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Preliminary Checklist of Malaxidinae and Liparidinae Representatives (Orchidaceae, Malaxideae) from Bali and Lombok Islands (Indonesia) with New Records

Hanna B. Margońska [1], Jeffrey Champion [2] and Monika M. Lipińska [1,3,*]

[1] Department of Plant Taxonomy and Nature Conservation, Faculty of Biology, University of Gdańsk, Wita Stwosza 59, 80-308 Gdańsk, Poland; hanna.b.margonska@biol.ug.edu.pl
[2] Omahku di Awan Jl. Raya Candi Kuning Candi Kuning 2, Bedugul 82192, Bali, Indonesia; juara_53@yahoo.com
[3] Foundation Polish Orchid Association, 81-825 Sopot, Poland
* Correspondence: monika.lipinska@ug.edu.pl

Abstract: Bali and Lombok are well known as popular touristic destinations. Both islands are accessible for potential floristic research, but surprisingly, information on their orchid flora is rather scarce and random. During our visits, among other orchid groups, we had an opportunity to observe several representatives of the tribe Malaxideae, which is considered to be one of the biggest and most interesting orchid groups with over 1700 taxa (including synonyms). In this paper, we present the first attempt at organizing the knowledge about these unique, often underestimated, orchids in Bali and Lombok, and we report several new records for both islands. For Bali, there are six from the genus *Crepidium* and four from *Liparis sensu lato*, and for Lombok, one from *Crepidium* and three from *Liparis sensu lato.*

Keywords: Asia; *Crepidium*; *Liparis sensu lato*; Malaxideae; Orchidales; orchids

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1. Introduction

Representatives of Malaxidinae ("*Malaxeae*" Benth. & Hook.f., Gen. Pl. 3: 463, 465. 1883.) and Liparidinae ("*Liparidae*" Lindl. ex Miq., Fl. Ind. Bat., 3: 618, 621. 1855. *emend.* Margońska et al. 2012 (2013)) are widely spread, especially in south-east Asia. However, many species are rather rare and are known only from single or sometimes few locations. Some species are known only from the original materials (namely protologues) since the ecosystems of the type-specimen collection have been destroyed over the past decades. Many species require confirmation and many more are expected to be discovered. Each piece of information about this unique orchid group is not only important from a scientific point of view, but above all, enables the creation and improvement of conservation strategies and plans. Orchid floras of many large islands in Indonesia, such as Sumatra and Java, have been comprehensively studied in the past. Several smaller islands, despite the fact that they are not difficult to access, are still waiting for their orchid flora to be studied and described. It seems that there are no practical obstacles to conduct research on islands such as Bali or Lombok, and yet the amount of scientific information or research materials gathered from these locations are extremely scarce. At the same time, these relatively small islands have a large number of inhabitants and are being subjected to rapid destruction with a significant loss of natural habitats and biodiversity.

The recognition of the biodiversity of tropical regions is extremely important for its conservation, and many studies around the world have been dedicated to this topic; however, the main inhibiting factor is an insufficient number of specialists in relation to the rate of species loss. It should be emphasized that the publications constituting checklists or species lists provide great support for more advanced floristic or taxonomic, as well as biogeographic, research. Studies aimed at the inventory of orchid taxa have been conducted

in various geographical regions with different approaches. Some have focused on listing all orchid species from a given country or area (e.g., Crimea [1], Lebanon [2], China [3], Vietnam [4], Sri Lanka [5], Panama [6], or the Mexican Yucatan Peninsula [7]). Others have cataloged specific taxa such as genera in a specific country (e.g., *Encyclia* Hook. in Cuba [8] or Peru [9]), continent (e.g., *Bulbophyllum* Thouars in Africa [10]), or region (e.g., *Dendrochilum* Blume in East Malaysia [11], *Bulbophyllum* in Borneo [12], or *Habenaria* Willd. in the Brazilian Rio Grande do Sul [13]). Many works of this type constitute the first step in monograph preparation (e.g., checklist of *Catasetum* Rich. ex Kunth [14]). The preliminary reconnaissance and research dealing with Orchidaceae as a whole has already been carried out for the islands of Lombok and Bali, but only those concerning the latter have been published (e.g., Girmansyah et al. [15]) and only some genera and regions were covered.

Subtribe Malaxidinae *sensu stricto* [16] consists of 12 genera, 19 taxa above the species level, and ca. 390 species (and their 1050 synonymic taxa). It comprises species with flowers resupinated by 360° and a lip directed upwards (the only exceptions are *Microstylis monophyllos* subsp. *brachypoda* (A. Gray) Szlach. & Marg., *M. muscifera* (Lindl.) subsp. *stelostachya* (Tang & Wang) Marg., *M. yunnanensis* Schltr., and *Tamayorkis* Szlach.). The lip in this group is parallel to gynostemium with a distinctly reduced hypochile, which can be three-lobed (middle and two lateral lobes) or single-lobed. The epichile contains 2–3 chambered concavities, differently formed and ornamented, but never globular. The gynostemium column is short, up to 2–3 times as long as the anther. The anther is erect, parallel to the column and stigma (only exception is the mountain genus *Tamayorkis*), with locules that open ventrally or apically (never laterally). The stigma in this group opens apically and is situated inside a deep pocket.

Subtribe Liparidinae *sensu stricto* [16] embraces 11 genera, 15 taxa above the species level, and ca. 300 species (and their nearly 900 synonymic taxa). Flowers in this group are resupinated by 180° and have a lip directed downwards (except for epiphytes that are hanging down, such as *Alatiliparis* Marg. & Szlach., *Platystyliparis* Marg., and *Crossoglossa* Dressler & Dodson). The lip is distinctly divided into a well-developed hypochile and epichile. Nectaries, if present, are usually in the form of smooth areas around the lip base and/or its basal callus/calli/lamellae/globular structure (*Alatiliparis*, *Disticholiparis* Marg. & Szlach., and *Platystyliparis*). Darker colored and shiny stripes (central thickening, sometimes called a pseudonectary) are usually well visible, reaching from the lip base to the distal part of the lip epichile. The gynostemium is elongated, 2–3 times (or sometimes more) longer than the anther (except for genera *Crossoglossa* and *Crossoliparis* Marg. where the length of gynostemium is similar to the length of the anther). The anther is always orthogonal to the column, and the staminodes and stigma locules open ventrally or laterally (never apically). The stigma always opens ventrally (inside a deep concavity, not a pocket).

Without any doubt, Bali and Lombok have been subjected to a high level of anthropogenic impact, resulting mainly in the loss of habitats due to agricultural and urban expansion by the inhabitants and tourists, with a minor direct threat from harvesting (few species of commercial value). Since both islands are rather small, the pace of environmental destruction is much faster, the scale is much bigger, and the situation requires immediate protective measures.

The information on the species from subtribes Malaxidinae and Liparidinae that occur on the islands of Bali and Lombok is random and insufficient. The overarching aim of the performed studies was therefore to collect, verify, and summarize these data. The data presented data here are the byproduct of research carried out on both pressed/spirit herbarium specimens, and an analysis of the literature carried in the course of several other scientific projects (by the first author). Specimens deposited in the Herbarium Bogoriense (BO) and especially in the local Herbarium Hortus Botanicus Baliense (HHBB, Herbarium Kebun Raya "Eka Karya" Bali, Indonesia) were carefully investigated, resulting in six new records for the genus *Crepidium* (total number on the island: six species) and four for *Liparis sensu lato* (total number on the island: twelve species) for Bali, and one for genus *Crepidium* and three for *Liparis s.l.* for Lombok.

2. Materials and Methods

Field observations were carried during touristic treks for the period 2016–2019. The identification was confirmed by standard methods of classical taxonomy. Taxonomical and floristic investigation was conducted based on preserved materials from various research institutions (AAU, AMES, B, BM, BO, BP, BR, C, C-GS, E, F, FI, G, GB, GH, HBG, K, L, LINN, MO, P, SEL, SING, TJ, U, UGDA, UPS, US, WAG, WU, W-R, Z, by Margońska; herbarium of Bali Botanical Garden, by Margońska and Lipińska), the literature, digital databases, and information from local researchers.

The work was conducted with the use of the following digital databases: the first author's *Archivum Orchidalium*, the corresponding author's OrchidBase, the orchid images collection of J. Champion, and the plant images collection of P. Dobrzyński (all accessible upon request).

For each species, we have estimated the stage of endangerment for Bali and Lombok. These suggestions are not related to the threat status within the whole distribution range for the discussed taxa but are based on the local specificity of these small and intensely explored islands.

Information on the general distribution follow data presented by Margońska et al. [16].

3. Results and Discussion

3.1. Malaxidinae (Margońska et al., 2012(13)) of Bali

Crepidium Bl., Bijdr. Fl. Ned. Ind. 387. 1825. *emend*. in Szlach., Fragm. Flor. Geobot., Suppl. 3: 123. 1995

1. *Crepidium acuminatum* (D. Don) Szlach., Fragm. Flor. Geobot., Suppl. 3: 123. 1995.

General distribution: Sri Lanka, India, Nepal, Bangladesh, Bhutan, China, Hong Kong, Taiwan, Burma, Laos, Cambodia, Vietnam, Thailand, Malaysia, Indonesia (Sumatra, Java, New Guinea), Philippines (Bohol, Leyte, Luzon), Australia. Alt. ca. 200–2300 m.

Notes: Plants of this species were encountered on the north side of Bukit Mangu (the mountain on the eastern flank of Lake Beratan, Bedugul) at an elevation around 1700 m on 8 January 2020 by Champion (personal observations, vouchered in his digital images collection). Comparison of the flowers with protologues and type-collections for *Crepidium* taxa from the region allowed confirmation of its identification as *C. acuminatum* (determination by Margońska). This is the first record for this species in Bali.

Remarks on the status: This species does not seem to be uncommon in Bali, however, its populations are not very numerous. Considering the pace and scale of degradation and the loss of suitable habitats and plant communities, it should be treated as an endangered species in Bali.

2. *Crepidium acutangulum* (Hook.f.) Szlach., Fragm. Flor. Geobot., Suppl. 3: 131. 1995 (Figure 1A).

General distribution: Malaysia, Indonesia (Sumatra, Java). Alt. ca. 200–1000 m.

Notes: Plants of this species were recorded in central part of Bali by Champion (personal observations, later vouchered by specimen "KC.014" deposited in HHBB). Its presence was confirmed by the authors in 2019 in a mountain valley forest around Bedugul, northeast of Lumbang Nagaloka (the authors' digital image collections and databases). Comparison of the flowers with protologues and type-collections for *Crepidium* taxa from the region allowed confirmation of its identification as *C. acutangulum* (determination by Margońska), which is classified in *C. resupinatum* (G. Forst.) Szlach. complex. This is the first scientific record for this species in Bali.

Figure 1. Representatives of Liparidinae and Malaxidinae from Bali and Lombok. (**A**). *Crepidium acutangulum* (flower); (**B**). *C. luniferum* (part of inflorescence); (**C**). *C. tjiwideiense* (flowers); (**D**). *C. micranthum* (plants in situ); (**E**). *Liparis wightiana* (plants in situ); (**F**). *L. cespitosa* (plants in situ). Photo credits: (**A**,**D**–**F**), Margońska; (**B**,**C**), Lipińska.

Remarks on the status: This species does not seem to be too uncommon in Bali, but its populations are scattered, not very abundant, and not very numerous. Considering the pace and scale of degradation and the loss of suitable habitats and plant communities, it should be treated as a vulnerable species in Bali.

3. *Crepidium amplectens* (J.J.Sm.) Szlach. var. *viridis* (J.J.Sm.) Marg., in Marg. et al., Taxon. Red. Subtribe Malaxidinae. 202. 2012 (2013).

General distribution: *C. amplectens*: Malaysia (N Borneo), Indonesia (Sumatra, Borneo, Java, Bali). Alt. 190–1100 m; var. *viridis*: Indonesia (Bali). Alt. ca. 900–950 m.

Notes: This taxon is known in Bali, amongst others, from its type-specimens collected on Mount Munduk Lumbang at 945 m and later cultivated in Bogor Botanical Garden. In the protologue, J.J. Smith emphasized that this variation has green leaves and nearly white to greenish yellow flowers without a red tint. The presence of this species on the island was confirmed by Champion (personal observations, his living orchid and digital images collection, voucher JC 6753). *Crepidium amplectens sensu stricto*, until now, has never been confirmed for Bali.

Remarks on the status: This species is not too uncommon in Bali, but its populations are scattered, not very abundant, and not very numerous. Considering the pace and scale of degradation and the loss of suitable habitats and plant communities, it should be treated as an endangered species in Bali.

4. *Crepidium junghuhnii* (J.J.Sm.) Szlach., Fragm. Flor. Geobot., Suppl. 3: 127.1995.

General distribution: Indonesia (Sumatra, Maluku, Java). Alt. 1000–1700 m.

Notes: Comber [17] first suggested the presence of *C. soleiiformis* in Bali. Later, however, he made a correction to the determination of the specimens found in Central Bali (900 m, by Comber in February 1983) and changed its identification to *C. junghuhnii*. Champion subsequently found this species on the western slope of Gunung Kramat, near Bedugul (around 1600 m as an epiphyte; documented in his digital images collection, voucher JC 4312). During our visits, we confirmed the presence of this species in Bali. The species has been newly recorded in Bedugul on the western side of Gunung Kramat around 1600 m as an epiphyte by Champion (2020, personal observations, voucher JC 8366). Plants found within the whole distribution range of this species usually have purple, or sometimes, greenish to greenish yellow, flowers . The flower color for plants found in Bali is purple.

Remarks on the status: This species is rather rare in Bali, and its populations, similar to the species mentioned above, are scattered and not very numerous. Plants usually occur in quite dense, several to a dozen, shoot colonies. Considering the rate and scale of degradation and the loss of suitable habitats and plant communities, it should be treated as an endangered species in Bali.

5. *Crepidium luniferum* (J.J.Sm.) Szlach., Fragm. Flor. Geobot., Suppl. 3: 128. 1995 (Figure 1B).

General distribution: Thailand, Indonesia, Papua New Guinea. Alt. 50–1700 m.

Notes: Plants were observed in the central part of Bali by Champion (personal observations, documented in his digital images collection, voucher JC 9745). They were recorded again during our visit in 2019 in a mountain valley forest around Bedugul, northeast of Lumbang Nagaloka (vouchers available in the authors' digital image databases). Comparison with protologues and type-collections for different *Crepidium* taxa allowed its identification as *C. luniferum* (determination by Margońska). This is the first record of this species for Bali.

Remarks on the status: This species is often found locally in Bali, and although its populations are dispersed, they are abundant and numerous. However, considering the pace and scale of degradation and the loss of habitats and suitable plant communities, it should be recognized as a vulnerable species in Bali.

6. *Crepidium tjiwideiense* (J.J.Sm.) Marg. & Szlach., Pol. Bot. Journ. 46(1): 43. 2001 (Figure 1C).

General distribution: Indonesia (Java). Alt. 1500–2000 m.

Notes: This species was first observed in wet forest in Central Bali in 2018 (by Margońska, Lipińska, and Dobrzyński) and among others on the slopes of Mount Batukaru (vouchers available in the authors' digital image databases). In general, plants of *C. tjiwideiense* have purple flowers, sometimes with a greenish to green lip or brightly greenish flowers without a red/purple tint. Specimens found in Bali had only a light green color. Comparison with protologues and type-collections of *Crepidium* taxa from the region al-

lowed confirmation of its identification as *C. tjiwideiense* (determination by Margońska). This is the first record of this species for Bali.

Remarks on the status: This species is rather rare in Bali, and its populations are scattered, not abundant and not very numerous. Considering the rate and scale of degradation and the loss of suitable habitats and plant communities, it should be treated as a vulnerable species in Bali.

7. *Crepidium micranthum* (Hook.f.) Szlach., Fragm. Flor. Geobot., Suppl. 3: 129. 1995 (Figure 1D).

General distribution: Thailand, Singapore, Malaysia, Indonesia, Papua New Guinea. Alt. 30–1200 m.

Notes: Plants of this species were recorded by us in 2018 and 2019 at many sites located in Central and East Bali, in the forests of mountain valleys and on the crests and slopes of forested mountains (vouchers available in the authors' digital image databases). After comparison with protologues and type-collections for different *Crepidium* species, it was identified as *C. micranthum* (determination by Margońska). This is the first record of this species for Bali.

Remarks on the status: This species is often found locally in Bali, but its populations are dispersed, though abundant and numerous. However, considering the pace and scale of degradation and the loss of suitable habitats and plant communities, it should be recognized as a low-risk species in Bali.

Additional notes on genus *Malaxis* Sol. ex Sw.

In Central Bali on the slopes of Mount Batukaru, three taxa of the genus have been recorded but without determination at the species level ([18], near Wongaya Gede village and Jatiluwih village). The orchid genus *Malaxis sensu stricto* is represented only in both Americas, whereas *Crepidium* can be found in Southeast Asia up to Oceania. Records for Balinese *Malaxis* probably belong to just one of *Crepidium* taxa, but the lack of preserved samples or photo documentation, especially of their flower elements, makes their determination impossible [16].

3.2. Liparidinae (emend. in Margońska et al., 2012(13)) of Bali

Records for several representatives of this subtribe have already been published for Bali, e.g., by Girmansyah et al. [15]. However, we were still able to find some new records for the island.

3.2.1. *Liparis* L.C. Rich., nom. cons., Orch. Europ. Annot. 21, 30, 38. 1817 (Repr. in Mem. Mus. Hist. Nat., Paris, 4: 43. 1818.)

A. Subgenus *Diteilis* (Raf.) Marg. *subgen. & status nov*. in Marg. et al., Taxon. Red. Subtribe Malaxidinae. Appendix 3: LXXXIX. 2012 (2013).

Two species of this subgenus were recorded for the first time for the island.

1. *Liparis rheedii* Lindl., Gen. Sp. Orchid. Pl. 26. 1830.

General distribution: Thailand, Singapore, Malaysia (N Borneo), Indonesia (Sumatra, Borneo, Java, Sumbawa, Sulawesi, New Guinea), Papua New Guinea. Alt. ca. 600–1500 m.

Notes: The presence of this species in Bali was confirmed by Champion for the central part of the island (personal observations, available in his digital images collection, voucher JC 3986). Plants were growing in wet to moist habitats, usually in well lighted places. The flowers of this species are usually purple to purple-red with a paler lip (greenish yellow with a purplish tint at the distal part) or sometimes greenish with a white lip and only lightly purplish in the middle part. Flowers from the plants found in Bali were purple to purple-red with a paler lip. Comparison with protologues and type-collections for different Liparis taxa from the region allowed confirmation of its identification as *L. rheedii* (determination by Margońska). This is the first scientific record of this species for the island.

Remarks on the status: This species is not very common in Bali and its populations are scattered and not very numerous. Considering the rate and scale of degradation and

the loss of suitable habitats and plant communities, it should be treated as an endangered species in Bali.

2. *Liparis wightiana* Thw., Enum. Pl. Zeyl. 4: 295. 1861 (Figure 1E).

(*sensu L. thwaitesi* Hook.f., Hooker's Icon. Pl. 21: t.2006. 1890.)

General distribution: Sir Lanka, China, Laos, Thailand, Malaysia, Indonesia (Sumatra, Java). Alt. ca. 36–1700 m.

Notes: Plants of this species were recorded by us in 2018 and 2019 (Margońska, Lipińska and Dobrzyński, vouchers available in the authors' digital image databases) in Central Bali, e.g., as terrestrials in the forests of mountain valleys, south from Danau Buyan. Plants usually have purple flowers with paler tepals. However, in some locations in Java and Sumatra, plants with white to pale greenish white flowers (without a red/purple tint) were observed by Comber in 1971, 1977, 1990, and 2001 (personal comments and [17,19]). Flowers of the plants found in Bali have only purple flowers. After comparison with protologues and type-collections for other *Liparis* species, this plant was identified as *L. wightiana* (determination by Margońska). This is the first record of this species for Bali.

Remarks on the status: This species is not very common in Bali and its populations are scattered and not very numerous. Considering the rate and scale of degradation and the loss of suitable habitats and plant communities, it should be recognized as an endangered species in Bali.

B. Subgenus *Cestichis* (Lindl.) Schltr., Rep. Spec. Nov. Reg. Veg., Beih. 1: 199. 1911. (1914). Seven taxa of this subgenus have been already recorded for Bali by Girmansyah et al. [15].

(a) section *Cestichis* Lindl., in S.T. Edwards, Bot. Reg. 10. London. 882. 1824 (1825). Gen. et Sp. Orch. 29. 1830. *nomen* ascribe to Thouars; section *Stichorkis* sensu type-section of *Stichorkis* Thouars Nouv. Bull. Sci. Soc. Philom. Paris 1: 318. 1809. (= "Division" Corrifolia Ridl., J. Linn. Soc. 24: 257, 282. 1886.)

3. *Liparis cespitosa* (Lam.) Lindl., Bot. Reg. sub t. 882. 1824.

(*sensu Stichorkis cespitosa* (Lam.) Thouars ex Marg. in Szlach., Marg. & Kułak, Acta Soc. Bot. Pol. 77 (1): 35. 2008.) (Figure 1F).

General distribution: Africa (Madagascar and neighbor islands); Asia (India, Sri Lanka to Southeast Asia including Malaysia, Indonesia, Papua New Guinea. Australia. Oceania). Alt. 50–1700 m.

Notes: This species has been recorded in central and eastern parts of Bali ([20]; Champion, voucher JC 6842; living orchid collection of Kebun Raya "Eka Karya" Bali; Margońska, Lipińska and Dobrzyński, vouchers available in the authors' digital image databases). It has been found as a rather common epiphyte at higher elevations, in wet or seasonally wet and cooler forests. In addition to field observations made by authors, specimens from the island are also well represented in herbarium materials (*Steenis 8140*; Bali BO 0070042!; *Müller 15606, 16539*; Bali Cult. ex Hort. Bot. Basiliensis!; verified by Margońska; Girmansyah et al. [15]; *E.R. Saal 36, Sarief & R.E.P. Maler 91 & 93* deposited in BO).

Remarks on the status: This species is common in Bali, its populations are scattered but rich in individuals (in dense colonies). Considering the rate and scale of degradation and the loss of suitable habitats and plant communities, it should be treated as a vulnerable species in Bali.

4. *Liparis elliptica* Wight, Icon. Pl. Ind. Orient. 5: 1735. 1852 (Figure 2A).

General distribution: Nepal, India, Sri Lanka, Burma, Thailand, Indochina, China to Southeast Asia including Philippines, Malaysia (also Borneo), Indonesia (Borneo, Java, New Guinea), Papua New Guinea, Oceania. Alt. 200–2500 m.

Figure 2. Representatives of Liparidinae from Bali and Lombok. (**A**). *Liparis elliptica* (plants in situ); (**B**). *L. viridiflora* (plants in situ); (**C**). *L. condylobulbon* (plants in situ); (**D**). *L. pallida* (plants in situ); (**E**). *L. compressa* (plants in situ); (**F**). *L. mucronata* (flower). Photo credits: (**A**–**E**), Margońska; (**F**), Lipińska.

Notes: The presence of this species has been confirmed for central and eastern [20] (as synonymic name: *L. bicornuta*) part of Bali. Plants have been seen in 2019 by the authors, in a mountain valley forest around Bedugul, northeast of Lumbang Nagaloka (vouchers available in the authors' digital image databases). Despite the fact that usually plants of this species have been referred to as terrestrials (Sumatra and Java), the Balinese representatives grow in wet mountain forest as epiphytes, sometimes in more open places as forest edges along plantations or roads. Comparison with protologues and type-collections of other *Liparis* taxa allowed confirmation of its identification as *L. elliptica* (determination

by Margońska). Girmansyah et al. [15] have confirmed the identification of the living plant collection from Kebun Raya "Eka Karya" Bali.

Remarks on the status: This species is rather common in Bali, but its populations are scattered, and single clusters include only a few individuals. Considering the pace and scale of degradation and the loss of suitable habitats and plant communities, it should be recognized as an endangered orchid species in Bali.

5. *Liparis viridiflora* (Bl.) Lindl., Gen. Sp. Orchid. Pl.: 31. 1830 (Figure 2B).

General distribution: India, Sri Lanka, Indochina, China to Southeast Asia including Philippines, Malaysia, Indonesia, Papua New Guinea. Australia. Oceania. Alt. 200–1700 m.

Notes: This species has been recorded in west [21], central, and eastern parts of Bali (vouchers available in the authors' digital image databases). It has been found as an epiphyte at higher elevations in wet or seasonally wet and cooler forests in well lighted places. In addition to the field observations made by the authors, specimens from the island are also represented in the living orchid collection of Kebun Raya "Eka Karya" Bali (vouchered by five specimens with garden number ER.VI.96, collected by *I Gst Made Sudirga HK 1538*, accession number E19971098!, deposited in Bali Kebun Raya Herbarium, wrongly called *L. condylobulbon*; verified by Margońska) and herbarium materials (*Maier Sarip 44*, Bali BO 0070042!; verified by Margońska). Girmansyah et al. [15] confirmed the determination of the specimens collected by *R.E.P. Maier & Sarip* with number *266* BO.

Remarks on the status: This species is often found locally in Bali, although its populations are dispersed; single clusters include up to several dozens of individuals. Considering the pace and scale of degradation and the loss of suitable habitats and plant communities, it should be treated as a low-risk species in Bali.

(b) section *Blepharoglossum* Schltr., Rep. Spec. Nov. Reg. Veg., Beih. 1: 202. 1911. (1914).

Four taxa from this section have been recorded for Bali by Girmansyah et al. [15].

6. *Liparis condylobulbon* Rchb.f., in Hamb. Gartenz. 18.: 34. 1862 (Figure 2C).

General distribution: Thailand, Taiwan to Southeast Asia including Philippines, Malaysia (also in Borneo), Indonesia (Borneo, Sumatra, Java, Sulawesi, Bali, Moluccas, New Guinea), Papua New Guinea, Australia, Oceania. Alt. (20–100) 400–1700 m.

Notes: This species has been recorded in western [22], central, and eastern parts of Bali ([20]; Champion, voucher JC 9134; Margońska, Lipińska and Dobrzyński, vouchers available in the authors' digital image databases). It has been found as a rather common epiphyte at higher elevations in wet, or seasonally wet, cooler forests, usually in well lighted places. In addition to field observations made by the authors, specimens from the island are also represented in the living orchid collection of Kebun Raya "Eka Karya" Bali (vouchered by five specimens with Garden number XIIIA, collected by *I Made Suja HK 554* in Bali, Indonesia, accession number E19800892!, deposited in Bali Kebun Raya Herbarium, wrongly identified as *L. cespitosa*; verified by Margońska) and in herbarium materials (*v Steenis 8140*, Bali BO 0070042!; verified by Margońska). Girmansyah et al. [15] has confirmed the determination of the specimen referred to as "*GM 695*" and collected in Bali, Indonesia. The authors of the checklist [15] mentioned "*clavigera* Ridl." as a separate species on the basis of just a single specimen, "*GM 696*". Nowadays, however, "*clavigera* Ridl." is treated as a part of a taxonomic complex within *L. condylobulbon* Rchb.f.

Remarks on the status: This species is often found locally in Bali, although its populations are dispersed; single clusters include up to several dozens of individuals. Considering the pace and scale of degradation and the loss of suitable habitats and plant communities, it should be treated as a low-risk species in Bali.

7. *Liparis lacerata* Ridl., J. Linn. Soc. 22: 284. 1886.

General distribution: Burma, Thailand, Hainan to Southeast Asia including Malaysia (also in Borneo), Indonesia (Borneo, Sumatra, New Guinea), Papua New Guinea. Alt. 100–600 m.

Notes: This species has been recorded in Central Bali. Plants were observed by the authors in 2019 in a mountain valley forest around Bedugul, northeast of Lumbang Nagaloka (vouchers available in the authors' digital image databases). Comparison with protologues and type-collections of other *Liparis* taxa allowed confirmation of its identification as *L. lacerata* (determination by Margońska). This is the first record of this species for Bali.

Remarks on the status: This species is found rather often in Bali, although its populations are dispersed; single clusters include up to several dozens of individuals. Considering the pace and scale of degradation and the loss of suitable habitats and plant communities, it should be treated as a vulnerable species in Bali.

8. *Liparis pallida* (Bl.) Lindl., Gen. Sp. Orchid. Pl. 31. 1830 (Figure 2D).

General distribution: Southeast Asia including Philippines, Indonesia (Sumatra, Java, Bali, New Guinea), Papua New Guinea. Alt. 800–2600 m.

Notes: This species has been recorded in Central and East Bali [20]. Plants were observed in 2019 by the authors in a mountain valley forest around Bedugul, northeast of Lumbang Nagaloka (vouchers available in the authors' digital image databases). Comparison with protologues and type-collections for other *Liparis* taxa allowed confirmation of its identification as *L. pallida* (determination by Margońska). In addition to the field observations made by the authors, specimens from the island were also represented in herbarium materials (*Müller 15606*, *16539*, Bali, Indonesia, Bali Cult. ex Hort. Bot. Basiliensis!; verified by Margońska). Girmansyah et al. [15] confirmed the identification of the specimen referred to as "*SJ 132*".

Remarks on the status: This species is found rather often in Bali, although its populations are dispersed; single clusters include up to several dozens of individuals. Considering the pace and scale of degradation and the loss of suitable habitats and plant communities, it should be treated as a vulnerable species in Bali.

9. *Liparis parviflora* (Bl.) Lindl., Gen. Sp. Orchid. Pl. 31. 1830.

General distribution: widespread in Southeast Asia including Thailand, Peninsular Malaysia, Java, Borneo, Sumatra, Sulawesi, and Philippines. Alt. 0–1400 m.

Notes: This species has been recorded in Central Bali on the slopes of Mount Batukaru (17], Wongaya Gede, ca. 800 m). Comparison with protologues and type-collections for other *Liparis* taxa allowed confirmation of its identification as *L. parviflora* (determination by Margońska). Girmansyah et al. [15] confirmed identification of the specimens collected by *R.E.P. Maier & Sarip* with number *196* BO.

Remarks on the status: This species is found rather often in Bali, although its populations are dispersed; single clusters include up to several dozens of individuals. Considering the pace and scale of degradation and the loss of suitable habitats and plant communities, it should be treated as a vulnerable species in Bali.

C. Subgenus *Phyllocardium* (Schltr.) Marg., in Marg. et al. Taxon. Red. Subtribe Malaxidinae. Appendix 3: XC. 2012 (2013).

10. *Liparis avanica* J.J.Sm., Bull. Jard. Bot. Buitenzorg, 2, 9: 46. 1913.

General distribution: Indonesia (Java). Alt. ca. 1000–1500 m.

Notes: Plants of this species have been observed in Bali by Champion (personal observations, his living plant collection, voucher JC 5938; determination confirmed by Margońska). This is the first record of this species for Bali.

Remarks on the status: This species is uncommon in Bali, its populations are dispersed, and single clusters are sparse. Considering the pace and scale of degradation and the loss of suitable habitats and plant communities, it should be treated as a vulnerable species in Bali.

Liparis sensu Disticholiparis Marg. & Szlach., Die Orchidee 55(2): 175–179. 2004.

11. *Liparis compressa* (Bl.) Lindl., Gen. & Sp. Orch. 32. 1830 (Figure 2E).

General distribution: Malaya Peninsula, Indonesia (Borneo, Sumatra, Java, Bali, Sulawesi), Philippines (Luzon). Alt. 200–2300 m.

Notes: This species has been observed in Central Bali on the slopes of Mount Batukaru between 800–2000 m ([18], near Jatiluwih village, 1000–1180 m). Plants of this species are epiphytes in wet mountain forests. Flowers are orange, red-brick, red to red-brown, and sometimes with a yellowish to purplish tint. Specimens from the island are represented in herbarium materials (*Dilmy 986*, Bali BO 0068886!; verified by Margońska). Girmansyah et al. [15] confirmed the determination of living plants in Bali Kebun Raya "Eka Karya" (verified by Margońska in 2018).

Remarks on the status: This species is rather common in Bali, although its populations are dispersed; single clusters include up to several dozens of individuals (or more in older plant communities). Considering the pace and scale of degradation and the loss of suitable habitats and plant communities, it should be treated as a vulnerable species in Bali.

12. *Liparis disticha* (Thouars) Lindl., Bot. Reg. 11: Sub text pl. 882. 1825.

General distribution: Widespread in Southeast continental and insular Asia. In Indonesia in Sumatra, Borneo, Java, Sulawesi up to New Guinea. Alt. 500–1500 m.

Notes: This species has been recorded as an epiphyte in wet mountain forests in Central Bali (vouchers available in the authors' digital image databases). Girmansyah et al. [15] confirmed the determination of specimens collected by *Sarief* with the number *196*.

Remarks on the status: This species is quite often found in Bali, although its populations are dispersed, and single clusters are abundant. Considering the pace and scale of degradation and the loss of suitable habitats and plant communities, it should be treated as a vulnerable species in Bali.

13. *Liparis mucronata* (Bl.) Lindl., Gen. & Sp. Orch. 32. 1830 (Figure 2F).

General distribution: Indonesia (Borneo, Sumatra, Java, Bali, Sulawesi). Alt. 0–1400 m.

Notes: This species has been recorded in Central Bali (Champion's personal observations and his living orchid and digital images collections, voucher JC 8632). The plants are epiphytes in wet mountain forests. Flowers are pale greenish, turning apricot to yellowish brown with age. Specimens from the island are represented in herbarium materials (*Maier Sarip 43*; Bali BO 0070042!; Cult. at BO leg. by J.J. Smith in 1923 BO 0070193! BO 0072820!; verified by Margońska).

Remarks on the status: This species is not often found in Bali, its populations are dispersed, and single clusters are rather sparse. Considering the pace and scale of degradation and the loss of suitable habitats and plant communities, it should be treated as a vulnerable species in Bali.

3.2.2. *Platystyliparis* Marg., Richardiana 7(1): 33–41. 2007

1. *Platystyliparis hirundo* (Holttum) Marg., Richardiana 7(1): 39. 2007.

General distribution: Malaysia. Alt. 1300–1500 m.

Notes: This species has been observed as epiphytes in wet mountain forests in Central Bali. Girmansyah et al. [15] determined that specimens named "SJ 92" were representative of the species. The presence of this species in Bali has been cited by Tirta [20]. However, this species is usually treated as endemic to Malaysia. We did not have an opportunity to personally verify this record.

Remarks on the status: The population size and abundance of this species in Bali is difficult to quantify and should be classified as DD (IUCN). However, considering the pace and scale of degradation and the loss of suitable habitats and plant communities, it should be treated as an endangered species in Bali.

3.3. Malaxidinae (Margońska et al., 2012 (2013)) of Lombok

Crepidium Bl., Bijdr. Fl. Ned. Ind. 387. 1825. *emend*. in Szlach., Fragm. Flor. Geobot., Suppl. 3: 123. 1995

1. *Crepidium carinatum* (Rchb.f.) Marg., Edinburgh J. Bot. 62: 167. 2005 (2006).

General distribution: Philippines (Luzon), Indonesia (Sumatra, Lombok). Alt. 1100–2100 m.

Notes: Specimens of this species collected on the island are represented in herbarium materials (*Azuma et al. A202*, Lombok BO 1840088!; verified by Margońska). The plants are terrestrials and grow in humus covered leaf litter in hillside and mountain forests in semi-lighted to shaded wet sites. This is the first record of this species for Lombok.

Remarks on the status: The population size and abundance of this species in Lombok is difficult to quantify and should be classified as DD (IUCN). However, considering the pace and scale of degradation and the loss of suitable habitats and plant communities, it should be treated as an endangered species in Lombok.

3.4. Liparidinae (emend. in Margońska et al., 2012 (2013)) of Lombok

Liparis L.C. Rich., nom. cons., Orch. Europ. Annot. 21, 30, 38. 1817 (repr. in Mem. Mus. Hist. Nat., Paris, 4: 43. 1818.)

A. Subgenus *Diteilis* (Raf.) Marg. *subgen. & status nov*. in Marg. et al., Taxon. Red. Subtribe Malaxidinae. Appendix 3: LXXXIX. 2012 (2013).

1. *Liparis wightiana* Thw., Enum. Pl. Zeyl. 4: 295. 1861 (Figure 1E).

(*sensu L. thwaitesi* Hook.f., Hooker's Icon. Pl. 21: t.2006. 1890.)

General distribution: Sri Lanka, China, Laos, Thailand, Malaysia, Indonesia (Sumatra, Java). Alt. ca. 36–1700 m.

Notes: Plants of this species were observed in 2005 on Mount Rinjani, along the trail from Senaru to the summit (ca. 1940 m). Specimens from the island are represented in herbarium materials (*Tokuoka, Toba, Azuma, Nanda, Denden 0879*, Lombok, Indonesia, BO 1842754!; verified by Margońska). Comparison with protologues and type-collections for other *Liparis* species allowed its identification as *L. wightiana* (determination by Margońska). Plants found in Lombok have only purple flowers, whereas in other areas of the distribution range, plants with green flowers can also be found. The is the first record of this species for Lombok.

Remarks on the status: The population size and abundance of this species in Lombok is difficult to quantify and should be classified as DD (in IUCN system). However, considering the pace and scale of degradation and the loss of suitable habitats and plant communities, it should be treated as an endangered species in Lombok.

B. Subgenus *Phyllocardium* (Schltr.) Marg., in Marg. Kowalkowska, A., Górniak, M. & Rutkowski, P. Taxon. Red. Subtribe Malaxidinae. Appendix 3: XC. 2012 (2013).

2. *Liparis javanica* J.J.Sm., Bull. Jard. Bot. Buitenzorg, 2, 9: 46. 1913.

General distribution: Indonesia (Java). Alt. ca. 1000–1500 m.

Notes: Plants of this species were observed in 2005 in a valley near Sajang (between 1000–1025 m). Specimens from the island are represented in herbarium materials (*Azuma, Tokuoka, Toba, Nanda, Denden A221 I & II*, Lombok, Indonesia, BO 1840065! 1840066!; verified by Margońska). Comparison with protologues and type-collections for other *Liparis* species allowed its identification as *L. javanica* (determination by Margońska). This is the first record of this species for Lombok.

Remarks on the status: The population size and abundance of this species in Lombok is difficult to quantify and should be classified as DD (in IUCN system). However, considering the pace and scale of degradation and the loss of suitable habitats and plant communities in Lombok, it should be treated as an endangered species on the island.

C. Subgenus *Cestichis* (Lindl.) Schltr., Rep. Spec. Nov. Reg. Veg., Beih. 1: 199. 1911. (1914).

(*sensu Stichorkis* Thouars, Nouv. Bull. Sci. Soc. Philom. Paris 1: 318. 1809. (= "Division" Corrifolia Ridl., J. Linn. Soc. 24: 257, 282. 1886.))

(a) section *Blepharoglossum* Schltr., Rep. Spec. Nov. Reg. Veg., Beih. 1: 202. 1911. (1914).

3. *Liparis condylobulbon* Rchb.f., Hamb. Gartenz. 18.: 34. 1862 (Figure 2C).

General distribution: Thailand, Taiwan to Southeast Asia including Philippines, Malaysia (also in Borneo), Indonesia (Borneo, Sumatra, Java, Sulawesi, Bali, Moluccas, New Guinea), Papua New Guinea, Australia, Oceania. Alt. (20–100) 400–1700 m.

Notes: This species is considered rather common. Specimens from the island are represented in herbarium materials (type-specimens for *L. confusa* var. *lombokensis* = *L. condylobulbon complex*, BO 0069943! 0069953! 0069954!, and other specimens deposited in many herbaria; verified by Margońska). This is the first record of this species for Lombok.

Remarks on the status: This species is rather common in Lombok, although its populations are scattered. In older plant communities, single clusters may include more than several dozens of individuals. However, considering the pace and scale of degradation and the loss of suitable habitats and plant communities on Lombok, it should be treated as a vulnerable species in the island.

4. Conclusions

Bali and Lombok are well recognized as popular tourist destinations; however, in terms of biodiversity, they remain rather unexplored. It seems that the number of practical obstacles to conducting research on these two islands is small, and yet the amount of scientific information or research materials collected from these locations is extremely scarce. At the same time, as already mentioned, both islands are suffering from the rapid destruction of natural habitats with significant biodiversity loss. Work presented in this publication is our first checklist regarding Orchidaceae from Bali and Lombok, which we had an opportunity to observe during our stays on the islands. In this paper, we have reported six new records for the genus *Crepidium* and four for *Liparis sensu lato* for Bali, and one new record for *Crepidium* and three for *Liparis sensu lato* for Lombok. We hope that this work will trigger local scientists, naturalists, and orchidologists to intensify their activity. The support of local communities is priceless for conservation efforts and guarantees the success of any formal conservation projects.

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