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Diversity of Bolivian Orchidaceae – a challenge for taxonomic, floristic and conservation research

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Abstract

Bolivia belongs to the least studied and, in terms of biodiversity, most underestimated countries of the tropics. This fact is reflected by the history of knowledge on the Orchidaceae, the most diverse botanical family of the country (possibly about 10% of the total flora). In 1929 about 300 species were known, and until 1958, when a first floristic checklist was compiled, this number increased to 450. Although floristic and taxonomic research has not been very intensive and in about 80% of the territory no orchid specimen has been collected, four decades later about 1,500 species are recorded (in 191 genera; more than 1,200 named and identified species; about 33% endemic to the country). Almost 80% of the species are epiphytes, and among these endemism is more common (36.6%) than in terrestrial species (22.8%). According to current estimates there are about 2,000–3,000 orchid species in the country. The available information on discovery rates and geographic distribution of the species reveals challenging facts for taxonomy and conservation. Almost 50% of the species belong to only 4% of the genera, and more than 60% of the species (almost 80% of the endemics) are concentrated in only 4% of the national territory, the Yungas montane rain forests, an evolution center of Neotropical orchids. The situation of some of the taxonomically most problematic genera is described. A multiplication of research capacities is required in order to achieve adequate treatment. The paper includes a preliminary checklist and first diversity and endemism maps. One new species, *Epidendrum adolfomorenoi* R. Vásquez & P. L. Ibisch, sp. nov., is described and illustrated.

Key words: Orchidaceae, Bolivia, biodiversity, endemism, taxonomy, conservation

See also Electronic Supplement at **http://www.senckenberg.de/odes/03–04.htm**

Introduction

"This is amazing orchid country. There are wonderful purple orchids in great masses; and pink orchids in trailing tendrils; and yellow orchids in Christmas-tree festoons eight feet long. (…) Perhaps the most impressive feature is the sheer mass of them" (MacCreagh 1926 about impressions gathered in the Andean foothills of northern Bolivia).

Orchids fascinate people more than any other plants do. Orchids were and are the reason for journeys to remote corners of the planet in order to discover new species. Although travelers like MacCreagh knew that Bolivia was an 'orchid country', until very recent times it was rather underestimated and neglected with regard to orchid diversity; fewer orchid hunters went to Bolivia than to Brazil, Ecuador or Peru. Originally, this was due to lack of access to the land-locked country and to the orchid-bearing regions that until recently were almost unpopulated and lacked major roads. Later, possibly, relative political instability meant that the country was avoided by travelers. Of course, this did not affect orchid knowledge only, but biodiversity exploration as a whole. Quite recently researchers began to recognize that Bolivia is a member of the club of biologically privileged 'megadiversity countries' (Ibisch 1998).

Orchids are by far the most diverse plant group in Bolivia. And obviously they fascinate botanists not only for their attractive flowers but simply for being so diverse. Some questions that arise are: How many orchids are re-

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ported from Bolivia? Why are there so many? What are the mechanisms of evolution of this diversity? What are the spatial patterns of this diversity? And, last but not least: Is that diversity at risk or can it be conserved in this modern period of large-scale land use and deforestation? This paper cannot give answers to all of those questions, but it tries to sketch what we know of the Bolivian orchid diversity and what the main challenges are with regard to future inventories, taxonomic research, and conservation action.

Material and methods

The study is based on more than 20 years of collecting and taxonomic studies of Bolivian orchids carried out by the first author (e.g. Dodson & Vásquez 1989), and more than five years of biodiversity research on Bolivian epiphytes and related plants by the second author (e.g. Ibisch 1996). In the framework of the diversity and conservation assessment of the whole family (see the first publication, Vásquez & Ibisch 2000, on the subtribe Pleurothallidinae) we compiled an orchid checklist that is presented in this paper. It is principally based on thousands of herbarium specimens deposited at Herbarium Vasquezianum (VASQ) in Santa Cruz (in the future to be transferred to LPB), and/or LPB, BOLV and SEL, and a complementary bibliography. As this paper is not intended to present a Bolivian orchid monograph we do not cite the several thousands of specimens and references – this will be done step by step in books such as Vásquez & Ibisch (2000). The checklist in Appendix 1 – available as an Organisms Diversity and Evolution Electronic Supplement (http://www.senckenberg.de/odes/03–04.htm) – indicates if the presence of a species is documented by a specimen held at VASQ, or refers to a bibliographic source. Unidentified specimens are included when it is highly probable that they will turn out to represent new species or new records for Bolivia. In some cases, however, species might later be assigned to recorded but poorly known species (especially in *Notylia* L., *Oncidium* Sw.). Unidentified species of *Stelis* Sw. are not included since they have been studied insufficiently. Considering the known distributional ranges, species were related to 23 different eco(sub)regions based on recent references (especially Ellenberg 1981; Ribera 1992; Beck et al. 1993; Ribera et al. 1994; Ministerio de Desarrollo Sostenible y Medio Ambiente 1995, 1997; Hanagarth & Beck 1996; Ibisch 1996; Navarro et al. 1996; Navarro 1997; Araujo & Ibisch 2000; López 2000; Ibisch et al. 2000, 2001, 2002a, b). These Bolivian ecoregions are illustrated in Fig. 1. Species numbers were counted for all ecoregions and mapped as each region's percentage share of the total number.

Results and discussion

Orchid discovery and species richness in Bolivia

Orchid discovery in Bolivia started as early as the 18th century with Thaddeus Peregrinus Haenke from Bohemia. In 1800 (in an unpublished manuscript) he was the first to illustrate a Bolivian orchid, possibly *Epidendrum humidicolum* (Vásquez & Ibisch 2000). The first systematic treatments of Bolivian orchids were published by Schlechter (1913, 1922, 1929). He knew of about 300 species in 78 genera (Dodson & Escobar 1993). Some 30 years later Foster (1958) compiled the first and only checklist of the Bolivian flora, including 450 orchid species. Until the 1980s, when an intensive inventory was started by the first author, orchids were mainly collected by foreign botanists and described abroad by taxonomists who never went to Bolivia. Thanks to increasing collection activity of Bolivians and foreigners who did intensive field work, the real dimensions of the Bolivian orchid diversity have become clearer during the last decade (Fig. 2). The American Carlyle Luer alone has described more than 160 species of Bolivian Pleurothallidinae known and accepted today (more than 40% of the species of this subtribe).

The knowledge on the Bolivian orchid inventory is developing rapidly. For example, 43 species have been discovered and/or described between 1997 and 1999. Almost every expedition to orchid-rich forests still offers the opportunity of discovering new taxa, even close to the largest cities like Santa Cruz, Cochabamba and La Paz.

Bolivia is among the countries with highest discovery rates, currently surpassed only by Peru and Ecuador. There are about as many species found as in tropical Africa, and more than in East Asia (e.g., see new species publications recorded by the Index Kewensis 1 June 2001–5 December 2001; Cribb et al. 2002). Even so, knowledge is rather deficient. The subtribe Pleurothallidinae belongs to the better known orchid groups of Bolivia (Vásquez & Ibisch 2000). However, on the average, the species are known from only two specimens collected. Many species are exclusively known from the type locality. For about 70% of the principal orchid-bearing area with montane rain forests (see below) there are no Pleurothallidinae specimen collections (Ibisch et al. 2001). For the whole territory and all orchid species, that number rises to at least 80%. Currently known species numbers may almost double eventually. While 385 Pleurothallidinae species are known, it is probable that more than 600 exist (Müller et al. in press).

Currently, about 1,500 species in 191 genera have been recorded in Bolivia (see Appendix 1, Electr. Suppl. 03–04). Almost 80% of them are epiphytes.

Considering the known species number, the discovery rates and the dimensions of the unsampled areas it is probable that about 2,000–3,000 species exist in Bolivia. Thus, the country's orchid diversity could become even more comparable to more northern Andean countries like Peru and Ecuador where much more effort has been spent on orchid inventory (e.g., Ecuador: 3,290 spp.; Valencia et al. 2000).

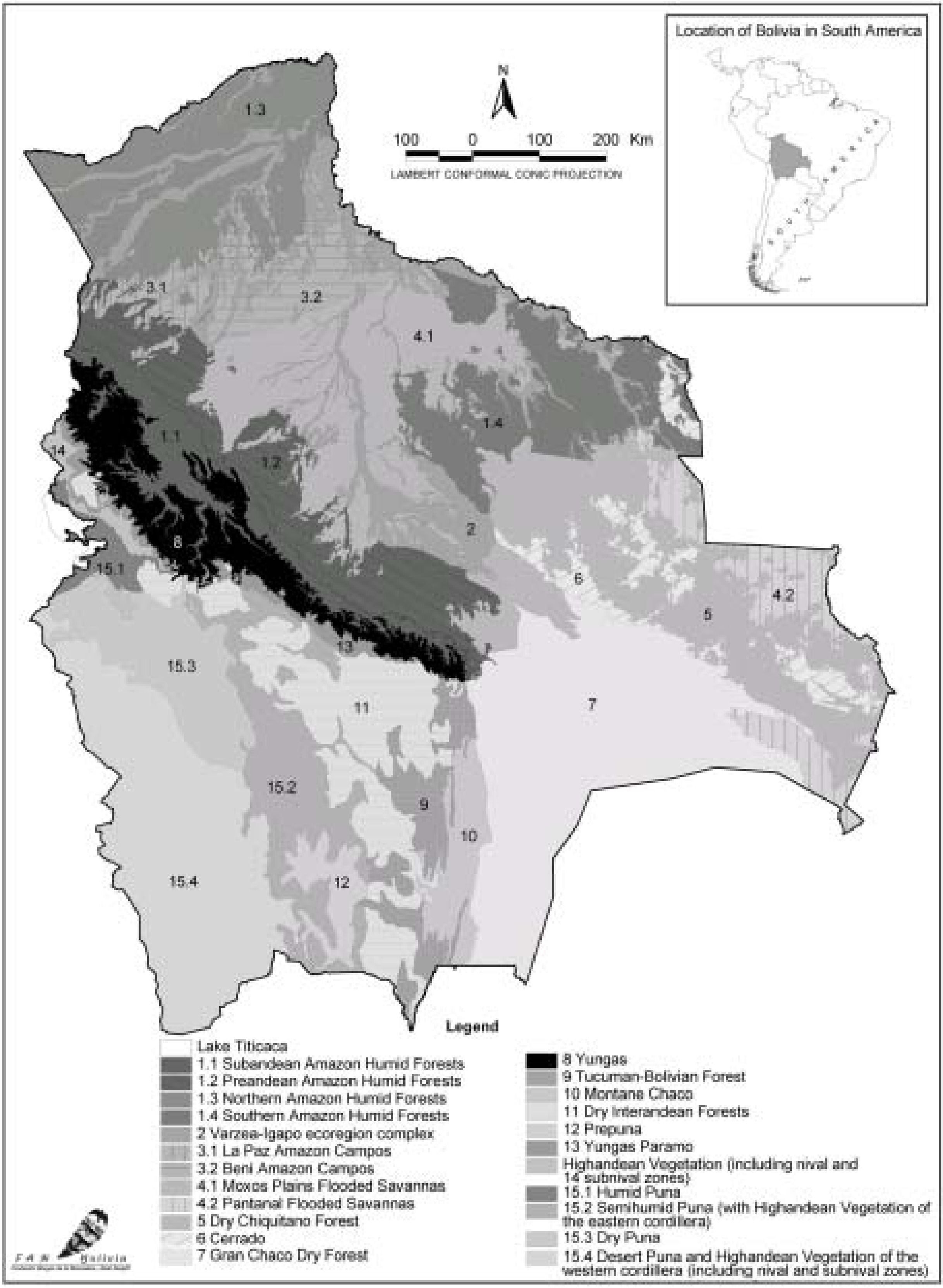


Fig. 1. Ecoregions of Bolivia.

Endemism

More than 400 out of the more than 1,200 species identified and described from Bolivia are considered to be endemic to the country (see Appendix 1, Electr. Suppl. 03–04), a share of 33%. Some Bolivian orchid taxa tend to comparatively high endemicity, e.g. *Lepanthes* Sw. with 78% (subtribe Pleurothallidinae: >50%). In epiphytic species, endemism is more common (36.6%) than in terrestrial species (22.8%).

Most species that are endemic are known from small ranges or even the type locality only. Of course, on the one hand, several of them will appear at other sites, even in other countries, as orchid inventory progresses. However, especially in the highly endemic taxa, it is very probable that many really have ranges

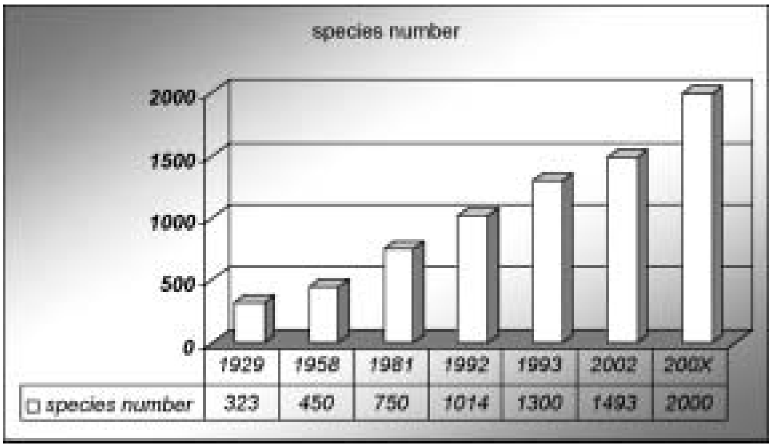


Fig. 2. Evolution of species numbers according to records and estimates. 1929: recorded species by Schlechter (1913–1929), cited after Dodson & Escobar (1993). 1958: recorded species by Foster (1958). 1981: estimate by Dressler, cited after Dodson & Escobar (1993). 1992: estimate of recorded species by Dodson (Dodson & Escobar 1993). 1993: estimate of possible species number by Dodson & Escobar (1993). 2002: currently recorded species. 200X: current estimate of possible species number.

Table 1. Ecoregional orchid species richness and endemism. Column a: total species number (considering all unidentified and undescribed species). Column b: ecoregional percentage share of total species number (considering all unidentified and undescribed species). Column c: number of identified and described species. Column d: percentage of unidentified or undescribed species. Column e: number of endemic species (described species only). Column f: ecoregional endemism percentage. Column g: ecoregional percentage share of total number of endemic species (described species only).

Bolivian (sub-)ecoregions		a	b	c	d	e	f	g
1.1	Subandean Amazon Humid Forests	258	17.3	198	23.2	35	17.7	8.7
1.2	Preandean Amazon Humid Forests	197	13.2	136	31.0	21	15.4	5.2
1.3	Northern Amazon Humid Forests	27	1.8	24	11.1	2	8.3	0.5
1.4	Southern Amazon Humid Forests	65	4.4	60	7.7	5	8.3	1.2
2	Varzea and Igapo	11	0.7	10	9.1	0	0	0
3.1	La Paz Amazon Campos	3	0.2	3	0	0	0	0
3.2	Beni Amazon Campos	1	0.07	1	0	0	0	0
4.1	Moxos Plain Flooded Savannas	6	0.4	6	0	1	16.6	0.2
4.2	Pantanal Flooded Savannas	3	0.2	1	66.7	0	0	0
5	Dry Chiquitano Forest	66	4.4	58	12.1	11	19.0	2.7
6	Cerrado	36	2.4	19	41.7	1	5.2	0.2
7	Gran Chaco Dry Forest	14	0.9	15	6.7	3	20.0	0.7
8	Yungas	903	60.5	744	17.8	316	42.5	78.7
9	Tucuman-Bolivian Forest	102	6.8	94	7.8	14	14.9	3.5
10	Montane Chaco	8	0.5	5	37.5	0	0	0
11	Dry Interandean Forests	32	2.1	24	25	8	33.3	2.0
12	Prepuna	1	0.07	0	100	0	0	0
13	Yungas Paramo	6	0.4	6	0	1	16.6	0.2
14	High-Andean Vegetation	0	0	0	0	0	0	0
15.1	Humid Puna	10	0.07	10	0	0	0	0
15.2	Semihumid Puna	9	0.6	9	0	2	22.2	0.5
15.3	Dry Puna	0	0	0	0	0	0	0
15.4	Desert Puna	0	0	0	0	0	0	0

limited to some high-altitude montane rain forests (see below). On the other hand, many new species to be discovered in Bolivia will be endemic; this effect might even increase the endemism percentages. Currently, the endemism percentage is comparable to those of other Andean countries like Peru (23%; Brako & Zarucchi 1993, Ibisch et al. 1996) and Ecuador (40%; Valencia et al. 2000). In Ecuador orchids represent about one third of all endemic plant species (Valencia et al. 2000).

Geographic concentration of species diversity and endemism

Bolivian orchid diversity is geographically concentrated in the Yungas ecoregion (Table 1, Figs. 1, 3). This ecoregion includes the northeastern Andean slopes with semihumid to very humid montane rain forests between 1,000 m and 3,500 m elevation. 66% of the species with known localities occur in this area which covers only 4% of the national territory (see Appendix 1, Electr. Suppl. 03–04). Regarding the endemic species, almost 80% are found in the Yungas (316 spp., see Table 1), and these represent about 43% of all species present in the ecoregion. Of course, there are endemic orchid species found in other ecoregions (Table 1), even in dry forests like the Chiquitano Forest Ecoregion (11 spp.) or Dry Interandean Valleys (10 spp.). The most species-rich high-Andean ecoregion is the Semihumid Puna (10 spp., 1 endemic).

Yungas is the Bolivian region richest in plant species, most important plant groups show a diversity maximum in this region (e.g. pteridophytes, bryophytes, Poaceae, Bromeliaceae; authors' unpublished data), but few are as concentrated as orchids. Most plant and animal groups have their concentration of endemic species in the Yungas region as well. For example, amphibians have an even higher endemism percentage than orchids (about 48%; J. Köhler, S. Reichle, pers. comm.). Generally, endemism percentages in the Andes increase with altitude, and most known local endemics are from the highest altitudinal rain forest belts, the cloud forests (e.g. Pleurothallidinae, see Vásquez & Ibisch 2000).

It is expected that the Yungas will be revealed as an even more prominent center of orchid diversity and endemism. Most undiscovered species are Yungas taxa,

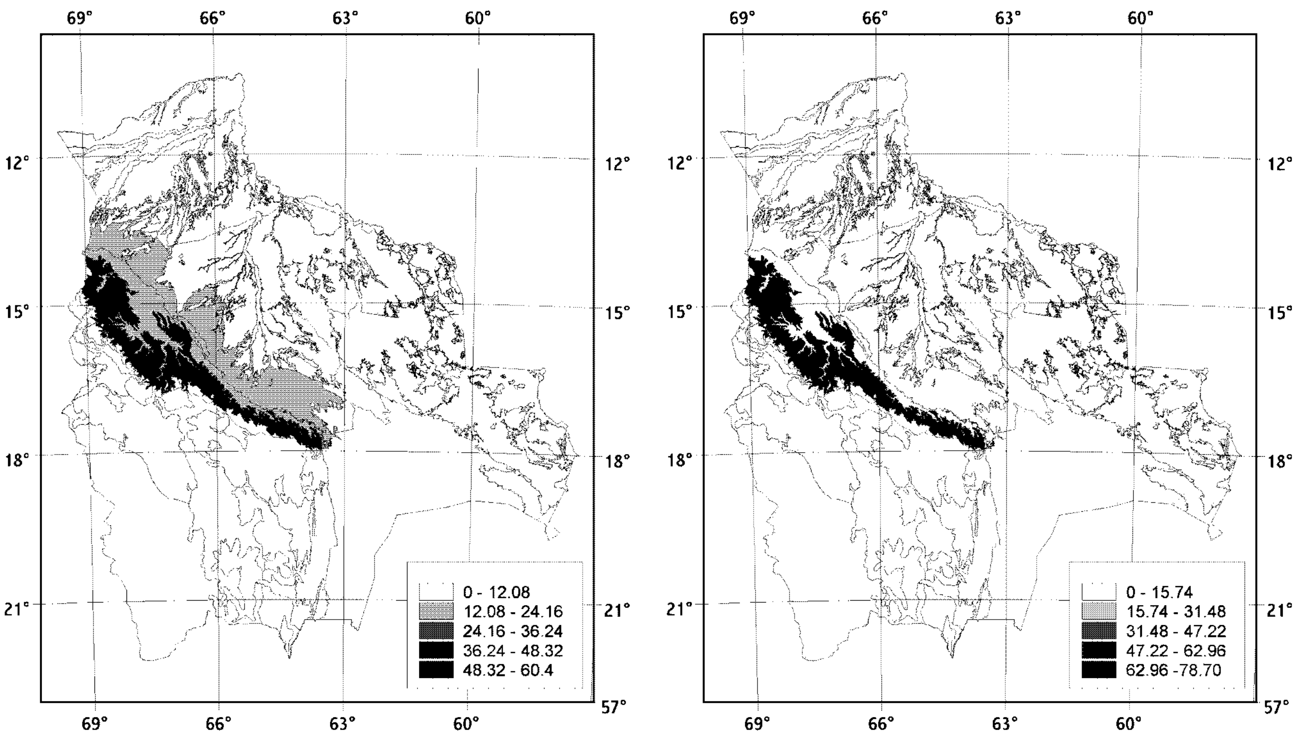


Fig. 3. Ecoregional distribution of Bolivian orchid diversity. A. Ecoregional percentage shares of total orchid species number. B. Ecoregional percentage shares of total endemic species number.

e.g. about 90% of the 43 new species described between 1997 and 1999 are reported from this ecoregion.

Challenges for taxonomy and capacity building

It is the exceptional diversity of a few orchid taxa that makes Bolivia so orchid-rich. There are eight genera – that is 4.2% of all genera – that represent about half of all species (47%; see Appendix 1, Electr. Suppl. 03–04). These genera are mainly epiphytic orchids of the mid-elevation montane Yungas rain forests. The most species-rich genera are *Epidendrum* L. (174 spp.), *Pleurothallis* R. Br. (133 spp.), *Maxillaria* Ruiz & Pav. (114 spp.), *Lepanthes* Sw. (62 spp.), *Oncidium* Sw. (58 spp.), *Stelis* Sw. (57 spp.), *Masdevallia* Ruiz & Pav. (54 spp.), and *Habenaria* Willd. (48 spp.). The Pleurothallidinae subtribe alone represents four of the eight most species-rich genera (*Pleurothallis*, *Lepanthes*, *Stelis*, *Masdevallia*). Of course, molecular studies will cause many taxonomic changes and possibly reduce the species numbers of the large genera that in some cases may turn out to be polyphyletic (e.g. *Pleurothallis*, Pridgeon et al. 2001).

Species-rich genera are those that still provide floristic surprises. They belong to the taxa with highest new discovery and description rates. In the case of *Epidendrum* we are aware of almost 60 species that were not previously recorded for Bolivia; many of them could turn out to be new species (for one example see the species description below). This is no surprise considering the fact that many new species from this genus are described from each Neotropical region (e.g. see Hágsater 2001). In the case of *Maxillaria* there is a similar number of species that could be new to science. New species are found even in conspicuously flowering groups such as *Masdevallia* (Luer 2001). The inconspicuous taxa need to be studied much more intensively. A real problem is the genus *Stelis*, the ‘beetle’ taxon among orchids. Due to the facts that these plants have tiny flowers of similar appearance, present a very uniform vegetative morphology that makes the differentiation of sterile specimens impossible, and are characterized by a high species turnover from one region to another, we know several dozens of morphospecies from Bolivia that have not been assigned to any existing or new species. Only in a few groups is there such a high percentage of species that is known from the type locality only. On the one hand, this shows that the species might tend to local endemism. On the other hand, without a doubt, this is the consequence of extremely deficient collection efforts and the lack of recent treatments and specialists.

Several terrestrial taxa like *Habenaria* Willd., *Cyclopogon* C. Presl or *Malaxis* Sol. ex Sw. are not well understood taxonomically (not only in Bolivia but also in neighboring countries; unfortunately there is no up-to-date bibliography that would facilitate the work on those taxa). Another challenging and ecologically interesting group are the terrestrial species of *Cyrtopodium* R. Br., adapted to grazing and natural fires in savannas – there will be several new species.

The question is: who will study all the Bolivian orchids still to be discovered and described? There is only one Bolivian specialist (R.V.) who is familiar with all groups present in the country, and just a couple of international taxonomists who work with one or another orchid group are contributing more or less sporadically to the Bolivian orchid inventory. In Bolivia, there are only a few young botanists devoted to taxonomy, and none of them is interested in the study of the most diverse plant family of the country. Worldwide, only a few taxonomists work on the most species-rich genera of Bolivia. The most diverse subtribe, Pleurothallidinae, is attended to almost exclusively by Carlyle Luer who, at 80, is tirelessly promoting the clarification of the taxonomy of all Neotropical species, creating a gigantic number of species descriptions and taxonomic treatments (he has described a total of more than 1,500 species from all countries where the Pleurothallidinae occur, and established 12 genera; Vásquez & Ibisch 2000).

Why are there so many orchids in Bolivia?

The question “Why are there so many orchids in the world?” is not to be answered here. However, a part of the answer might be: “Because there are so many orchids in countries like Bolivia”. And, as recognized above, in Bolivia there are so many orchids because some groups have experienced an intensive speciation in the humid montane forests. Thus, some answers must be found in these ecosystems. In general, we agree with Gentry & Dodson (1987) and Ackerman (1998) that orchids are so diverse for being less resilient against factors that break up gene pools and due to the long-distance dispersal of their dust-seeds causing innumerable founder populations. Obviously, in the Bolivian Yungas, optimum habitat conditions for orchids combine with such factors as geographic isolation by rather recent geological and climatic events and local habitat disturbances (see also Gentry 1982, Gentry & Dodson 1987, Ibisch 1996). In general, orchid evolution should be catalyzed by a complex system of interacting factors like ethology (highly specialized adaptation to pollinators), dependence on mycorrhiza fungi, life history characteristics (e.g. random long-distance dispersal and high seed mortality), habitat peculiarities (rather unstable, nutrient-poor and water-stressful epiphytic habitat), and small, dispersed populations (compare, e.g., Benzing & Atwood 1984, Benzing 1986, Gentry & Dodson 1987, Ibisch et al. 1996, Nieder & Barthlott 2001). When this system acts under Yungas-like environmental and historical conditions, a speciation explosion is triggered.

Another question is: "Why are there countries with more orchids than Bolivia?" Examples are Peru or Ecuador which seem to have many more orchid species (it must be acknowledged that their orchid inventory has been carried out much more intensively). One factor are larger respective areas of optimum orchid habitats. Another one is the geographic location of Bolivia towards the southern border of the tropics. Actually, the Yungas are the southernmost appendix of the large Andean montane rain forest belt: many taxa that have evolved in the northern Andes have not invaded Bolivian territory, and Pleistocene climate changes (several much drier and colder epochs; Graf 1992, 1994; Baker et al. 2001) in the smaller Andean rain forest belt of Bolivia might have led to more rain forest fragmentation and species extinction events than in the northern Andean countries.

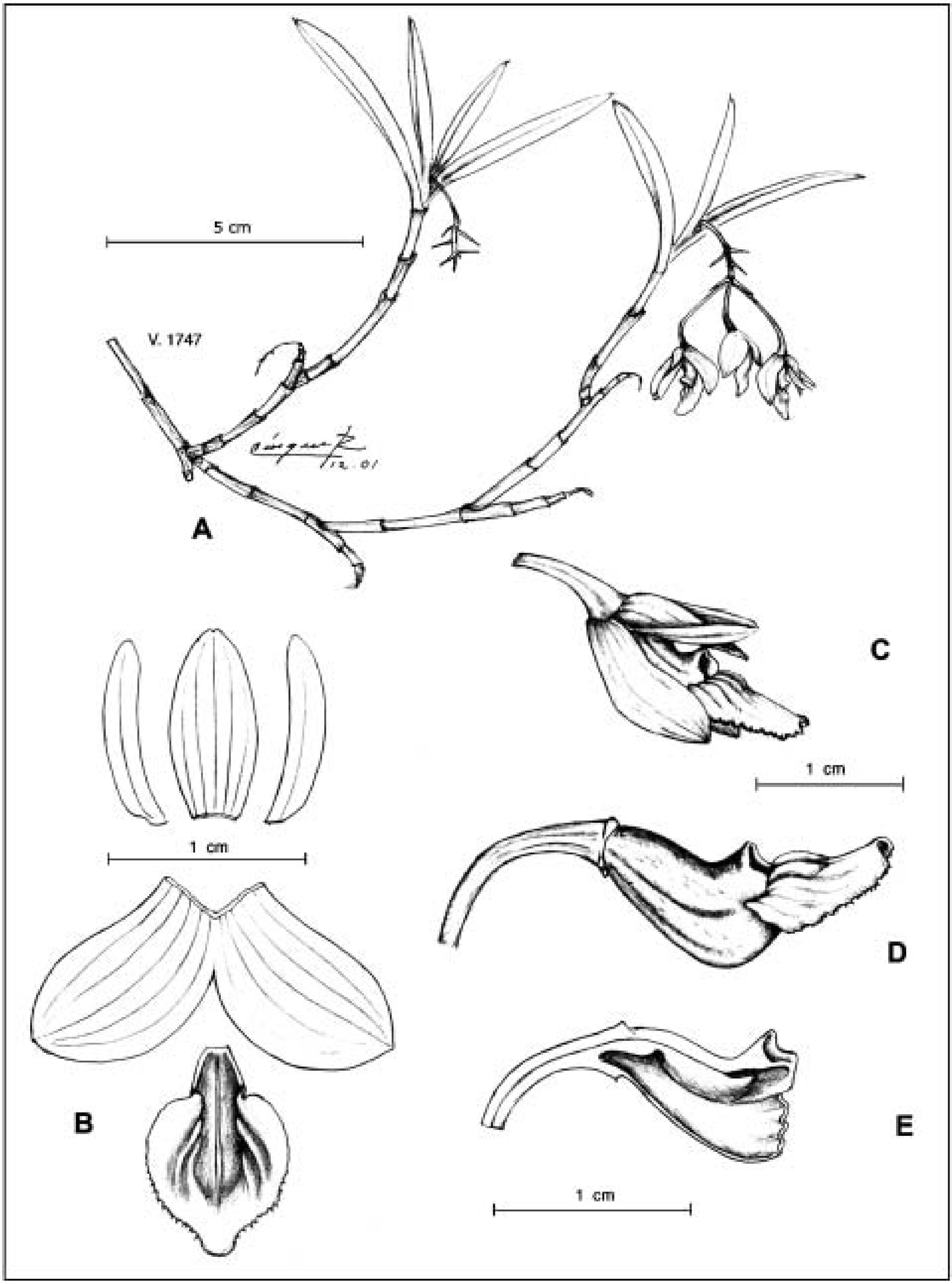
In the neighboring, extratropical Andean country of Argentina, there are only 280 orchid species (Johnson 2001) (about 65 genera, in contrast to the 191 in Bolivia) – the reason is the much more seasonal climate with high temperature and precipitation variation during the year, and very low minimum temperatures, notably during a special weather situation that brings cold Antarctic wind into the subtropical and even tropical regions (Hanagarth 1993). A geological accident created the Andean knee at the latitude of Santa Cruz in Bolivia that is very important for the Andean biodiversity located northwards. Southwards the eastern cordillera is oriented from the south to the north and does not slow down the cold winds. Northwards the much higher cordillera stretches from southeast to the northwest. There, the cold southern winds are mitigated and the humidity of the tradewinds is captured, creating perhumid conditions.

Outlook – challenges for conservation

As most of the orchids are plants that need rather intact humid forests, and as they belong to the most diverse and endemic taxa of Bolivia, it seems logical that at least some might be among the most threatened species of the country. Vásquez & Ibisch (2000), applying a semi-quantitative estimation method, concluded that about 45% of the Pleurothallidinae could be vulnerable or more or less threatened. A more recent study that tried to consider the conservation status of the habitats and the range size had more optimistic results (Ibisch et al. 2002b). However, it is probable that some species that are locally endemic to localities where the conservation status has worsened drastically in the last decades are critically endangered or extinct: e.g. *Lepanthes brevis, L. ciliolata, L. glaberrima, L. miraculum, L. nebulina, L. pileata, L. puck, L. serriola, Masdevallia chaparensis, M. nitens, M. tinekae, M. vasquezii, Pleurothallis weddelliana*, or *Stelis iminapensis*. First orchid gap analyses of the Yungas forests, where there is a rather good protected area coverage, show that a certain number of orchid species possibly is not represented in the current protected area system (unpublished data, Müller et al. in press).

It is important to understand that endemic taxa or highly attractive orchid species are not automatically threatened taxa (e.g. Ibisch 1998, Vásquez & Ibisch 2000). Kessler (2001) has shown for some non-orchid plant taxa that in the Bolivian Yungas endemism percentage is higher in slightly disturbed forests. With orchids the situation may be different. Maximum endemism percentages might possibly be observed in closed-canopy forests. This is related to the fact that most orchids are epiphytic plants and need tree branches of a certain age for colonization (Ibisch 1996). According to Kessler's (2001) analysis, many endemic species seem to be less competitive, thus terrestrial endemics are benefited by mild habitat disturbances. However, in the case of canopy epiphytes their habitat itself is not very stable, rather stressful and characterized by less competition (Ibisch 1996). On the one hand, that could mean that some orchid species (e.g. twig epiphytes) tolerate some forest disturbance as well. Actually, some epiphytic species of montane cloud forests, in areas where the forest has been cleared, can be observed on rocks (e.g. *Neodryas herzogii*, Sehuencas, Carrasco National Park). On the other hand, others really seem to need intact shady forests and disappear rapidly when the canopy is opened up (e.g. *Lepanthes* spp.). Consequently, the specific sensibility of each species must be taken into account when the real conservation status is assessed.

Orchid conservation could be easy because the species are so concentrated in Bolivian territory, or it could be difficult for the same reason. Theoretically, not only for orchid diversity, it would be adequate to protect strictly all Yungas and subandean forests north of the Andean knee. Unfortunately, this area with rather favorable climate and soils is increasingly becoming a focus for immigrating highland peasants. It also contains some critical non-biological resources of high national priority, such as minerals and especially oil. Still, there are vast intact forest areas; as a matter of fact, the orchid-rich rain forests of Bolivia are much better conserved than their equivalents in Peru or Ecuador. But soon the work of conservationists will become harder, and it might be impossible to save the large forest tracts. Increasing the taxonomic knowledge on the many and special orchids of this area will not 'win the battle', but it contributes a little bit by providing arguments for its protection.


5 cm
V. 1747
A
B
C
1 cm
1 cm
D
E
1 cm

Species description

Epidendrum adolfomorenoi R. Vásquez & P. L. Ibisch, sp. nov. Fig. 4.

Type: Bolivia: La Paz: Prov. Nor Yungas: between Chuspipata and Coroico, 3,000 m, 24 Nov. 1992, *R. Vásquez, C. Luer, J. Luer & D. Ric 1747*. Holotype at Herbario Nacional de Bolivia (LPB), isotype at Herbarium Vasquezianum (VASQ).

Diagnosis: Similis est *Epidendrum cochabambanum* Dodson & Vásquez sed sepalis inflexis petalis cum sepalo dorsale conniventibus et margine apicale labelli revoluto differt.

Description: Plant a sympodial epiphytic herb. Stems terete, about 2 mm in diameter, declined, with a succession of short suberect branches, 2–5 cm between branches. Leaves 2–5, towards the apex of the branches; sheaths about 10–20 mm long, tubular, striate; blades about 1.5–6 cm long, about 4–5 mm wide, linear, subcoriaceous, the apex asymmetric, mucronate. Sphate lacking. Inflorescence apical, racemose, nutant, 2–2.5 cm long. Flowers 4–6. Floral bracts 3–5 mm long, much shorter than the ovary, narrowly triangular, acuminate. Ovary about 15 mm long, neither inflated nor ornamental, light pink at the base, dark pink towards the apex. Perigon whitish with purple stripes. Dorsal sepal about 10 × 6 mm, ovate-elliptic, concave, 3-veined, the apex rounded. Lateral sepals connate up to 1/3 from the base, individually about 11 × 7 mm, inflexus, obovate, oblique, 5-veined, the apex rounded. Petals about 10 × 2 mm, connivent with the dorsal sepal, linear-oblong, one-veined, the margins revolute, the apex rounded. Lip united to the column forming a saccate base, ovate-cuneate, apical margins revolute; disc fleshy, 5-keeled. Column about 10 mm long, recurved at the apex, yellowish-white with violet stripes. Anther and pollinia not seen. Nectary a wide cavity formed by the column and the base of the lip.

Species identification: *Epidendrum adolfomorenoi* is recognized by its slender, declined and branched stems, the linear and coriaceous leaves, the nutant and few-flowered raceme, the white-creamed flowers with violet stripes, the connivent petals, the lateral sepals partially united at the base, the base of the lip united to the column forming a large cavity, and the revolute margins of the lip.

Distribution, ecology and conservation: Known only from the type collection. Epiphytic in wet montane forest of the Yungas region in La Paz at 3,000 m altitude. It grows in moss-covered branches. Flowering from October to December. According to the National Conservation Assessment method as described in Vásquez & Ibisch (2000), the species could be vulnerable (NCS = 52 = 32 + 16 + 0 + 0 + 4).

Etymology: It is named in honor of Adolfo Moreno Pareja, former Executive Director of the Fundación Amigos de la Naturaleza, for his contributions to orchid research and conservation of the biodiversity of Bolivia.

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◄ **Fig. 4.** *Epidendrum adolfomorenoi*, sp. nov. A. Habit. B. Perigon. C. Flower. D. Columna and labellum, lateral view. E. Columna and part of labellum, longitudinal cut. Drawings by R. Vásquez.

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