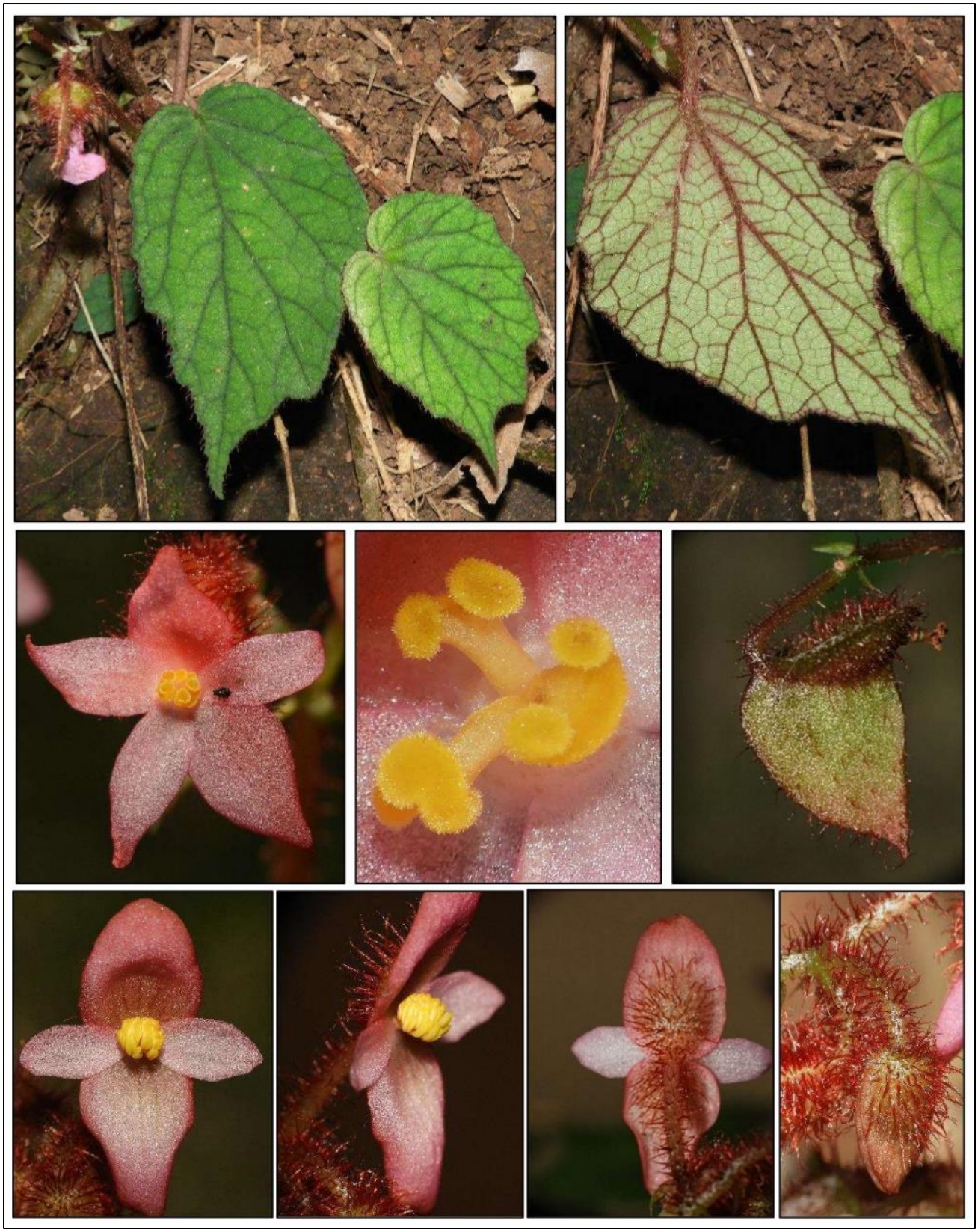

Figure 8. ***Begonia tamdaoensis***

Figure 9. ***Begonia sp.1 (ovate)***

Figure 10. ***Begonia sp.1 (ovate variegated)***

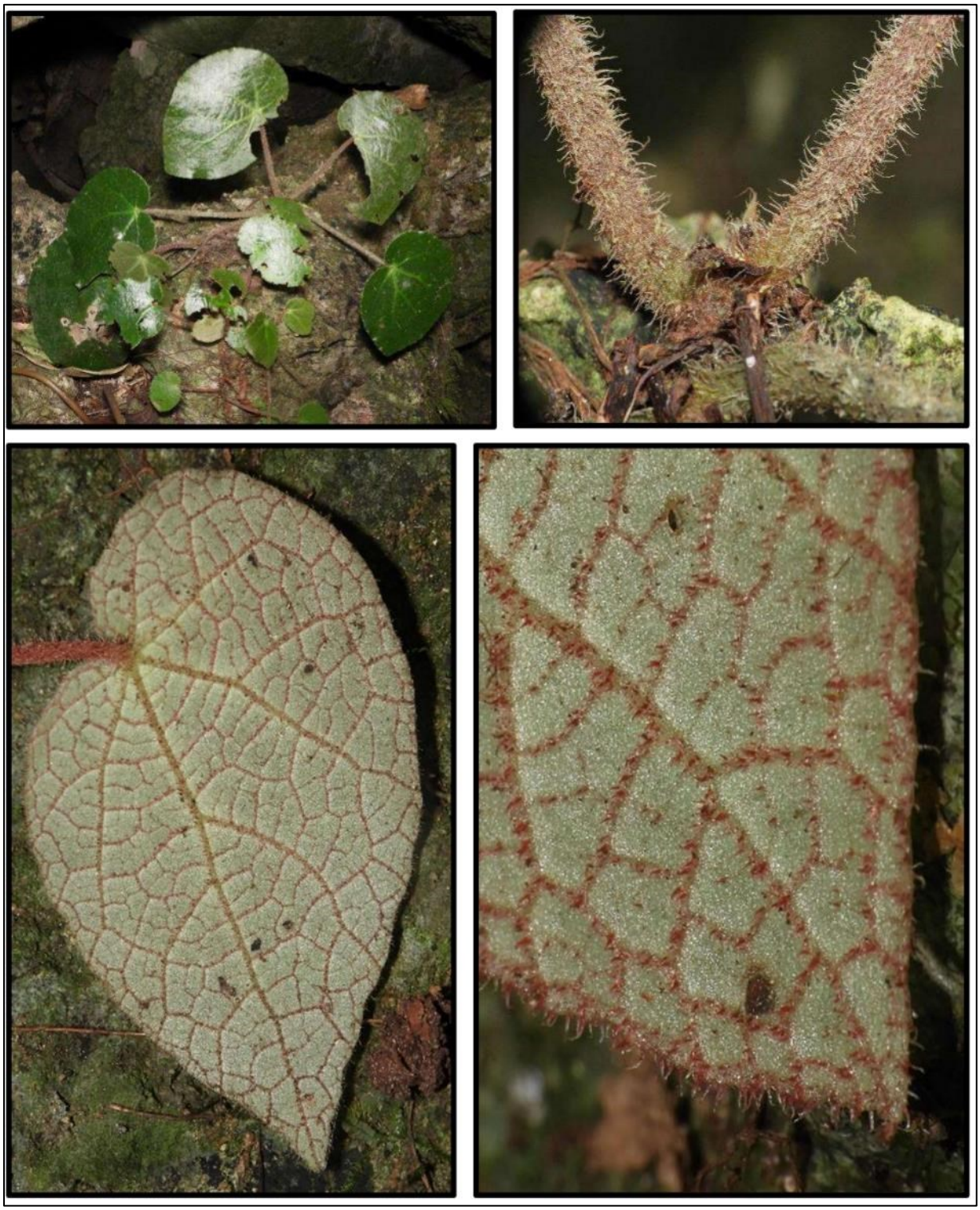

Figure 11. ***Begonia sp.2 (hairy)***

Figure 12. ***Begonia sp.3 (aff. fluvialis)***

Figure 13. ***Begonia sp.4 (peltate)***

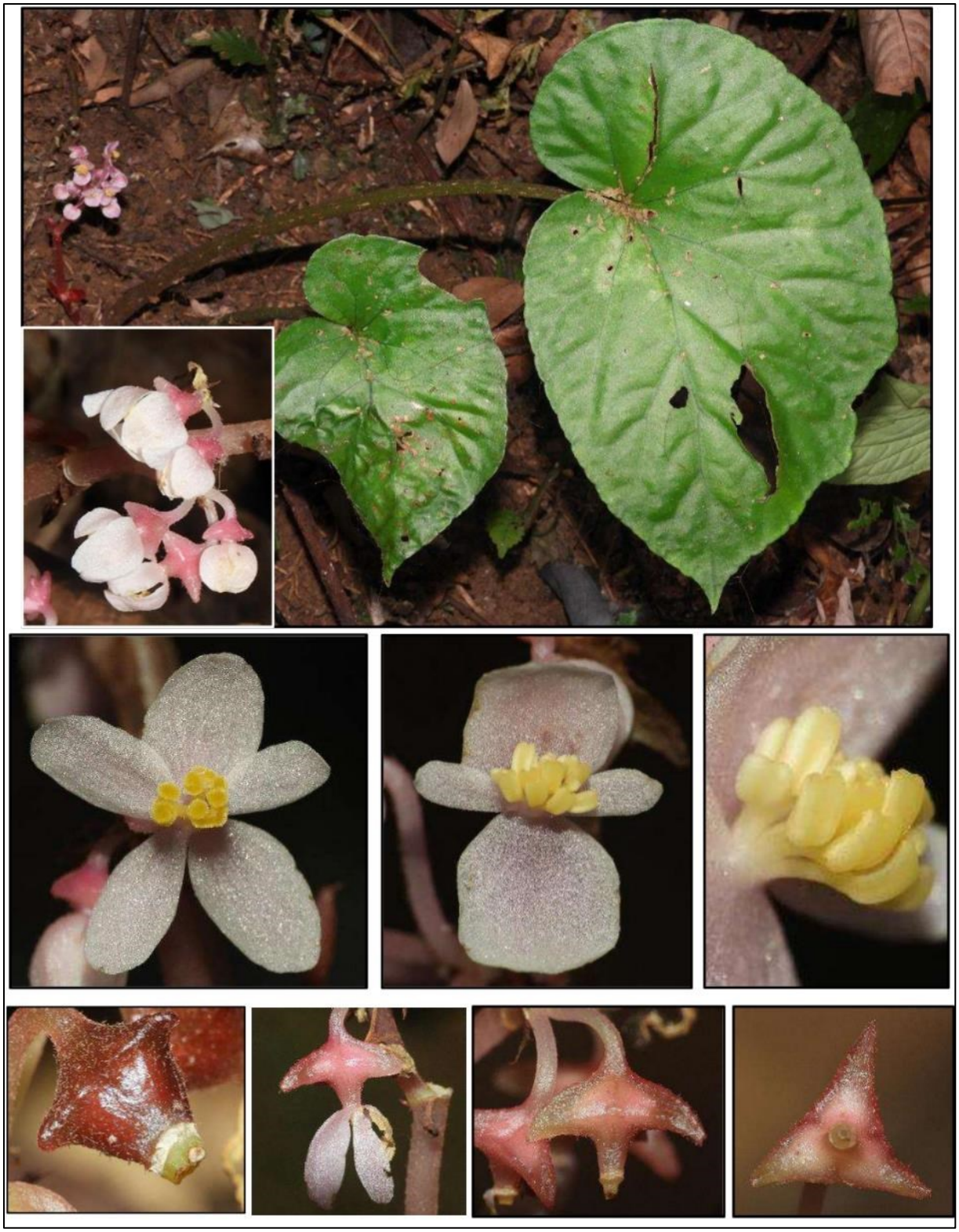

Figure 14. ***Begonia sp.5 (horned)***

Figure 15. ***Begonia sp.6 (aff. acetosella)***

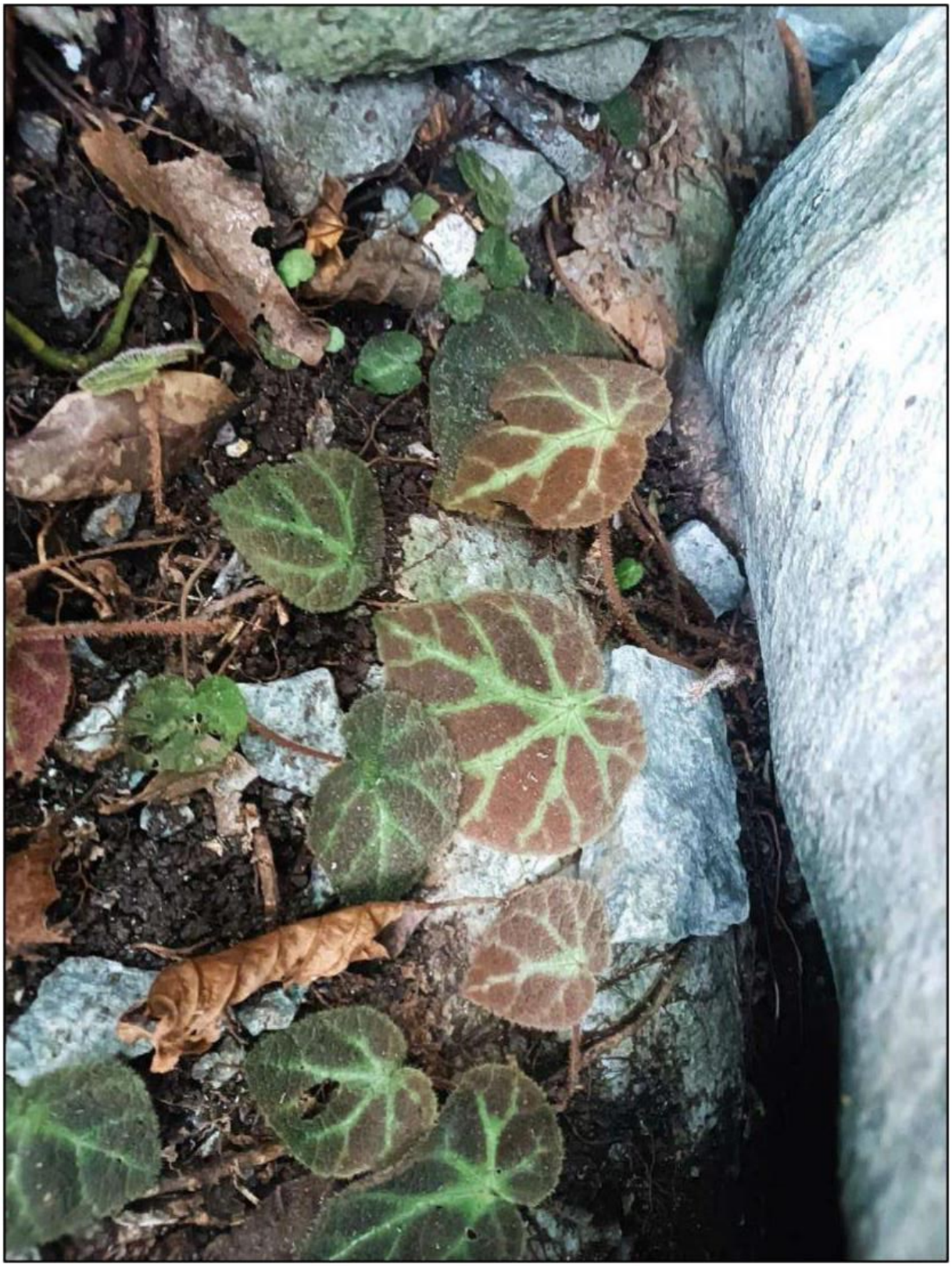

Figure 16. ***Begonia sp.7 (aff. oreodoxa)***

Figure 17. ***Begonia sp.8 (glabrous)***

Figure 18. ***Begonia sp.9 (aff. acetosella)***

Figure 19. ***Begonia sp.10 (big leaf)***

Figure 20. ***Begonia sp.11 (cf. satelloides)***

REFERENCES

Hughes, M., & Hollingsworth, P. M. (2008). Population genetic divergence corresponds with species-level biodiversity patterns in the large genus Begonia. *Molecular Ecology*, *17*(11), 2643–2651. https://doi.org/10.1111/j.1365-294X.2008.03788.x

Leong, W.-C., Deng, T., Sun, H., Peng, C.-I., & Chung, K.-F. (2015). Begonia difformis comb. & stat. Nov. (Sect. Platycentrum, Begoniaceae), a new species segregated from B. palmata D. Don. *Phytotaxa*, *227*(1), Article 1. https://doi.org/10.11646/phytotaxa.227.1.9

Tian, D., Xiao, Y., Tong, Y., Fu, N., Liu, Q., & Li, C. (2018). Diversity and conservation of Chinese wild begonias. *Plant Diversity*, *40*(3), 75–90. https://doi.org/10.1016/j.pld.2018.06.002

WFO. (2024). World Flora Online*, https://wfoplantlist.org/taxon/wfo-4000004308-2023-12?page=1 [accessed 22 April 2024]*. https://wfoplantlist.org/taxon/wfo-4000004308-2023-12?page=1