

STATE OF KNOWLEDGE OF BOLIVIAN ARACEAE

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ABSTRACT. From a database containing 1377 collections of Bolivian Araceae, representing more than 80% of all collections of the family gathered in the country, we compiled an updated list enumerating 23 native genera with 114 described species and nine infraspecific taxa, and three cultivated genera with one species each. We are aware of at least 60 additional distinct species to which we were unable to assign names, many of them probably representing undescribed taxa. We estimate that the total number of Araceae occurring in the country exceeds 300 species. The first Bolivian collections date from 1830, but 92% of all collections have been made since 1978. Only five of 112 collectors have obtained 58% of the Bolivian Araceae collections. Geographically, only a few easily accessible areas have been sampled intensively (but not at all completely), while most of the country, particularly the Amazonian portion and parts of the humid Andean slopes, remains very poorly known. Clearly, much work needs to be conducted on Bolivian Araceae, particularly involving intensive surveys of specific sites and the cultivation of little-known taxa.

Key words: Araceae, Bolivia, checklist, Neotropics

RESUMEN. De una base de datos que contiene 1377 colecciones de Araceae bolivianas, representando más de 80% de todas las colecciones de la familia hechas en el país, compilamos una lista conteniendo 23 géneros nativos con 114 especies descritas y nueve taxones infraspecificos, así como tres géneros cultivados con una especie cada uno. Conocemos por lo menos 60 especies adicionales a las cuáles no pudimos asignar nombres, en muchos casos probablemente representando especies no descritas. Estimamos que el número total de Araceae en el país excede 300 especies. Las primeras colecciones bolivianas datan de 1830, pero un 92% de todas las colectas han sido hechas a partir de 1978. Cinco de 112 colectores han obtenido 58% de las colectas bolivianas de Araceae. Geográficamente, solamente regiones fácilmente accesibles han sido colectadas intensivamente (pero aún allí no completamente), mientras que la mayor parte del país, particularmente la Amazonía y partes de la vertiente andina húmeda, permanecen muy poco conocidas. Se necesita estudios adicionales de Araceae bolivianas, sobre todo inventarios intensivos de lugares específicos y el cultivo de especies poco conocidas.

INTRODUCTION

The family Araceae, with 106 genera and roughly 3200 described species, is nearly worldwide in distribution. Thirty-six genera and about two thirds of the species occur in the Neotropics, where centers of diversity are located in Panama, northwestern South America, and the humid eastern Andean slope south to about 18°S (Croat 1986, 1992, 1995). Despite much recent field work and taxonomic work, South American Araceae remain relatively poorly known, mainly because of high levels of endemism and the difficulties involved in collecting the family (Croat 1994). With an estimated 18,000–20,000 plant species, Bolivia supports one of the world's richest and at the same time most poorly known floras (Campbell & Hammond 1989, Beck 1998).

The first three collections of Araceae in Bolivia were made by A. d'Orbigny in 1830, fol-

lowed by a few collections by H.A. Weddell in 1845 and by H.H. Rusby in 1885. Between 1890 and 1939, some 70 Araceae collections were gathered, mainly by M. Bang, O. Buchtien and B. Krukoff, whereas other important collectors of that period, such as T. Herzog, J. Steinbach and R.S. Williams apparently avoided collecting Araceae. Many of these collections were described as new by Engler, Krause, and Rusby. Almost no collections were made from the 1940s until the establishment of the Herbario Nacional de Bolivia in 1978. In 1958, R.C. Foster listed 48 species of Araceae in 15 genera for Bolivia (Foster 1958). Since then, the number of Araceae collections has increased enormously, mainly through collections by S. Beck (1979–present), T. Croat (1980), J. Solomon (1980–1988), M. Nee (1985–present), M. Kessler and co-workers (1989–1997), N. Helme (1993–1995), and A. Acebey (1996–1997), with the result that Foster's (1958) check-list is now badly outdated. The aim of the present study was to

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compile all information on Bolivian Araceae accessible to us, to present an updated checklist, and to analyze the spatial coverage of the knowledge of this family in the country.

MATERIAL AND METHODS

A database of all Bolivian collections of Araceae known to us through September 1998 was compiled from specimens deposited at the Missouri Botanical Garden (MO), the Herbario Nacional de Bolivia (LPB), and the New York Botanical Garden (NY), and from literature records (Madison 1977, 1978, 1981, Croat 1981, 1991, Bogner & Nicolson 1988, Mayo 1991, Ibsch 1996). Species identifications were mostly conducted by Croat. Throughout the text, the term "recorded" is used exclusively in reference to those taxa listed in Appendix 1, while "estimated" refers to species numbers estimated with the Chao 1 method (see below). Intraspecific taxa were not considered in the species counts.

Extrapolated species numbers were calculated with Chao's (1984) Chao 1 formula

$$S_1 = S_{\text{obs}} + (a^2/2b)$$

where S_1 is the estimated number of species, S_{obs} the observed species number, a , the number of species registered only once (singletons), and b , the number of species recorded twice (doubletons). This approach provides a rough estimate of total species numbers in areas that have not been thoroughly sampled, as well as of the completeness of the sampling (Colwell & Coddington 1995). Recent simulation analyses have shown, however, that the Chao 1 estimator tends to underestimate the real species number considerably when less than 70% of the total species number have been recorded (S.K. Herzog & M. Kessler unpubl. data). This also applies to most other estimators presented by Colwell & Coddington (1995). The Chao estimator was selected because of its relatively low sensitivity to varying sample intensity and species richness, and because several other estimators are not applicable to the data structure of the present study.

To analyze the geographical coverage of collecting activity, known number of collections, known number of species and the estimated number of species were recorded on a 1° grid. For fairly well-collected grid squares, total species numbers were extrapolated by Chao's (1984) method, whereas in strongly under-collected grid squares the number was interpolated from well-known squares, taking into account the distribution of vegetation types (Ribera et al. 1996).

RESULTS

Our database contained 1377 collections of Araceae from Bolivia, of which 1320 were identified to species or recognized by us to represent a distinct species to which we were unable to assign a name. Based on our knowledge of Araceae collections in Bolivian, North American, and European herbaria, we believe that this database contains >80% of all Bolivian Araceae collections. One additional species was documented by a photograph. The resulting species list contains 23 native genera with 114 named species with 9 infraspecific taxa, and 60 unnamed species (TABLE 1, APPENDIX). No less than 68 species (27 of them named) have been recorded only once in Bolivia, and just 37 species (including two unnamed species) are known from 10 or more collections. The taxonomic status of several described species, e.g., *Philodendron pseudoundulatum*, *Taccarum caudatum*, and *T. warmingii* is still uncertain. Three cultivated genera (*Alocasia*, *Colocasia*, *Zantedeschia*) have also been recorded, but will not be further considered here.

Following Chao's (1984) method, the total number of Araceae in Bolivia is estimated at 281 species (TABLE 1). However, this is likely to be an underestimate because the number of recorded species is considerably lower (62.6%) than the estimated species number and the Chao 1 estimator tends to underestimate total species numbers by 20–30% when the species-accumulation curve has not yet closely approached an asymptotic value (S.K. Herzog & M. Kessler unpubl. data). We would therefore not be surprised if future fieldwork eventually confirms the presence of over 300 species of Araceae in Bolivia. Despite this bias, the estimated species numbers in TABLE 1 and FIGURE 2 probably reflect accurately the relative richness and state of knowledge of different genera and geographical regions.

The temporal evolution of the number of Araceae species known from Bolivia roughly parallels that of the number of collections (see introduction), with few species known in the 19th century, noticeable increase around the turn of the century, stagnation in the mid-20th century and strong increase since 1978. Not unexpectedly, the ratio of new country records (including named and unnamed species) per number of collections has been continuously decreasing from 73% in 1890–1909 to 16% in 1970–1985 and 9% in 1990–1998. The majority of new records in the last two decades have involved unnamed taxa, reflecting both the more systematic gathering in quantitative vegetation studies of sterile specimens which would have been ignored by

TABLE 1. Number of named species, unnamed species, the sum of named and unnamed species, and the estimated total existing species number (following the Chao 1 estimate) of native Araceae in Bolivia.

Genus	Named species	Unnamed species	Sum	Estimated total species number
<i>Alloschemone</i>	1	0	1	1
<i>Anthurium</i>	34	17	51	62
<i>Asterostigma</i>	1	0	1	1
<i>Caladium</i>	1	0	1	1
<i>Dieffenbachia</i>	2	7	9	12
<i>Dracontium</i>	2	0	2	3
<i>Gorgonidium</i>	2	0	2	2
<i>Heteropsis</i>	2	1	3	3
<i>Homalomena</i>	2	1	3	3
<i>Monstera</i>	7	4	11	11
<i>Philodendron</i>	32	23	55	139
<i>Pistia</i>	1	0	1	1
<i>Rhodospatha</i>	3	0	3	3
<i>Schismatoglottis</i>	1	0	1	1
<i>Spathantheum</i>	1	0	1	1
<i>Spathicarpa</i>	1	0	1	1
<i>Spathiphyllum</i>	0	1	1	1
<i>Stenospermation</i>	5	2	7	10
<i>Synandropadix</i>	1	0	1	1
<i>Syngonium</i>	3	2	5	5
<i>Taccarum</i>	4	0	4	6
<i>Urospatha</i>	1	0	1	1
<i>Xanthosoma</i>	7	2	9	12
Totals	114	60	174	281

earlier collectors whose aim was to obtain fertile gatherings, and the time-lag between the collection and the description of new taxa.

Of the 1294 collections which could be assigned to a 1° grid square, 719 (55.6%) were gathered in only five squares (FIGURE 2A). The largest number of collections (400 in two squares) has been made in the Yungas of La Paz, especially along the road from La Paz to Caranavi and Yucumo, Depto. La Paz, which includes the collecting grounds of many early collectors (e.g., Bang, Buchtien, Krukoff) and has been intensively sampled in more recent times by Beck, Croat, Kessler, Solomon, and others. Other comparatively well-collected areas correspond to the old and new roads from Cochabamba to Villa Tunari, Depto. Cochabamba (144 collections), the road from Charazani to Apolo, Depto. La Paz (96), and Reserva Valle de Sajta, Universidad Mayor de San Simón, and the eastern portions of Parque Nacional Carrasco, Depto. Cochabamba (79).

Not surprisingly, the number of species known per 1° square paralleled the number of collections, with the five most species-rich squares corresponding to the five squares with highest numbers of specimens (FIGURE 2B). However, the overall coverage of Bolivian Araceae is still very incomplete. Only 25 of the 100 grid squares believed to hold at least one species

of Araceae had a ratio of number of recorded to estimated species numbers of $\geq 50\%$ (FIGURE 2D). These included 13 squares with five or fewer Araceae species, but only seven of 35 squares with an estimated ≥ 30 species. Some fairly well known species-rich areas include the vicinity of Santa Cruz city, Depto. Santa Cruz (79%), parts of Parque Nacional Noel Kempff Mercado in northeastern Depto. Santa Cruz (60–65%), parts of the Yungas of La Paz (51–69%), and the two roads from Cochabamba to Villa Tunari, Depto. Cochabamba (53%). On the other hand, no collections of Araceae have yet been made in nine of the 35 degree squares with an estimated number of ≥ 30 species. Species-rich areas that are particularly under-collected include large portions of Amazonian Bolivia, the Cordilleras of Copapata and Mosetenes along the boundary of Depts. La Paz and Cochabamba, and eastern Parque Nacional Carrasco and western Parque Nacional Amboró.

DISCUSSION

Despite enormous advances in the last decades, the knowledge of Bolivian Araceae is still inadequate, both taxonomically and geographically. This is especially true in *Philodendron*, *Anthurium*, *Dieffenbachia*, and *Monstera*, where we have found a large number of species to

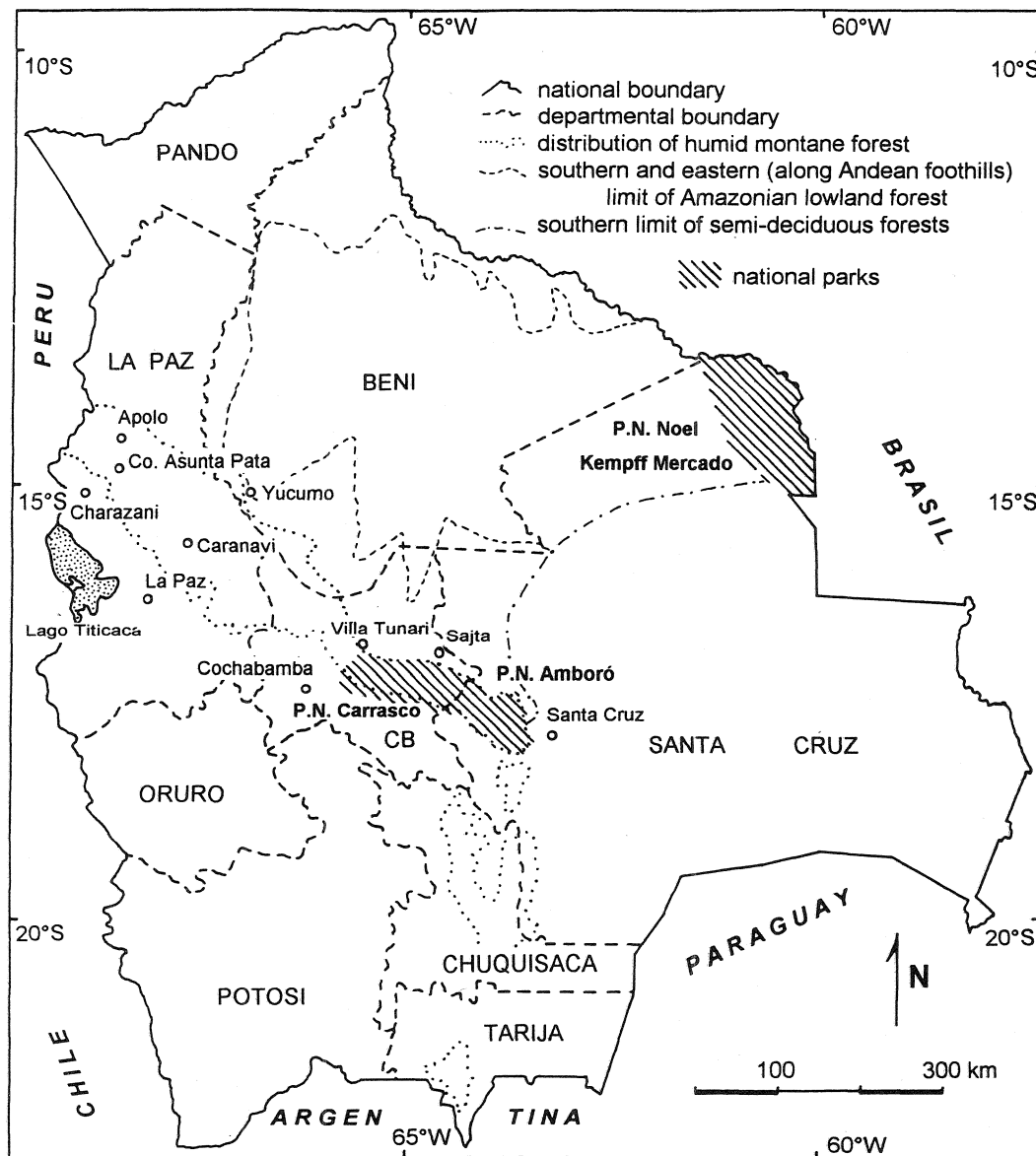


FIGURE 1. Map of Bolivia, with localities and political subdivisions mentioned in the text. CB = Cochabamba.

which we were unable to assign names. These genera are known for being taxonomically difficult and are in need of more intensive study (Croat 1994). Many of the unnamed species probably are undescribed and endemic to Bolivia. While some are now known from sufficiently complete herbarium material to allow description, most are only represented by one or a few, frequently fragmentary and sterile collections. For example, we have seen fertile material of

just one species of *Dieffenbachia* from Bolivia, while the other eight species are only represented by sterile collections. In other genera, e.g., *Monstera*, the taxonomy is so nebulous that a revision of the genus is desirable.

Within Bolivia, species richness is highest along the humid Andean slopes south to 18°S (FIGURE 2C). Richness appears to be lower in the Amazonian part of the country, but intensive surveys are lacking for any site in the Bo-

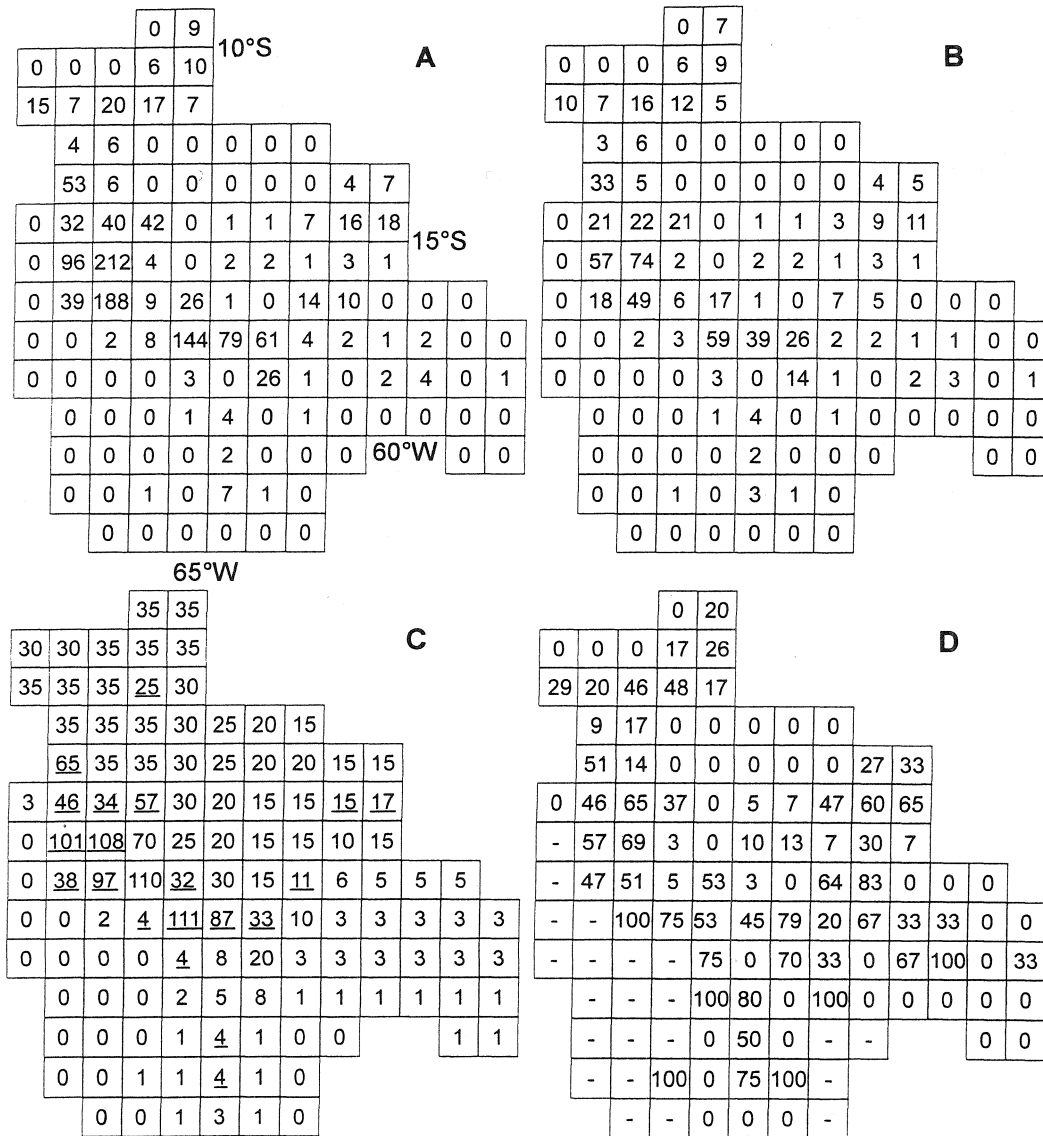


FIGURE 2. Number of collections (A), number of named and unnamed species recorded (B), estimated number of species (C), and ratio of recorded to estimated species numbers (as percentage) (D) per 1° square in Bolivia. In (C), underlined numbers were estimated directly from the data with the Chao 1 method in well-collected squares, whereas the remaining values were interpolated.

livian Amazon. Several species, including the genera *Alloschemone* and *Heteropsis*, are in Bolivia only known from the northernmost part of the country, and it is likely that a more thorough search will reveal more such cases. It is remarkable that in Amazonian Ecuador, up to 71 species of Araceae have been found in a single 1-ha-plot (Balslev et al. 1998), whereas for Bolivian Amazonia the highest estimates for entire 1°-grids (seven orders of magnitude larg-

er) are only 35 species. Diversity of Araceae decreases markedly towards the more arid lowland regions of eastern Bolivia. The high elevations of the Andes, and along the Andean slopes south of 18°S which, albeit locally very humid, are subject to regular influxes of cold air and therefore appear less well suited to Araceae. The broad geographical scope of the present study did not allow a more detailed analysis of variation of species richness and ende-

mism within biogeographic regions, e.g., the Andes or Amazonia.

Overall, species numbers of Araceae appear to be somewhat lower in Bolivia than in northwestern and northern South America. The 174 species recorded from the country are still well below the counts for Peru (218 named species, Brako & Croat 1994), Venezuela (266 named species, Croat 1994), Ecuador (404 named species, Croat 1999) and Colombia (estimated >500 named and unnamed species, Croat 1992).

Only eight named species are endemic to Bolivia (6.9%) (APPENDIX 1), a much smaller proportion than reported for Peru (17.4%, Brako & Croat 1994, excluding species now known to occur in Bolivia) or Ecuador (47.3%, Croat 1999). However, given the poor knowledge of Araceae taxonomy and distribution in general, and Bolivia Araceae in particular, all these numbers are still very preliminary.

Additional fieldwork is needed to improve our knowledge of the taxonomy and systematics of Araceae in Bolivia. In particular, quantitative surveys of specific sites and the cultivation and flowering of sterile, field collected material, is desirable.

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APPENDIX. List of Araceae recorded from Bolivia, with number of collections known to us (#), distribution by department in Bolivia (BE = Beni, CH = Chuquisaca, CO = Cochabamba, LP = La Paz, PA = Pando, SC = Santa Cruz), elevational distribution (based on Bolivian specimens only), and a selected voucher collection (herbarium acronyms follow Holmgren et al. 1990).

Species	#	Distribution	Elevation	Voucher
<i>Alloschemone</i>				
<i>occidentalis</i> (Poepp.) Engl. & K. Krause	1	PA	120	Solomon 17114 (LPB)
<i>Alocasia</i>				
<i>macrorrhizos</i> (L.) Schott	1	BE—Cultivated	240	Williams 1169 (MO)
<i>Anthurium</i>				
<i>amoenum</i> Kunth	8	LP	1100–2100	Solomon 8643 (MO)
<i>amoenum</i> var. <i>humile</i> (Schott) Engl.	1	LP	1450	Kessler 10250 (MO)
<i>atropurpureum</i> R.E. Schult. & Maguire	4	SC	200–1900	Ibisch 93.0503 (LPB)
<i>atropurpureum</i> var. <i>ar- enicola</i> Croat	1	LP	180	Haase 343 (LPB)
<i>atropurpureum</i> var. <i>thoma- sii</i> Croat	3	BE, SC	250–1850	Thomas 5696 (MO)
<i>brevipedunculatum</i> Madi- son	3	BE, LP, SC	200–700	Solomon 6434 (MO)
<i>breviscapum</i> Kunth	5	LP	700–1800	Lewis 36916 (MO)
<i>buchtienii</i> K. Krause	6	LP, SC—Endemic	400–700	Krukoff 10808 (NY)
<i>clavigerum</i> Poepp.	37	BE, CO, LP, PA, SC	150–1300	Beck 12607 (LPB)
<i>conjunctum</i> K. Krause	1	LP—Endemic	540	Buchtien 1303 (B)
<i>coripatense</i> N.E. Br.	39	CO, LP, SC	1300–3200	Croat 51368 (MO)
<i>croatii</i> Madison	13	BE, CO, LP	250–1400	Croat 51283 (MO)
<i>ernestii</i> Engl.	2	CO	450–1550	Kessler 7890 (MO)
<i>gracile</i> (Rudge) Schott	53	BE, CO, LP, PA, SC	150–1500	Helme 230 (LPB)
<i>grande</i> N.E. Br.	20	CO, LP	850–3000	Solomon 7521 (MO)
cf. <i>interruptum</i> Sodiro	1	LP	1500	Gentry 70932 (MO)
<i>kunthii</i> Poepp.	22	BE, CO, LP, PA, SC	200–1500	Beck 6993 (LPB)
<i>lechlerianum</i> Schott	14	CO, LP	1100–2750	Krukoff 10294 (NY)
<i>lutescens</i> Engl.	1	LP	2850	Solomon 5212 (MO)
<i>macleanii</i> Schott	1	LP	900	Helme 579 (LPB)
<i>microspadix</i> K. Krause	7	CO, LP	1300–2650	Solomon 12979 (MO)
<i>nigrescens</i> Engl.	4	CO, LP	2000–2400	Luteyn 13741 (NY)
<i>obtusum</i> (Engl.) Grayum	3	CO, LP	500–1300	Acebey 502 (LPB)
<i>ottonis</i> K. Krause	31	CO, LP, SC	600–2500	Beck 4724 (LPB)
<i>oxycarpum</i> Poepp.	11	BE, LP	200–1050	Kessler 3918 (LPB)
<i>paraguayense</i> Engl.	67	BE, CH, CO, LP, SC	200–2100	Beck 502 (LPB)
<i>paraguayense</i> var. <i>coroi- canum</i> Croat	3	LP, SC	700–900	Croat 51657 (MO)
<i>parile</i> N.E. Br. ex Engl.	22	CO, LP	200–1500	Beck 1630 (LPB)
<i>pentaphyllum</i> (Aubl.) G. Don var. <i>pentaphyllum</i>	12	BE, CO, LP, PA, SC	200–1500	Moraes 4233 (LPB)
<i>plowmanii</i> Croat	28	CO, LP, PA, SC	110–1100	Haase 266 (LPB)
<i>polydactylum</i> Madison	2	LP	600–800	Krukoff 10477 (NY)
<i>scandens</i> (Aubl.) Engl. subsp. <i>pusillum</i> Sheffer	1	LP	1300	Kessler 11555 (MO)
<i>scandens</i> subsp. <i>scandens</i>	32	CO, LP, SC	700–2550	Nee 30334 (NY)
<i>scandens</i> subsp. 1	1	LP	1300	Kessler 9728 (MO)
<i>solomonii</i> Croat	5	LP, SC—Endemic	200–1400	Solomon 12494 (MO)
<i>soukupii</i> Croat	2	LP, CO	1700–2200	Beck 8756 (LPB)
<i>triphyllum</i> Brongn. ex Schott	13	CO, LP	1300–3000	Croat 51324 (MO)
<i>uleanum</i> Engl.	2	CO, LP	250–1300	Kessler 8723 (MO)
<i>versicolor</i> Sodiro	2	CO	450–1300	Kessler 7564 (MO)
<i>weberbaueri</i> Engl.	13	BE, LP	450–2850	Beck 4535 (LPB)
sp. 1	13	LP	1100–2500	Solomon 8103 (MO)
sp. 2	2	CO, LP	650–1400	Acebey 771 (LPB)
sp. 3	2	LP	700–1350	Beck 21333 (LPB)

APPENDIX. Continued.

Species	#	Distribution	Elevation	Voucher
sp. 4	2	LP	1150–1300	Beck 21925 (LPB)
sp. 5	2	LP	900–1300	Helme 556 (LPB)
sp. 6	2	CO, LP	1300–1500	Kessler 7636 (MO)
sp. 7	2	LP	1300	Kessler 9730 (LPB)
sp. 8	1	LP	1300	Kessler 9789 (MO)
sp. 9	1	LP	1500	Kessler 10204 (MO)
sp. 10	1	LP	1400	Kessler 10325 (MO)
sp. 11	1	LP	2400	Kessler 10459 (MO)
sp. 12	1	LP	2400	Kessler 10534 (MO)
sp. 13	1	LP	1100	Kessler 11012 (MO)
sp. 14	1	LP	1500	Kessler 11345 (MO)
sp. 15	1	LP	1150	Kessler 11664 (MO)
sp. 16	1	LP	1500	Solomon 9553 (MO)
sp. 17	1	LP	2100	Solomon 19062 (MO)
<i>Asterostigma pavonii</i> Schott	2	LP	1150–1200	Solomon 9400 (MO)
<i>Caladium bicolor</i> (Aiton) Vent.	17	BE, CO, LP, SC	200–1900	Beck 3297 (LPB)
<i>Colocasia esculenta</i> (L.) Schott	—	LP—Cultivated	1000	photo Kessler
<i>Dieffenbachia elegans</i> A.M.E. Jonker & Jonker	3	CO	450–900	Kessler 8180 (MO)
cf. <i>parvifolia</i> Engl.	5	CO	700–1300	Kessler 7567 (MO)
sp. 1	5	CO, LP	330–1100	Helme 423 (LPB)
sp. 2	4	CO, LP	180–1450	Beck 10216 (LPB)
sp. 3	1	CO	1000	Kessler 7995 (MO)
sp. 4	1	BE	400	Kessler 10795 (MO)
sp. 5	1	LP	400	Kessler 11144 (MO)
sp. 6	1	LP	1400	Kessler 11516 (MO)
sp. 7	1	SC	190	Nee 41364 (NY)
<i>Dracontium margaretae</i> Bogner	1	BE	200	Beck 15078 (MO)
<i>ulei</i> K. Krause	1	PA	125	Nee 31734 (NY)
<i>Gorgonidium mirabile</i> Schott	13	CH, CO, LP, SC	2100–3350	Lewis 35459 (MO)
<i>vermicidum</i> (Speg.) Bogner & Nicolson	10	CO, LP, SC, TA	1600–3100	Beck 16101 (LPB)
<i>Heteropsis flexuosa</i> (Kunth) G.S. Bunting	1	PA	190	Gentry 77987 (MO)
<i>oblongifolia</i> Kunth	4	PA	200–250	Beck 19048 (LPB)
sp. 1	1	PA	250	Sperling 6479 (MO)
<i>Homalomena crinipes</i> Engl.	7	BE, CO, LP	400–1050	Croat 51282 (MO)
<i>picturata</i> (Linden & André) Regel	2	CO	300–1000	Kessler 7996 (MO)
sp. 1	1	LP	400	Kessler 11165 (MO)
<i>Monstera adansonii</i> Schott	19	BE, CO, LP, PA, SC	200–1600	Beck 8167 (LPB)
<i>adansonii</i> var. <i>klotzschiana</i> (Schott) Madison	4	BE, LP	200–500	Helme 848 (LPB)
<i>adansonii</i> var. <i>laniata</i> (Schott) Madison	6	BE, LP, SC	200–1000	Solomon 6496 (MO)
<i>dubia</i> (Kunth) Engl. & K. Krause	30	BE, CO, LP, PA, SC	150–1300	Smith 14144 (MO)

APPENDIX. Continued.

Species	#	Distribution	Elevation	Voucher
<i>lechleriana</i> Schott	11	BE, CO, LP, PA, SC	200–1500	Krömer 33 (LPB)
<i>obliqua</i> Miq.	82	BE, CO, LP, PA, SC	100–1100	Seidel 2132 (LPB)
<i>pinnatiparitita</i> Schott	9	BE, CO, LP, PA	200–900	Acebey 697 (LPB)
<i>spruceana</i> (Schott) Engl.	8	BE, CO, LP, PA, SC	150–1000	Nee 35380 (NY)
<i>subpinnata</i> (Schott) Engl.	18	BE, CO, LP, PA	200–1450	Beck 8167 (LPB)
sp. 1	4	BE, LP	330–400	Helme 249 (LPB)
sp. 2	3	LP, SC	100–865	Gentry 73837 (MO)
sp. 3	3	LP	250–400	Kessler 11121 (MO)
sp. 4	3	LP, PA	200–1350	Moraes 286 (MO)
<i>Philodendron</i>				
<i>accreanum</i> K. Krause	5	CO, LP, PA	150–1300	Beck 18256 (LPB)
<i>acuminatissimum</i> Engl.	1	LP	1350	Acebey 198 (LPB)
<i>angustisectum</i> Engl.	1	SC	190	Nee 41193 (NY)
<i>bipinnatifidum</i> (Schott) Schott	3	SC	200–400	Nee 33398 (NY)
<i>brandtianum</i> K. Krause	1	PA—Endemic	150	Ule 9235 (B)
<i>brevispathum</i> Schott	5	LP, PA, SC	200–250	Beck 20160 (LPB)
<i>camposportoanum</i> G.M. Barroso	49	BE, CH, CO, LP, PA, SC	200–1500	Beck 432 (LPB)
<i>cataniapoense</i> G.M. Barroso	3	BE, LP, SC	400–1400	Kessler 10279 (MO)
<i>caudatum</i> K. Krause	5	CO, LP	400–1300	Krömer 72 (LPB)
<i>chinchamayense</i> Engl.	5	LP	200–400	Helme 741 (LPB)
cf. <i>divaricatum</i> K. Krause	1	LP	400	Kessler 11117 (MO)
<i>ernestii</i> Engl.	7	LP, PA	100–1300	Helme 920 (LPB)
cf. <i>guttiferum</i> Kunth	2	CO	400–600	Beck 1525 (LPB)
<i>hederaceum</i> (Jacq.) Schott	7	CO, LP, SC	300–900	Beck 1526 (LPB)
<i>heleniae</i> Croat ssp. <i>amazonense</i> Croat	1	CO	500	Acebey 531 (LPB)
<i>heterophyllum</i> Poepp.	11	BE, CO, LP, PA	200–1400	Kessler 4436 (MO)
<i>hylaeae</i> G.S. Bunting	3	LP, PA	125–400	Nee 31830 (NY)
<i>imbe</i> Schott	1	SC	150	Peña-Chocarro 186 (USZ)
<i>lechlerianum</i> Schott	18	CO, LP, PA, SC	200–1700	Solomon 8776 (MO)
<i>maximum</i> K. Krause	5	BE, CO, LP, PA, SC	125–1600	Beck 3408 (LPB)
<i>megalophyllum</i> Schott	36	BE, CO, LP, PA, SC	100–1400	Nee 31385 (NY)
<i>ornatum</i> Schott	30	BE, CO, LP, PA, SC	150–2000	Smith 12983 (MO)
<i>paxianum</i> K. Krause	3	LP	700–1450	Kessler 11455 (MO)
<i>pedatum</i> (Hook.) Kunth	2	PA, SC	700	Killeen 3905 (MO)
<i>pinnatilobum</i> Engl.	1	BE	230	Solomon 6180 (MO)
<i>pseudoundulatum</i> A. Grau	1	SC—Endemic	?	Grau 19 (LIL)
<i>quinquelobum</i> K. Krause	5	BE, LP, PA	200–400	Boom 4772 (NY)
<i>ruizii</i> Schott	11	CO, LP	700–1300	Kessler 7565 (MO)
<i>speciosum</i> Schott ex Endl.	—	LP	400	photo Kessler
cf. <i>sphalerum</i> Schott	1	CO	900–1100	Kessler 7916 (MO)
<i>uleanum</i> Engl.	1	SC	250	Billiet 5942 (USZ)
<i>undulatum</i> Engl.	8	CH, CO, LP, SC	200–700	Nee 37904 (NY)
sp. 1	11	CO, LP	250–2100	Beck 21440 (LPB)
sp. 2	2	LP	1100	Kessler 3917 (MO)
sp. 3	2	CO, LP	900–1300	Kessler 4453 (MO)
sp. 4	2	LP	1300–1400	Kessler 10280 (MO)
sp. 5	2	LP	700–1050	Krömer 78 (LPB)
sp. 6	1	BE	250	Acebey 28 (LPB)
sp. 7	1	LP	1500	Gentry 71004 (MO)
sp. 8	1	LP	330	Helme 189 (LPB)
sp. 9	1	LP	190	Helme 877 (LPB)
sp. 10	1	CO	1800	Kessler 7336 (MO)
sp. 11	1	CO	1300	Kessler 7527a (MO)
sp. 12	1	CO	1000	Kessler 7997 (MO)
sp. 13	1	SC	450	Kessler 8561 (MO)
sp. 14	1	CO	250	Kessler 8713 (MO)
sp. 15	1	CO	250	Kessler 8860 (MO)
sp. 16	1	LP	1300	Kessler 9715 (MO)

APPENDIX. Continued.

Species	#	Distribution	Elevation	Voucher
sp. 17	1	LP	1500	<i>Kessler 10217</i> (MO)
sp. 18	1	LP	1500	<i>Kessler 11426</i> (MO)
sp. 19	1	LP	1400	<i>Kessler 11522</i> (MO)
sp. 20	1	SC	490	<i>Nee 33368</i> (NY)
sp. 21	1	SC	190	<i>Nee 41139</i> (NY)
sp. 22	1	LP	600	<i>Seidel 2248</i> (LPB)
sp. 23	1	BE	230	<i>Solomon 7983</i> (MO)
<i>Pistia</i>				
<i>stratiotes</i> L.	19	BE, PA, SC	200–900	<i>Ritter 2381</i> (MO)
<i>Rhodospatha</i>				
<i>boliviensis</i> (Engl.) K. Krause	3	LP	330–1500	<i>Gentry 70941</i> (MO)
<i>brachypoda</i> G.S. Bunting	5	BE, CO, LP	400–1100	<i>Kessler 7891</i> (MO)
<i>latifolia</i> Poepp.	18	CO, LP, PA, SC	200–1500	<i>Solomon 14114</i> (MO)
<i>Schismatoglottis</i>				
<i>spruceanum</i> (Schott) G.S. Bunting var. <i>spruceanum</i>	1	SC	500	<i>Killeen 1433</i> (MO)
<i>Spathantheum</i>				
<i>orbignyanum</i> Schott	35	CH, CO, LP, SC, TA	2000–3200	<i>Beck 7412</i> (LPB)
<i>Spathicarpa</i>				
<i>hastifolia</i> Hook.	2	BE	200	<i>Boom 5111</i> (NY)
<i>Spathiphyllum</i>				
sp. 1	1	SC	?	<i>Foster 13686</i> (USZ)
<i>Stenospermatum</i>				
<i>ad simile</i> Sodiro	3	LP	1350–1500	<i>Kessler 10111</i> (MO)
cf. <i>andreaenum</i> Engl.	1	LP	1200	<i>Beck 24273</i> (LPB)
<i>mathewsii</i> Schott	5	CO, LP	1100–1900	<i>Kessler 8030</i> (MO)
<i>rusbyi</i> N.E. Br.	8	CO, LP—Endemic	700–3000	<i>Beck 7241</i> (LPB)
sp. 1	2	LP	1300–1500	<i>Solomon 7510</i> (MO)
sp. 2	1	LP	1050	<i>Kessler 9987</i> (MO)
sp. 3	1	LP	1500	<i>Kessler 11398</i> (MO)
<i>Synandropadix</i>				
<i>vermitoxicus</i> (Griseb.) Engl.	5	CH, PA, SC, TA	150–2000	<i>Beck 9855</i> (LPB)
<i>Syngonium</i>				
<i>atrovirens</i> G.S. Bunting	5	BE, CO, LP	250–700	<i>Helme 922</i> (LPB)
<i>podophyllum</i> Schott	40	BE, CO, LP, PA, SC	200–2600	<i>Acebey 548</i> (LPB)
<i>yurimaguense</i> Engl.	13	BE, CO, LP, PA	200–1050	<i>Solomon 6290</i> (MO)
sp. 1	3	LP	700–1200	<i>Croat 51647</i> (MO)
sp. 2	1	LP	370	<i>Gentry 70654</i> (MO)
<i>Taccarum</i>				
<i>cardenasianum</i> Bogner	2	CO	2500	<i>Liberman 1857</i> (LPB)
<i>caudatum</i> Rusby	1	TA—Endemic	2350	<i>Steinbach 7272</i> (NY)
<i>warmingii</i> Engl.	1	SC—Endemic	450	<i>Bang s.n.</i> (C)
<i>weddellianum</i> Brongn. ex Schott	25	BE, LP, PA, SC	200–1500	<i>Nee 33354</i> (NY)
<i>Urospatha</i>				
<i>sagittifolia</i> (Rodsch.) Schott	9	LP, PA, SC	200–750	<i>Haase 88</i> (LPB)
<i>Xanthosoma</i>				
<i>poepigii</i> Schott	3	LP	600–1250	<i>Seidel 8106</i> (LPB)
<i>pubescens</i> Poepp.	9	CO, LP, SC	400–2000	<i>Helme 583</i> (LPB)
<i>purpuratum</i> K. Krause	6	CO, LP, PA, SC	200–1600	<i>Beck 20282</i> (LPB)
<i>striatipes</i> (Kunth & C.D. Bouché) Madison	5	BE, SC	250–500	<i>Killeen 1433</i> (MO)

APPENDIX. Continued.

Species	#	Distribution	Elevation	Voucher
cf. <i>sygonitifolium</i> Rusby	1	SC	270	<i>Fuentes 1403</i> (USZ)
cf. <i>trichophyllum</i> K. Krause	1	SC	550	<i>Billiet 6191</i> (USZ)
<i>undipes</i> (K. Koch & C.D. Bouché) K. Koch	4	LP, SC	1000–2000	<i>Beck 22477</i> (LPB)
sp. 1	1	LP	700	<i>Acebey 144</i> (LPB)
sp. 2	1	LP	2000	<i>Beck 13550</i> (LPB)
<i>Zantedeschia</i> <i>aethiopica</i> (L.) Spreng.	3	LP—Cultivated		<i>Solomon 8190</i> (MO)