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THE SYSTEMATIC DISTRIBUTION OF VASCULAR EPIPHYTES: AN UPDATE

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ABSTRACT. The list of vascular plant families and genera containing epiphytic species published by Madison (1977) is updated here. Ten percent (23,456 species) of all vascular plant species are epiphytes. Seven percent (876) of the genera, 19 percent (84) of the families, 45 percent (44) of the orders and 75 percent (6) of the classes contain epiphytes. Twenty-three families contain over 50 epiphytic species each. The Orchidaceae is the largest family of epiphytes, containing 440 epiphytic genera and 13,951 epiphytic species. Forty-three genera of vascular plants each contain over 100 epiphytic species.

In 1977 Madison published a list of the vascular plant families and genera that contain epiphytic species. Madison compiled this list from literature reports, consultation with taxonomic specialists, and a survey of herbarium material. He reported that 65 families contain 850 genera and 28,200 species of epiphytes. His total accounted for about ten percent of all species of vascular plants.

Madison's list was the most comprehensive compilation of vascular epiphytes since the works of Schimper (1888) and Richards (1952) upon which it was partly based. Since the publication of Madison's list many additional records of epiphytic species have been compiled. These additions are partly due to literature citations unavailable to Madison as well as more recently acquired knowledge of many tropical plant families. Two recent symposia on the biology of tropical epiphytes, one at the Marie Selby Botanical Gardens (see papers in this volume) and the other at the Missouri Botanical Garden (Ann. Missouri Bot. Gard., in press), underscored the need to update Madison's list by the addition of these new reports and the correction of omissions (e.g., *Lycopodium*) and erroneous inclusions (e.g., *Ananas, Carludovica*).

Madison listed the epiphytic genera in all families of vascular plants except for the Orchidaceae, which is the largest family of plants and has the most epiphytic members. Instead he provided an estimate that the orchids accounted for approximately 500 genera and 20,000 species of epiphytes. For the sake of completeness a compilation is included here of epiphytic orchid genera that is based on an exhaustive survey of the family by Atwood (1986).

The definition of an epiphyte used here follows those of Schimper (1888), Richards (1952) and Wallace (1987). The term epiphytes includes "true epiphytes," "hemi-epiphytes," "casual epiphytes," and in some cases "semi-epiphytic climbers." True epiphytes, or holo-epiphytes, are those plants that normally spend their entire life cycle perched on another plant and receive all mineral nutrients from non-terrestrial sources. Hemi-epiphytes normally spend only part of their life cycle perched on another plant and thus some mineral nutrients are received from terrestrial sources. Hemi-epiphytes either begin their life cycle as epiphytes and eventually send roots and shoots to the ground (primary hemi-epiphytes), or begin as terrestrially established seedlings that secondarily become epiphytic by severing all connections with the ground (secondary hemi-epiphytes). Species in which some individuals of a population function as true epiphytes while others are terrestrial are called casual epiphytes. Semi-epiphytic climbers are vines that climb by adventitious roots which partly function in water and mineral uptake (Wallace, 1987). Accidental epiphytes and parasites are excluded from this survey. The above categories, with the exclusion of semi-epiphytic climbers, correspond to the definition of epiphytes recognized by Madison.

MATERIALS AND METHODS

Madison's list of epiphytic genera (1977: Table 1) served as the starting point for this survey. His list was compiled from literature reports, his own collections, the advice of taxonomic specialists and a survey of specimens at the Harvard University Herbaria (A and GH). The list has been updated from several sources. First, additional literature citations of epiphytes appearing since the publication by Madison were reviewed. However, not all literature reports of epiphytes included here have been verified by specialists. Casual anecdotal accounts generally were omitted. Second, the large collection of epiphytic plants in the research collection at the Marie Selby Botanical Gardens was a source of information. Third, new estimates for plant families containing epiphytes were provided by taxonomic specialists studying those families (i.e., Araceae,

Asteraceae, Bromeliaceae, Cactaceae, Clusiaceae, Cyclanthaceae, Ericaceae, Marcgraviaceae, Melastomataceae, Onagraceae, Orchidaceae, Rubiaceae, Scrophulariaceae, and Solanaceae).

In order to obtain an estimate of the distribution of the epiphytic habit in vascular plants, the list of genera is presented in an hierarchical classification that reflects possible phylogenetic relationships. It is recognized that no unequivocal hypothesized phylogenetic scheme of vascular plants exists. However, for expediency the classification of Tryon and Tryon (1982) was chosen for the ferns and allies, that of Foster and Gifford (1974) and Scagel et al. (1965) for the gymnosperms, and the system of Cronquist (1981) for the angiosperms. The overall totals for families, genera and species required to calculate the percentage of vascular epiphytes per taxon were taken from the same sources. In the case of the ferns, estimates for New World taxa were taken from Tryon and Tryon (1982), and for Old World taxa from Willis (1966) and Copeland (1947). Although these treatments of the ferns are quite different in their concepts of families, genera and species, they provide reliable, if not readily comparable, figures for numbers of taxa. For the angiosperms the number of genera and species for each family was compiled from Cronquist (1981), Willis (1966) or preferentially a family specialist when available (see Acknowledgments). In the cases where a range of numbers for total genera or species was given, the median of that range was used. The estimates for the Orchidaceae were taken from Atwood (1986) and readers are referred to that publication for his methods.

Results

Epiphytic taxa are reported for all but two major divisions of extant vascular plants (Table 1). No epiphytes have been reported in the Ginkgophyta or the Coniferophyta. Ten percent of all vascular plant species (23,456 species) are epiphytic. Seven percent of the genera (876 genera), 19 percent of the families (84 families), 45 percent of the orders (44 orders), and 75 percent of the classes (6 classes) contain epiphytes (Table 2). The angiosperms account for the great majority of epiphytic taxa at all hierarchical levels. Eighty-nine percent of all epiphytic genera (782 genera) and species (20,859 species) of vascular plants are angiosperms. However, within the ferns and allies a higher percentage of the total (34 percent of families, 39 percent of genera, 29 percent of species) are epiphytes than in the gymnosperms or angiosperms. The gymnosperms are depauperate in epiphytes: only one-half percent of the species are epiphytes. Within the angiosperms only nine percent of the species are epiphytes, but 45 percent of the orders and 18 percent of the families contain epiphytes. The monocotyledons account for the majority of epiphytic genera (67 percent; 520 genera) and species (80 percent; 16,608 species) in the angiosperms. Within that class 31 percent of the species and 21 percent of the genera are epiphytic.

Twenty-three families of vascular plants contain over 50 epiphytic species each (Table 3). Sixteen of these families are angiosperms; the remaining seven are ferns and allies. These 23 families account for 98 percent of the epiphytic species and 87 percent of the epiphytic genera found in the vascular plants. The Orchidaceae is by far the largest family of epiphytes, containing 50 percent (440 genera) of all epiphytic genera and 60 percent (13,951 species) of all epiphytic species.

Forty-three genera of vascular plants have over 100 epiphytic species each (Table 4). Eight of these genera are ferns and 23 are orchids. These 43 genera comprise only five percent of all epiphytic genera, but contain 58 percent (13,544 species) of all epiphytic species.

Of the vascular plant families that include epiphytes, 45 percent (38 families) contain fewer than five epiphytic species, and 18 percent (15 families) contain only one epiphyte. Of the total number of epiphytic genera, 452 (52 percent) contain less than five epiphytic species, and 217 (25 percent) contain only a single epiphyte.

Discussion

Madison (1977) reported 65 families, 850 genera and 28,200 species of vascular epiphytes. In the present compilation the number of families has increased by 19 and the number of genera by 26. The total number of species has decreased by 4,744. The decrease in the number of species is primarily due to the discrepancy in the number of epiphytic species reported in the Orchidaceae. Madison's figure of approximately 20,000 epiphytic orchid species is more than 6,000 species greater than the number reported here. If this difference is subtracted from Madison's 28,200 total epiphytic species, the remaining number is 1,300 less than the total number of epiphytic species reported here. Hence by correcting just for his estimate of epiphytic orchid species, the actual total number of epiphytic species known today is significantly greater than previously recorded. This reasoning also applies to Madison's overestimate of the number of epiphytic orchid genera. Estimates of the number of epiphytic taxa of ferns and gymnosperms has not significantly changed. Non-orchid genera and species of monocotyledons has increased over Madison's

TABLE 1. The systematic distribution of vascular epiphytes. For genera and species the number of epiphytic taxa is followed by the total number of taxa.

Taxa	Genera	Species
Division Pteridophyta	92/239	2,593/9,000
Class Filicopsida	90/235	2,388/7,749
Subclass Polypodiidae	88/233	2,380/7,740
Order Ophioglossales	1/3	8/56
Family Ophioglossaceae	1/3	8/56
Genus *Ophioglossum* L.		8/30
Order Polypodiales	87/224	2,372/7,565
Family Schizaeaceae	1/4	2/170
Genus *Schizaea* J. Sm.		2/30
Family Hymenophyllaceae	2/2	400/600
Genus *Hymenophyllum* J. Sm.		250/300
Trichomanes L.		150/300
Family Vittariaceae	9/9	112/112
Genus *Ananthacorus* Underw. & Maxon		1/1
Anetium (Kunze) Splitg.		1/1
Antrophyum Kaulf.		40/40
Hecistopteris J. Sm.		1/1
Monogramma Schkurh.		2/2
Polytaenium Desv.		10/10
Scoliosorus Moore		1/1
Vaginularia Fee		6/6
Vittaria J. Sm.		50/50
Family Dennstaedtiaceae	2/18	3/370
Genus *Lindsaea* Dryander ex J. Sm.		2/150
Oenotrichia Copel.		1/4
Family Dryopteridaceae	10/55	292/1,920
Genus *Arthropteris* J. Sm.		15/15
Dryopteris Adans.		1/150
Elaphoglossum Schott		250/500
Lastreopsis Ching		1/35
Lomariopsis Fee		1/45
Oleandra Cav.		20/40
Polystichum Roth		1/160
Psammiosorus C. Christ.		1/1
Rumohra Raddi		1/2
Teratophyllum Holtt.		1/9
Family Aspleniaceae	1/7	400/675
Genus *Asplenium* L.		400/650
Family Davalliaceae	8/9	139/150
Genus *Araiostegia* Copel.		12/12
Davallia J. Sm.		40/40
Davallodes (Copel.) Copel.		11/11
Humata Cav.		50/50
Nephrolepis Schott		15/20
Parasorus Alderwerelt		1/1
Scyphularia Fee		8/8
Trogostolon Copel.		2/2
Family Blechnaceae	1/9	1/175
Genus *Stenochlaena* J. Sm.		1/5
Family Polypodiaceae	53/65	1,023/1,100
Genus *Acrosorus* Copel.		5/5
Aglaomorpha Schott		4/4
Amphoradenium Desv.		6/6
Anarthropteris Copel.		1/1
Arthromeris (Moore) J. Sm.		6/9
Belvisia Mirbel		15/15
Calymmodon Presl		25/25
Campyloneurum Presl		25/25
Christiopteris Copel.		4/4
Colysis Presl		2/30
Crypsinus Presl		40/40
Dendroconche Copel.		2/2
Diblemma J. Sm.		1/1
Dictymia J. Sm.		3/3
Drymotaenium Makino		2/2
Drynaria (Bory) J. Sm.		20/20
Drynariopsis (Copel.) Ching		1/1

TABLE 1. Continued.

Taxa	Genera	Species
Eschatogramme Trev.		4/4
Goniophlebium (Bl.) Presl		20/20
Grammatopteridium Alderwerelt		2/2
Grammitis Sw.		400/400
Holcosorus Moore		3/3
Holostachyum (Copel.) Ching		1/1
Lecanopteris Reinw.		15/15
Lemmaphyllum Presl		4/4
Leptochilus Kaulf.		1/1
Loxogramme (Bl.) Presl		25/25
Marginariopsis C. Christ.		1/1
Merinthosorus Copel.		2/2
Microgramma Presl		13/13
Microsorium Link		40/40
Nematopteris Alderwerelt		1/1
Neocheiropteris C. Christ.		3/3
Neurodium Fee		1/1
Niphidium J. Sm.		4/4
Oleandropsis Copel.		1/1
Oreogrammatis Copel.		1/1
Paragramma (Bl.) Moore		2/2
Paraleptochilus Copel.		2/2
Photinopteris J. Sm.		1/1
Platycerium Desv.		15/15
Pleopeltis /Kunth in HBK		10/10
Polypodiopteris Reed		3/3
Polypodium L.		140/150
Prosaptia Presl		20/20
Pteropsis Desv.		6/6
Pycnoloma C. Christ.		3/3
Pyrrosia Mirbel		100/100
Scleroglossum Alderwerelt		6/6
Selliguea Bory		4/5
Solanopteris Copel.		4/4
Thayeria Copel.		1/1
Thylacopteris Kunze ex Mett.		2/2
Subclass Psilotidae	2/2	8/9
Order Psilotales	2/2	8/9
Family Psilotaceae	2/2	8/9
Genus *Psilotum* Sw.		2/2
Tmesipteris Bernh.		6/7
Class Lycopodiopsida	2/4	205/1,251
Order Lycopodiales	1/2	200/401
Family Lycopodiaceae	1/2	200/401
Genus *Lycopodium* L.		200/400
Order Selaginellales	1/1	5/700
Family Selaginellaceae	1/1	5/700
Genus *Selaginella* Beauv.		5/700
Division Cycadophyta	1/10	1/155
Class Cycadopsida	1/10	1/155
Order Cycadales	1/10	1/155
Family Zamiaceae	1/7	1/125
Genus *Zamia* L.		1/35
Division Gnetophyta	1/3	3/66
Class Gnetopsida	1/3	3/66
Order Gnetales	1/1	3/30
Family Gnetaceae	1/1	3/30
Genus *Gnetum* L.		3/30
Division Magnoliophyta	782/11,836	20,859/221,868
Class Magnoliopsida	262/9,409	4,251/167,893
Subclass Magnoliidae	4/496	717/11,761
Order Magnoliales	1/177	6/2,948
Family Winteraceae	1/7	6/100
Genus *Drimys* J. R. & G. Forst. s.l.		6/70
Order Piperales	2/20	710/1,782
Family Piperaceae	2/10	710/3,100
Genus *Peperomia* Ruiz & Pav.		700/1,000
Piper L.		10/2,000

TABLE 1. Continued.

Taxa	Genera	Species
Order Ranunculales	1/148	1/3,148
Family Ranunculaceae	1/50	1/2,000
Genus *Thalictrum* L.		1/150
Subclass Hamamelidae	8/174	563/3,373
Order Urticales	7/112	562/2,130
Family Moraceae	4/40	522/1,000
Genus *Antiaropsis* K. Schum.		1/1
Coussapoa Aubl.		20/45
Ficus L.		500/800
Pourouma Aubl.		1/50
Family Urticaceae	3/45	40/700
Genus *Elatostema* Gaudich.		10/200
Pilea Lindl.		20/400
Procris Comm. ex Juss.		10/20
Order Myricales	1/3	1/50
Family Myricaceae	1/3	1/50
Genus *Myrica* L.		1/35
Subclass Caryophyllidae	20/500	152/10,864
Order Caryophyllales	20/458	152/9,464
Family Cactaceae	18/115	150/1,500
Genus *Aporocactus* Lem.		6/6
Cryptocereus Alex.		1/2
Disocactus Lindl.		7/7
Eccremocactus Britton & Rose		3/3
Epiphyllum Haworth		21/21
Heliocereus (Berg.) Britton & Rose		5/5
Hylocereus (Berg.) Britton & Rose		18/20
Lymanbensonia Kimm.		1/1
Mediocactus Britton & Rose		2/2
Nopalxochia Britton & Rose		1/1
Pfeiffera Salm-Dyck		1/1
Rhipsalis Gaertn.		58/65
Schlumbergera Lem.		6/6
Selenicereus (Berg.) Britton & Rose		13/17
Strophocactus Britton & Rose		1/1
Weberocereus Britton & Rose		3/3
Werckleocereus Britton & Rose		2/2
Wilmattea Britton & Rose		1/1
Family Caryophyllaceae	2/75	2/2,000
Genus *Arenaria* L.		1/250
Stellaria L.		1/150
Subclass Dilleniidae	60/1,460	925/24,643
Order Theales	13/176	181/3,385
Family Marcgraviaceae	7/7	89/122
Genus *Marcgravia* L.		50/55
Marcgraviastrum Bedell, ined.		10/15
Norantea Aubl.		1/2
Ruyschia Jacq.		7/7
Sarcopera Bedell, ined.		4/10
Schwartzia Vell.		8/14
Souroubea Aubl.		9/19
Family Clusiaceae	6/50	92/1,200
Genus *Clusia* L.		85/145
Clusiella Planch. & Triana		3/7
Havetiopsis Planch. & Triana		1/5
Odematopus Planch. & Triana		1/10
Quapoya Aubl.		1/3
Renggeria Meisn.		1/3
Order Malvales	3/225	6/3,300
Family Elaeocarpaceae	1/10	1/400
Genus *Sericolea* Schlecht.		1/20
Family Bombacaceae	2/25	5/200
Genus *Ceiba* Mill.		1/10
Spirotheca Ulbrich		4/4
Order Nepenthales	1/8	6/193
Family Nepenthaceae	1/1	6/75
Genus *Nepenthes* L.		6/75

TABLE 1. Continued.

Taxa	Genera	Species
Order Violales	1/276	30/4,818
Family Begoniaceae	1/4	30/1,000
Genus *Begonia* L.		30/900
Order Ericales	37/174	673/4,044
Family Epacridaceae	1/30	1/400
Genus *Prionotes* R. Br.		1/1
Family Ericaceae	36/122	672/3,500
Genus *Agapetes* D. Don ex G. Don		60/80
Anthopterus W. J. Hook.		3/6
Anthopteropsis A. C. Sm.		1/1
Calopteryx A. C. Sm.		1/2
Cavendishia Lindl.		75/100
Ceratostema Juss.		16/23
Costera J. J. Sm.		8/8
Demosthenesia A. C. Sm.		6/11
Didonica Luteyn & Wilbur		2/2
Dimorphanthera F. Muell.		25/71
Diogenesia Sleum.		5/13
Diplycosia Bl.		61/98
Disterigma Niedenzu ex Drude		15/30
Gaultheria Kalm ex L.		8/200
Gonocalyx Planch. & Lind. ex A. C. Sm.		6/8
Killipiella A. C. Sm.		2/2
Lateropora A. C. Sm.		2/3
Lyonia Nutt.		1/35
Macleania W. J. Hook.		25/45
Mycerinus A. C. Sm.		1/3
Oreanthes Benth.		4/4
Orthaea Kl.		20/31
Pellegrinnia Sleum.		1/4
Pernettyopsis King & Gamble		1/1
Plutarchia A. C. Sm.		6/12
Psammisia Kl.		25/55
Rhododendron L.		112/850
Rusbya Britton		1/1
Satyria Kl.		20/23
Semiramisa Kl.		2/4
Siphonandra Kl.		1/1
Sphyrospermum Poepp. & Endl.		18/22
Themistoclesia Kl.		22/31
Thibaudia Ruiz & Pav.		20/60
Utleya Wilbur & Luteyn		1/1
Vaccinium L.		95/450
Order Ebenales	1/87	1/1,752
Family Sapotaceae	1/70	1/800
Genus *Bumelia* Sw.		1/60
Order Primulales	4/64	28/2,100
Family Myrsinaceae	4/30	28/1,000
Genus *Cybianthus* Mart.		5/40
Embelia Burm.		5/130
Grammadenia Benth.		6/15
Myrsine L.		12/200
Subclass Rosidae	68/3,194	791/57,047
Order Rosales	10/317	21/6,696
Family Cunoniaceae	2/25	3/350
Genus *Ackama* A. Cunn.		1/3
Weinmannia L.		2/170
Family Pittosporaceae	1/9	5/200
Genus *Pittosporum* Banks ex Soland.		5/150
Family Grossulariaceae	1/25	1/350
Genus *Phyllonoma* Willd. ex Schult.		1/8
Family Crassulaceae	3/25	5/900
Genus *Echeveria* DC.		2/150
Kalanchoe Adans.		1/200
Sedum L.		2/600
Family Saxifragaceae	2/40	4/700
Genus *Hydrangea* L.		2/80
Quintinia A. DC.		2/20

TABLE 1. Continued.

Taxa	Genera	Species
Family Rosaceae	1/100	3/3,000
Genus *Pyrus* L.		3/30
Order Myrtales	37/445	671/7,205
Family Alzateaceae	1/1	1/1
Genus *Alzatea*		1/1
Family Myrtaceae	2/140	7/3,000
Genus *Mearnsia* Merr.		4/7
Metrosideros Banks ex Gaertn.		3/60
Family Onagraceae	1/17	15/675
Genus *Fuchsia*		15/100
Family Melastomataceae	33/180	648/4,770
Genus *Adelobotrys* DC.		21/25
Anerincleistus Korth.		1/1
Backeria Bakh. f.		2/2
Blakea P. Br.		98/100
Calvoa J. D. Hook.		4/18
Catanthera F. Muell.		16/16
Clidemia D. Don		11/145
Creochiton Bl.		4/6
Dalenia Korth.		2/2
Dicellandra J. D. Hook.		1/3
Diplectria Reichb.		4/4
Dissochaeta Bl.		20/20
Graffenrieda DC.		2/40
Gravesia Naud.		13/110
Hypenanthe Bl.		4/4
Kendrickia J. D. Hook.		1/1
Leandra Raddi		4/200
Macrolenes Naud. ex Miq.		20/20
Medinilla Gaudich.		300/400
Miconia Ruiz & Pav.		11/1,000
Monolena Triana		6/15
Myrianthemum Gilg		1/1
Neodissochaeta Bakh. f.		10/10
Omphalopus Naud.		1/1
Ossaea DC.		2/100
Pachycentria Bl.		8/8
Phainantha Gleason		4/4
Plethiandra J. D. Hook.		6/6
Pleiochiton Naud.		7/7
Pogonanthera Bl.		1/1
Preussiella Gilg		2/2
Topobea Aubl.		59/60
Triolena Naud.		2/18
Order Cornales	1/16	3/140
Family Cornaceae	1/11	3/100
Genus *Griselinia* G. Forst.		3/6
Order Celastrales	3/119	4/2,149
Family Celastraceae	2/50	3/800
Genus *Euonymus* L.		2/175
Microtropis Wall.		1/70
Family Aquifoliaceae	1/4	1/400
Genus *Ilex* L.		1/400
Order Rhamnales	2/67	4/1,670
Family Vitaceae	2/11	4/700
Genus *Pterisanthes* Bl.		2/20
Tetrastigma Planch.		2/90
Order Sapindales	3/500	3/5,346
Family Aceraceae	1/2	1/112
Genus *Acer* L.		1/110
Family Burseraceae	1/18	1/600
Genus *Dacryodes* Vahl		1/50
Family Anacardiaceae	1/70	1/600
Genus *Spondias* L.		1/12
Order Geraniales	1/25	5/2,154
Family Balsaminaceae	1/2	5/451
Genus *Impatiens* L.		5/450

TABLE 1. Continued.

Taxa	Genera	Species
Order Apiales	11/370	80/3,700
Family Araliaceae	9/70	78/700
Genus *Didymopanax* Decne. & Planch.		1/40
Motherwellia F. Muell.		1/1
Oreopanax Decne. & Planch.		1/120
Pentapanax Seem.		2/15
Polyscias J. R. & G. Forst.		5/80
Pseudopanax C. Koch		2/6
Schefflera J. R. & G. Forst.		60/200
Sciadophyllum P. Br.		5/30
Tupidanthus J. D. Hook. & Thoms.		1/1
Family Apiaceae	2/300	2/3,000
Genus *Hydrocotyle* L.		1/100
Myrrhidendron Coulter & Rose		1/5
Subclass Asteridae	102/3,585	1,103/60,205
Order Gentianales	14/547	163/5,502
Family Loganiaceae	2/20	21/500
Genus *Desfontainia* Ruiz & Pav.		1/5
Fagraea Thunb.		20/35
Family Gentianaceae	3/75	4/1,000
Genus *Leiphaimos* Cham. & Schlecht.		1/40
Macrocarpaea Gilg		2/35
Voyria Aubl.		1/8
Family Apocynaceae	1/200	1/2,000
Genus *Mandevilla* Lindl.		1/114
Family Asclepiadaceae	8/250	137/2,000
Genus *Ceropegia* L.		3/160
Conchophyllum Bl.		1/10
Cynanchum L.		2/150
Dischidia R. Br.		60/90
Dischidiopsis Schlecht.		9/9
Heynella Backer		1/1
Hoya R. Br.		60/200
Marsdenia R. Br.		1/10
Order Solanales	12/182	56/5,099
Family Solanaceae	12/85	56/2,800
Genus *Dyssochroma* Miers		2/2
Ectozoma Miers		1/1
Hawkesiophyton A. T. Hunz.		3/3
Juanulloa Ruiz & Pav.		10/10
Lycianthes Hassl.		2/200
Markea L. C. Rich.		8/8
Merinthopodium Donn. Sm.		5/5
Rahowardiana D'Arcy		1/1
Schultesianthus A. T. Hunz.		5/5
Solandra Sw.		1/10
Solanum L.		15/1,700
Trianaea Planch. & Linden		3/3
Order Lamiales	1/403	2/7,805
Family Verbenaceae	1/100	2/2,600
Genus *Clerodendrum* L.		2/400
Order Scrophulariales	37/758	615/11,465
Family Scrophulariaceae	1/190	3/4,000
Genus *Wightea* Wall.		3/3
Family Gesneriaceae	30/120	560/2,500
Genus *Aeschynanthus* Jack		80/80
Agalmyla Bl.		15/15
Alloplectus Mart.		25/65
Alsobia Hanst.		2/2
Asteranthera Hanst.		1/1
Boea Comm. ex Lam.		2/25
Capanea Planch.		8/11
Codonanthe (Mart.) Hanst.		17/17
Codonanthopsis Mansf.		3/3
Columnea L.		70/70
Cyrtandra J. R. & G. Forst		10/600
Dalbergaria Tussac		65/65

TABLE 1. Continued.

Taxa	Genera	Species
Dichrotrichum Reinw.		4/4
Didymocarpus Wall.		1/120
Drymonia Mart.		100/110
Fieldia A. Cunn.		1/1
Heppiella Regel		1/23
Loxostigma C. B. Cl.		3/4
Lysionotus G. Don		2/2
Mitraria Cav.		1/1
Monopyle Benth.		1/23
Nematanthus Schrader		26/26
Neomortonia Wiehler		3/3
Paradrymonia Hanst.		8/28
Pentadenia (Planch.) Hanst.		23/24
Rufodorsia Wiehler		4/4
Sarmienta Ruiz & Pav.		1/1
Sinningia Nees		3/60
Streptocarpus Lindl.		10/132
Trichantha W. J. Hook.		70/70
Family Acanthaceae	2/250	8/2,500
Genus *Glockeria* Nees		1/10
Louteridium S. Watson		7/7
Family Bignoniacea	2/100	29/800
Genus *Gibsoniothamnus* L. O. Wms.		11/11
Schlegelia Miq.		18/18
Family Lentibulariaceae	2/5	15/200
Genus *Pinguicula* L.		3/35
Utricularia L.		12/150
Order Campanulales	5/93	24/2,490
Family Campanulaceae	5/70	24/2,000
Genus *Burmeistera* Karst. & Triana		5/82
Canarina L.		1/3
Centropogon Presl		7/300
Clermontia Gaudich.		10/27
Cyanea Gaudich.		1/60
Order Rubiales	25/451	223/6,503
Family Rubiaceae	25/450	223/6,500
Genus *Amaracarpus* Bl.		3/60
Balmea Martinez		1/1
Coprosma J. R. & G. Forst.		6/90
Cosmibuena Ruiz & Pav.		6/15
Didymochlamys J. D. Hook.		2/2
Hillia Jacq.		20/20
Hydnophytum Jack		75/80
Lecananthus Jack		1/2
Lucinaea DC.		15/25
Malanea Aubl.		2/27
Manettia Mutis ex L.		5/130
Myrmecodia Jack		40/45
Myrmedoma Becc.		2/2
Myrmephytum Becc.		2/2
Nertera Banks & Soland.		6/12
Ophiorrhiza L.		5/150
Posoqueria Aubl.		1/15
Proscephaleium Korth.		1/1
Psychotria L.		7/700
Randia L.		2/250
Ravnia Oerst.		4/4
Relbunium Benth. & J. D. Hook.		2/30
Schradera Vahl		12/15
Squamellaria Becc.		2/2
Timonius DC.		1/150
Order Asterales	8/1,100	20/20,000
Family Asteraceae	8/1,100	20/20,000
Genus *Anaphylis* DC.		1/35
Dahlia Cav.		1/20
Eupatorium L. (s.l.)		7/1,200
Liabum Adans.		2/90
Pseudogynoxys (Greenm.) Cabrera		1/21

TABLE 1. Continued.

Taxa	Genera	Species
Rensonia S. F. Blake		1/1
Senecio L.		5/2,000
Tuberostylis Steetz		2/2
Class Liliopsida	520/2,427	16,608/53,975
Subclass Arecidae	21/329	1,439/6,461
Order Cyclanthales	7/10	86/200
Family Cyclanthaceae	7/10	86/200
Genus *Asplundia* Harling		60/90
Dicranopygium Harling		5/50
Evodianthus Oerst.		1/1
Ludovia Brongn.		3/3
Sphaeradenia Harling		15/40
Stelestylis Drude		1/3
Thoracocarpus Harling		1/1
Order Pandanales	1/3	4/732
Family Pandanaceae	1/3	4/732
Genus *Pandanus* L.		4/550
Order Arales	13/116	1,349/2,529
Family Araceae	13/110	1,349/2,500
Genus *Amydrium* Schott		4/4
Anthurium Schott		750/1,000
Epipremnum Schott		15/15
Monstera Adans.		29/30
Pedicellarum Hotta		1/1
Philodendron Schott		300/350
Pothos L.		50/75
Remusatia Schott		1/4
Rhaphidophora Hassk.		100/100
Rhodospatha Poepp.		14/20
Scindapsus Schott		20/30
Stenospermation Schott		30/30
Syngonium Schott		35/35
Subclass Commelinidae	10/703	15/14,977
Order Commelinales	5/71	10/1,004
Family Rapateaceae	2/16	6/100
Genus *Epidryos* Maguire		3/3
Stegolepis Kl. ex Koern.		3/23
Family Commelinaceae	3/50	4/700
Genus *Campelia* L. C. Rich.		1/3
Cochliostema Lem.		2/2
Cyanotis D. Don.		1/50
Order Cyperales	5/570	5/12,000
Family Cyperaceae	3/70	3/4,000
Genus *Cephalocarpus* Nees		1/7
Cyperus L.		1/550
Pseudoeverardia Gilly		1/1
Family Poaceae	2/500	2/8,000
Genus *Microlaena* R. Br.		1/10
Tripogon Roem. & Schult.		1/20
Subclass Zingiberidae	33/134	1,170/4,520
Order Bromeliales	26/45	1,144/2,500
Family Bromeliaceae	26/45	1,144/2,500
Genus *Acanthostachys* Link, Kl. & Otto		2/2
Aechmea Ruiz & Pav.		120/150
Araeococcus Brongn.		4/4
Billbergia Thunb.		45/50
Brocchinia Schult. f.		3/18
Bromelia L.		3/40
Canistrum E. Morr.		3/7
Catopsis Griseb.		20/20
Glomeropitcairnia Mez		2/2
Guzmania Ruiz & Pav.		120/140
Hohenbergia Bak.		20/40
Hohenbergiopsis L. B. Sm. & R. Read		1/1
Lymania R. Read		4/4
Mezobromelia L. B. Sm. & R. Read		4/4
Navia J. H. Schult.		2/60
Neoregelia L. B. Sm.		65/75

TABLE 1. Continued.

Taxa	Genera	Species
Nidularium Lem.		15/22
Pitcairnia L'Herit.		75/280
Protea Brongn. & C. Koch		5/7
Pseudaechmea L. B. Sm. & R. Read		1/1
Quesnelia Gaudich.		6/12
Ronnbergia E. Morr. & Andre		6/7
Streptocalyx Beer		14/15
Tillandsia L.		400/450
Vriesea Lindl.		200/260
Wittrockia Lindm.		4/6
Order Zingiberales	7/89	26/2,020
Family Zingiberaceae	5/47	20/1,000
Genus *Alpinia* Roxb.		1/100
Brachychilum (R. Br. ex Wall.) Petersen		1/1
Burbidgea J. D. Hook.		5/5
Hedychium Koen.		12/50
Riedelia Oliv.		1/50
Family Costaceae	1/4	4/175
Genus *Costus* L.		4/150
Family Marantaceae	1/30	2/400
Genus *Maranta* L.		2/23
Subclass Liliadae	456/1,199	13,984/27,516
Order Liliales	15/451	31/8,248
Family Liliaceae	10/280	24/4,000
Genus *Astelia* Banks & Soland.		6/25
Clivia Lindl.		1/3
Collospermum Skotts.		5/5
Curculigo Gaertn.		1/10
Cyrtanthus Ait.		1/47
Dianella Lam.		2/30
Hippeastrum Herb.		2/75
Pamianthe Stapf		1/3
Rhodocodon Baker		1/8
Smilacina Desf.		4/25
Family Agavaceae	2/18	3/600
Genus *Agave* L.		1/300
Yucca L.		2/40
Family Smilacaceae	2/12	3/300
Genus *Lapageria* Ruiz & Pav.		1/1
Luzuriaga Ruiz & Pav.		2/3
Family Dioscoreaceae	1/6	1/630
Genus *Dioscorea* L.		1/600
Order Orchidales	441/748	13,953/19,268
Family Burmanniaceae	1/20	2/130
Genus *Burmannia* L.		2/57
Family Orchidaceae	440/725	13,951/19,128
Genus *Abdominea* J. J. Sm.		2/2
Acampe Lindl.		6/6
Acineta Lindl.		10/10
Acostaea Schltr.		8/8
Acriopsis Reinw. ex Bl.		12/12
Ada Lindl.		9/9
Adenoncos Bl.		17/17
Adrorhizon J. D. Hook.		1/1
Aerangis Rchb. f.		60/60
Aeranthes Lindl.		30/30
Aerides Lour.		19/19
Aganisia Kaempf. ex Spreng.		1/1
Aglossorhyncha Schltr.		6/6
Agrostophyllum Bl.		60/60
Alamania La Ll. & Lex.		1/1
Ambrella H. Perrier		1/1
Amesiella Schltr. ex Garay		1/1
Amparoa Schltr.		2/2
Ancistrochilus Rolfe		2/2
Ancistrorhynchus Finet		13/13
Andreettaea Luer		1/1
Angraecopsis Krzl.		14/14

TABLE 1. Continued.

Taxa	Genera	Species
Angraecum Bory		206/206
Anguloa Ruiz & Pav.		10/10
Ansellia Lindl.		2/2
Anthosiphon Schltr.		1/1
Antillanorchis Garay		1/1
Appendicula Bl.		100/100
Arachnis Bl.		2/2
Armodorum Breda		2/2
Arpophyllum La Ll. & Lex.		5/5
Artorima Dressl. & Poll.		1/1
Ascocentrum Schltr.		8/8
Ascochilopsis Carr		1/1
Ascochilus Ridl.		6/6
Ascoglossum Schltr.		1/1
Aspasia Lindl.		6/6
Barbosella Schltr.		27/27
Barkeria Knowles & Westc.		14/14
Barombia Schltr.		1/1
Basiphyllaea Schltr.		3/3
Batemannia Lindl.		4/4
Beadlea Small		1/54
Beclardia A. Rich.		1/1
Beloglottis Schltr.		1/7
Benthamia A. Rich.		6/26
Biermannia King & Pantl.		8/8
Bifrenaria Lindl.		27/27
Bogoria J. J. Sm.		4/4
Bollea Rchb. f.		7/7
Bolusiella Schltr.		10/10
Bonniera Cordemoy		2/2
Brachypeza Garay		7/7
Brachtia Rchb. f.		6/6
Brassavola R. Br.		23/23
Brassia R. Br.		38/38
Bromheadia Lindl.		11/11
Broughtonia R. Br.		6/6
Bulbophyllum Thouars		1,000/1,000
Bulleyia Schltr.		1/1
Cadetia Gaud.		67/67
Calymmanthera Schltr.		5/5
Calyptrochilum Krzl.		2/2
Campylocentrum Benth.		45/45
Capanemia Barb. Rodr.		16/16
Cardiochilus Cribb		2/2
Catasetum L. C. Rich. ex Kunth		76/76
Cattleya Lindl.		45/45
Caucaea Schltr.		1/1
Caularthron Raf.		3/3
Centroglossa Barb. Rodr.		6/6
Ceratochilus Bl.		2/2
Ceratostylis Bl.		70/70
Chamaeangis Schltr.		15/15
Chamaeanthus Schultr. ex J. J. Sm.		10/10
Chamelophyton Garay		1/1
Chaseella Summerh.		1/1
Chaubardia Rchb. f.		3/3
Chaubardiella Garay		6/6
Chauliodon Summerh.		1/1
Cheiradenia Lindl.		2/2
Chilopogon Schltr.		3/3
Chiloschista Lindl.		15/15
Chitonanthera Schltr.		7/7
Chitonochilus Schltr.		1/1
Chondrorhyncha Lindl.		16/16
Chroniochilus J. J. Sm.		5/5
Chrysocycnis Lind. & Rchb. f.		5/5
Chysis Lindl.		6/6
Chytroglossa Rchb. f.		4/4

TABLE 1. Continued.

Taxa	Genera	Species
Cirrhaea Lindl.		3/3
Cischweinfia Dressl. & N. Wms.		6/6
Claderia Hook. f.		2/2
Cleisomeria Lindl. ex G. Don		2/2
Cleisocentron Bruhl		3/3
Cleisostoma Bl.		95/95
Clowesia Lindl.		5/5
Cochleanthes Raf.		20/20
Cochlioda Lindl.		7/7
Coelia Lindl.		5/5
Coeliopsis Rchb. f.		2/2
Coelogyne Lindl.		100/100
Comparettia Poepp. & Endl.		11/11
Constantia Barb. Rodr.		4/4
Cordiglottis J. J. Sm.		7/7
Coryanthes W. J. Hook.		20/20
Cottonia Wight		1/1
Cryptarrhena Lindl.		4/4
Cryptocentrum Benth.		14/14
Cryptochilus Wall.		6/6
Cryptophoranthus Barb. Rodr.		36/36
Cryptopus Lindl.		3/3
Cryptopylos Garay		1/1
Cycnoches Lindl.		17/17
Cymbidiella Rolfe		3/3
Cymbidium Sw.		50/50
Cypholoron Dodson & Dressl.		2/2
Cyrtidium Schltr.		4/4
Cyrtopodium R. Br.		12/12
Cyrtorchis Schltr.		18/18
Dendrobium Sw.		900/900
Dendrochilum Bl.		120/120
Dendrophylax Rchb. f.		5/5
Diadenium Poepp. & Endl.		2/2
Diaphananthe Schltr.		45/45
Dichaea Lindl.		45/45
Dickasonia L. O. Wms.		1/1
Dilochia Lindl.		3/5
Dilomilis Raf.		4/4
Dimerandra Schltr.		2/2
Dimorphorchis D. Don		2/2
Dinklageella Mansf.		1/1
Diothonaea Lindl.		7/7
Diplocaulobium Krzl.		94/94
Diplocentrum Lindl.		2/2
Diploprora J. D. Hook.		1/1
Dipodium R. Br.		12/12
Dipteranthus Barb. Rodr.		2/2
Dipterostele Schltr.		2/2
Distylodon Summerh.		1/1
Dodsonia Ackerman		2/2
Domingoa Schltr.		2/2
Dracula Luer		93/93
Dresslerella Luer		8/8
Dressleria Dodson		4/4
Dryadella Luer		31/31
Dryadorchis Schltr.		2/2
Drymoanthus Nicholls		2/2
Drymoda Lindl.		2/2
Dunstervillea Garay		1/1
Dyakia E. A. Christ., ined.		1/1
Earina Lindl.		7/7
Eggelingia Summerh.		2/2
Elleanthus Presl		70/70
Eloyella P. Ortiz		3/3
Encheiridion Summerh.		1/1
Encyclia W. J. Hook.		130/130
Eparmatostigma Garay		1/1

TABLE 1. Continued.

Taxa	Genera	Species
Epiblastus Schltr.		20/20
Epidanthus L. O. Wms.		3/3
Epidendrum L.		500/500
Epigeneium Gagnep.		12/12
Eria Lindl.		500/550
Eriopsis Lindl.		2/3
Erycina Lindl.		2/2
Esmeralda Rchb. f.		2/2
Eulophiella Rolfe		2/2
Eurychone Schltr.		2/2
Fernandezia Ruiz & Pav.		9/9
Flickingeria Hawkes		70/70
Galeandra Lindl.		20/20
Gastrochilus D. Don		38/38
Genyorchis Schltr.		6/6
Glomera Bl.		50/50
Glossorhyncha Ridl.		70/70
Gomesa R. Br.		9/9
Gongora Ruiz & Pav.		40/40
Grammangis Rchb. f.		2/2
Grammatophyllum Bl.		12/12
Graphorkis Thouars		5/5
Grobya Lindl.		3/3
Grosourdya Rchb. f.		8/8
Gynoglottis J. J. Sm.		1/1
Hagsatera G. Tomayo		2/2
Haraella Kudo		1/1
Harrisella Fawc. & Rendle		4/4
Hederorkis Thouars		2/2
Helcia Lindl.		1/1
Helleriella Hawkes		3/3
Hexisea Lindl.		5/5
Hintonella Ames		1/1
Hippeophyllum Schltr.		6/6
Hoehneella Ruschi		2/2
Hofmeisterella Rchb. f.		1/1
Holcoglossum Schltr.		8/8
Homalopetalum Rolfe		4/4
Houlletia Brongn.		8/8
Huntleya Batem. ex Lindl.		10/10
Hybochilus Schltr.		2/2
Hygrochilus Pfitz.		1/1
Hymenorchis Schltr.		9/9
Imerinaea Schltr.		1/1
Ionopsis Kunth		3/3
Isabelia Barb. Rodr.		2/2
Ischnocentrum Schltr.		1/1
Ischnogyne Schltr.		1/1
Isochilus R. Br.		13/13
Jacquiniella Schltr.		11/11
Jumellea Schltr.		60/60
Kefersteinia Rchb. f.		25/25
Kegeliella Mansfeld		4/4
Koellensteinia Rchb. f.		1/11
Lacaena Lindl.		3/3
Laelia Lindl.		69/69
Lemurella Schltr.		3/3
Lemurorchis Krzl.		1/1
Leochilus Knowles & Westc.		16/16
Lepanthes Sw.		500/500
Lepanthopsis Ames		25/25
Leptotes Lindl.		5/5
Liparis L. C. Rich.		300/350
Listrostachys Rchb. f.		3/3
Lockhartia W. J. Hook.		29/29
Loefgrenianthus Hoehne		1/1
Lopharis Raf.		25/25
Lueddemannia Lind. & Rchb. f.		1/1

TABLE 1. Continued.

Taxa	Genera	Species
Luisia Gaud.		47/47
Lycaste Lindl.		43/43
Lycomormium Rchb. f.		5/5
Macradenia R. Br.		11/11
Macroclinium Dodson		25/25
Macropodanthus L. O. Wms.		1/1
Malleola J. J. Sm.		34/34
Masdevallia Ruiz & Pav.		400/400
Maxillaria Ruiz & Pav.		600/600
Mediocalcar J. J. Sm.		20/20
Megalotus Garay		1/1
Meiracyllium Rchb. f.		2/2
Mendoncella Hawkes		11/11
Mesospinidium Rchb. f.		7/7
Mexicoa Garay		1/1
Microcoelia Lindl.		26/26
Micropera Lindl.		19/19
Microsaccus Bl.		14/14
Microtatorchis Schltr.		49/49
Miltonia Lindl.		12/12
Miltoniopsis Godefr.-Lebeuf		6/6
Mobilabium Rupp		1/1
Monomeria Lindl.		4/4
Mormodes Lindl.		64/64
Mormolyca Fenzl		6/6
Myoxanthus Poepp. & Endl.		42/42
Mystacidium Lindl.		5/5
Nabaluia Ames		1/1
Nageliella L. O. Wms.		2/2
Neobathiea Schltr.		7/7
Neocogniauxia Schltr.		2/2
Neodryas Rchb. f.		4/4
Neofinetia Hu		1/1
Neogardneria Schltr.		1/1
Neogyna Rchb. f.		1/1
Neokoehleria Schltr.		7/7
Neomoorea Rolfe		1/1
Neowilliamsia Garay		5/5
Nephrangis Summerh.		1/1
Nidema Britt. & Millsp.		2/2
Notylia Lindl.		46/46
Oberonia Lindl.		300/300
Octarrhena Thwaites		35/35
Octomeria R. Br.		134/134
Odontoglossum Kunth (s.l.)		140/140
Oeonia Lindl.		6/6
Oeoniella Schltr.		3/3
Oerstedella Rchb. f.		28/28
Oliveriana Rchb. f.		4/4
Omoea Bl.		2/2
Oncidium Sw.		430/432
Orleanesia Barb. Rodr.		7/7
Ornithocephalus W. J. Hook.		28/28
Ornithochilus Wall. ex Lindl.		1/1
Ornithophora Barb. Rodr.		2/2
Otochilus Lindl.		4/4
Otoglossum (Schltr.) Garay & Dunsterv.		8/8
Oxyanthera Brongn.		6/6
Pabstia Garay		5/5
Pachyphyllum Kunth		25/25
Palumbina Rchb. f.		1/1
Paphinia Lindl.		8/8
Paphiopedilum Pfitz.		33/70
Papilionanthe Schltr.		10/10
Papillalabium Dockr.		1/1
Papperitzia Rchb. f.		1/1
Paraphalaenopsis Hawkes		4/4
Pedilochilus Schltr.		15/15

TABLE 1. Continued.

Taxa	Genera	Species
Pelatantheria Ridl.		3/3
Pennilabium J. J. Sm.		10/10
Peristeranthus T. E. Hunt		1/1
Peristeria W. J. Hook.		8/8
Perrierella Schltr.		1/1
Pescatorea Rchb. f.		14/14
Phalaenopsis Bl.		46/46
Phloeophila Hoehne & Schltr.		7/7
Pholidota Lindl. ex W. J. Hook.		40/40
Phragmipedium Rolfe		5/15
Phragmorchis L. O. Wms.		1/1
Phreatia Lindl.		190/190
Phymatidium Lindl.		7/7
Physosiphon Lindl.		6/6
Physothallis Garay		2/2
Pinelia Lindl.		3/3
Pityphyllum Schltr.		4/4
Platyglottis L. O. Wms.		1/1
Platyrhiza Barb. Rodr.		1/1
Platystele Schltr.		58/58
Plectorrhiza Dockr.		3/3
Plectrelminthus Raf.		1/1
Plectrophora Focke		6/6
Pleurothallis R. Br.		1,500/1,500
Poaephyllum Ridl.		3/3
Podangis Schltr.		1/1
Podochilus Bl.		75/75
Polycycnis Rchb. f.		20/20
Polyotidium Garay		1/1
Polyradicion Garay		4/4
Polystachya W. J. Hook.		150/150
Pomatocalpa Breda		46/46
Ponera Lindl.		9/9
Porpax Lindl.		8/8
Porphyrodesme Schltr.		3/3
Porphyroglottis Ridl.		1/1
Porroglossum Schltr.		21/21
Porrorhachis Garay		2/2
Promenaea Lindl.		15/15
Pseudacoridium Ames		1/1
Pseuderia Schltr.		4/4
Pseudolaelia Campos-Porto & Brade		6/6
Psychopsis Raf.		4/4
Psygmorchis Dodson & Dressl.		6/6
Pteroceras Hasselt ex Hassk.		41/41
Pterostemma Krzl.		1/1
Quekettia Lindl.		5/5
Quisqueya D. Dod		4/4
Rangaeris Summerh.		6/6
Rauhiella Pabst & Braga		1/1
Reichenbachanthus Barb. Rodr.		5/5
Renanthera Lour.		14/14
Renantherella Ridl.		2/2
Restrepia Kunth		32/32
Restrepiella Garay & Dunsterv.		1/1
Restrepiopsis Luer		17/17
Rhaesteria Summerh.		1/1
Rhinerrhiza Rupp		2/2
Rhipidoglossum Schltr.		4/4
Rhynchogyna Seidenf. & Garay		2/2
Rhyncholaelia Schltr.		2/2
Rhynchophreatia Schltr.		5/5
Rhynchostylis Bl.		3/3
Ridleyella Schltr.		1/1
Robiquetia Gaud.		39/39
Rodriguezia Ruiz & Pav.		34/34
Rodrigueziopsis Schltr.		2/2
Rossioglossum (Schltr.) Garay & Kennedy		5/5

TABLE 1. Continued.

Taxa	Genera	Species
Rudolfiella Hoehne		2/2
Rusbyella Rolfe		2/2
Saccoglossum Schltr.		2/2
Saccolabiopsis J. J. Sm.		13/13
Saccolabium Bl.		4/4
Salpistele Dressl.		6/6
Sanderella O. Ktze.		2/2
Sarcochilus R. Br.		14/14
Sarcostoma Bl.		2/2
Saundersia Rchb. f.		1/1
Scaphosepalum Pfitz.		26/26
Scaphyglottis Poepp. & Endl.		52/52
Scelochilus Kl.		34/34
Schlimmia Planch. & Lind. ex Lindl. & Paxt.		5/5
Schoenorchis Bl.		22/22
Schomburgkia Lindl.		17/17
Scuticaria Lindl.		6/6
Sedirea Garay & Sweet		2/2
Seidenfadenia Garay		1/1
Sepalosiphon Schltr.		1/1
Sievekingia Rchb. f.		15/15
Sigmatogyne Pfitz.		2/2
Sigmatostalix Rchb. f.		35/35
Sirhookera O. Ktze.		2/2
Smithsonia Saldanha		3/3
Smitinandia Holtt.		3/3
Sobennikoffia Schltr.		3/3
Sobralia Ruiz & Pav.		96/96
Solenangis Schltr.		2/2
Solenidium Lindl.		3/3
Sophronitis Lindl.		7/7
Sphyrarhynchus Mansfeld		1/1
Sphyrastylis Schltr.		6/6
Stanhopea Frost ex W. J. Hook.		55/55
Stelis Sw.		300/300
Stellilabium Schltr.		16/16
Stenia Lindl.		1/1
Stenorrhynchus L. C. Rich		1/9
Stereochilus Lindl.		5/5
Stolzia Schltr.		4/4
Summerhayesia Cribb		2/2
Sunipia Buc.-Ham. ex J. E. Sm.		25/25
Symphyglossum Schltr.		4/4
Systeloglossum Schltr.		5/5
Taeniophyllum Bl.		187/187
Taeniorrhiza Summerh.		1/1
Telipogon Kunth		82/82
Tetramicra Lindl.		11/11
Teuscheria Garay		6/6
Thecostele Rchb. f.		5/5
Thelasis Bl.		10/10
Thrixspermum Lour.		165/165
Thysanoglossa Porto & Brade		1/1
Trachoma Garay		6/6
Tervoria Lehmann		4/4
Trias Lindl.		2/2
Triceratorhynchus Summerh.		1/1
Trichocentrum Poepp. & Endl.		23/23
Trichoceros Kunth		8/8
Trichoglottis Bl.		80/80
Trichopilia Lindl.		21/21
Trichosalpinx Luer		84/84
Tridactyle Schltr.		35/35
Trigonidium Lindl.		12/12
Trisetella Luer		15/15
Trizeuxis Lindl.		1/1
Tuberolabium Yamamoto		5/5
Uncifera Lindl.		7/7
Vanda Jones		45/45

TABLE 1. Continued.

Taxa	Genera	Species
Vandopsis Pfitz.		18/18
Ventricularia Garay		1/1
Warmingia Rchb. f.		2/2
Xenikophyton Garay		1/1
Xylobium Lindl.		22/22
Ypsilopus Summerh.		2/2
Zygopetalum W. J. Hook.		40/40
Zygosepalum Rchb. f.		7/7
Zygostates Lindl.		12/12

figures by 27 percent (17 genera) and 44 percent (807 species), respectively. Within the dicotyledons the number of epiphyte-containing families has increased by 37 percent (14 families), the number of genera by 32 percent (64 genera), and the number of species by 12 percent (451 species). Of the 65 families originally reported by Madison to contain epiphytes, estimates for all but 8 families (Aquifoliaceae, Gnetaceae, Myrtaceae, Piperaceae, Pittosporaceae, Schizaeaceae, Vitaceae, and Zamiaceae) have been revised in some fashion (including name changes) in the current list.

Despite the differences in the number of epiphytic species estimated by Madison and in this report, the percentage of all species of vascular plants that are epiphytic is the same: ten percent. This similarity is accounted for by the fact that

TABLE 2. Synopsis of the distribution of vascular epiphytes in hierarchical taxonomic categories.

Major groups	Taxonomic categories	Epiphytes	Total	Percent
All vascular plants	classes	6	8	75
	orders	44	97	45
	families	84	432	19
	genera	876	12,140	7
	species	23,456	231,638	10
Ferns and allies (Pteridophyta)	classes	2	3	67
	orders	5	8	50
	families	13	33	34
	genera	92	239	39
	species	2,593	9,000	29
Gymnosperms (Cycadophyta, Ginkgophyta, Coniferophyta, Gnetophyta)	classes	2	3	67
	orders	2	6	33
	families	2	15	13
	genera	2	65	3
	species	4	770	½
Angiosperms (Magnoliophyta)	classes	2	2	100
	subclasses	10	11	91
	orders	37	83	45
	families	69	384	18
	genera	782	11,836	7
	species	20,859	221,868	9
Dicotyledons (Magnoliopsida)	subclasses	6	6	100
	orders	28	64	44
	families	52	319	16
	genera	262	9,409	3
	species	4,251	167,893	3
Monocotyledons (Liliopsida)	subclasses	4	5	80
	orders	9	19	47
	families	17	65	26
	genera	520	2,427	21
	species	16,608	53,975	31

TABLE 3. Families of vascular plants containing over 50 epiphytic species.

Families	Genera			Species		
	Epiphytic	Total	Percent	Epiphytic	Total	Percent
Orchidaceae	440	725	61	13,951	19,128	73
Araceae	13	110	12	1,349	2,500	54
Bromeliaceae	26	45	58	1,144	2,500	46
Polypodiaceae	53	65	82	1,023	1,100	93
Piperaceae	2	10	20	710	3,100	23
Ericaceae	36	122	30	672	3,500	19
Melastomataceae	33	180	18	648	4,770	14
Gesneriaceae	30	120	25	560	2,500	22
Moraceae	4	40	10	522	1,000	52
Aspleniaceae	1	7	14	400	675	59
Hymenophyllaceae	2	2	100	400	600	67
Dryopteridaceae	10	55	18	292	1,920	15
Rubiaceae	25	450	6	223	6,500	3
Lycopodiaceae	1	2	50	200	401	50
Cactaceae	18	115	16	150	1,500	10
Davalliaceae	8	9	89	139	150	93
Asclepiadaceae	8	250	3	137	2,000	7
Vittariaceae	9	9	100	112	112	100
Clusiaceae	6	50	12	92	1,200	8
Marcgraviaceae	7	7	100	89	122	73
Cyclanthaceae	7	10	70	86	200	43
Araliaceae	9	70	13	78	700	11
Solanaceae	12	85	14	56	2,800	2

both Madison's total number of epiphytic species (due to an overestimate of the orchids) and his total number of vascular plants are proportionally higher than those reported here. The 231,638 total species of vascular plants used here to calculate the percentage of vascular epiphytes was derived from estimates provided by the references cited above. It is recognized that this is undoubtedly a low figure, especially in light of the many unnamed tropical species. Yet it is a verifiable figure that is sufficient for making the comparisons required here.

If all 23,456 epiphytic species occurred in the same family (obviously quite unlikely!), the origin of the epiphytic habit could be attributed to a single evolutionary event implying that colonization of the arboreal habitat was uncommon in the history of vascular plants. However, the distribution of these 23,456 species in 84 families, 44 orders, six classes and four divisions (TABLE 2) suggests that this character state has evolved independently many times. Even within families, many of the epiphytic genera apparently do not share recent common ancestors and most likely evolved the epiphytic habit independently. In the angiosperms, epiphytes are found in ten of the 11 subclasses and in 37 of the 83 orders (TABLE 2). In the dicotyledons, even though only three percent of the species are epiphytic, 44 percent of the orders contain epiphytes. Hence, representation of epiphytism at the ordinal level provides a different perspective of the overall distribution within the class than does representation at the species level.

Only one family, the Vittariaceae, is exclusively epiphytic, and of the 23 largest epiphytic families (TABLE 3), only nine have a majority of species that are epiphytic. However, of the 43 largest epiphytic genera (TABLE 4), 39 are primarily epiphytic, and 23 are exclusively so. Exclusively epiphytic genera with fewer than 100 species are even more common, especially within the Cactaceae, Gesneriaceae, Melastomataceae, Orchidaceae, Pteridophyta, and Solanaceae.

Although epiphytic species are scattered throughout the vascular plants, the majority is concentrated in a relatively small number of families and genera. The 23 families that contain over 50 epiphytic species each (TABLE 3) makes up only 27 percent of all epiphytic families, but accounts for 87 percent of all epiphytic genera and 98 percent of all epiphytic species. The remaining two percent of epiphytic species are distributed among the remaining 73 percent of epiphytic families. Of those families 62 percent contain less than five epiphytic species and 25 percent contain only one epiphyte. The 43 largest genera (those containing 100 species or more; TABLE 4) comprise only five percent of all epiphytic genera, but account for 58 percent of all

TABLE 4. Genera of vascular plants containing 100 species or more.

Genera	Families	Species		
		Epiphytic	Total	Percent
Pleurothallis R. Br.	Orchidaceae	1,500	1,500	100
Bulbophyllum Thouars	Orchidaceae	1,000	1,000	100
Dendrobium Sw.	Orchidaceae	900	900	100
Anthurium Schott	Araceae	750	1,000	75
Peperomia Ruiz & Pav.	Piperaceae	700	1,000	70
Maxillaria Ruiz & Pav.	Orchidaceae	600	600	100
Epidendrum L.	Orchidaceae	500	500	100
Eria Lindl.	Orchidaceae	500	550	91
Ficus L.	Moraceae	500	800	63
Lepanthes Sw.	Orchidaceae	500	500	100
Oncidium Sw.	Orchidaceae	430	432	99
Asplenium L.	Aspleniaceae	400	650	62
Grammitis Sw.	Polypodiaceae	400	400	100
Masdevallia Ruiz & Pav.	Orchidaceae	400	400	100
Tillandsia L.	Bromeliaceae	400	450	89
Liparis L. C. Rich.	Orchidaceae	300	350	86
Medinilla Gaudich.	Melastomataceae	300	400	75
Oberonia Lindl.	Orchidaceae	300	300	100
Philodendron Schott	Araceae	300	350	86
Stelis Sw.	Orchidaceae	300	300	100
Elaphoglossum Schott	Dryopteridaceae	250	500	50
Hymenophyllum J. Sm.	Hymenophyllaceae	250	300	83
Angraecum Bory	Orchidaceae	206	206	100
Lycopodium L.	Lycopodiaceae	200	400	50
Vriesea Lindl.	Bromeliaceae	200	260	77
Phreatia Lindl.	Orchidaceae	190	190	100
Taeniophyllum Bl.	Orchidaceae	187	187	100
Thrixspermum Lour.	Orchidaceae	165	165	100
Polystachya W. J. Hook.	Orchidaceae	150	150	100
Trichomanes L.	Hymenophyllaceae	150	300	50
Odontoglossum Kunth (s.l.)	Orchidaceae	140	140	100
Polypodium L.	Polypodiaceae	140	150	93
Octomeria R. Br.	Orchidaceae	134	134	100
Encyclia W. J. Hook.	Orchidaceae	130	130	100
Aechmea Ruiz & Pav.	Bromeliaceae	120	150	80
Dendrochilum Bl.	Orchidaceae	120	120	100
Guzmania Ruiz & Pav.	Bromeliaceae	120	140	86
Rhododendron L.	Ericaceae	112	850	13
Appendicula Bl.	Orchidaceae	100	100	100
Coelogyne Lindl.	Orchidaceae	100	100	100
Drymonia Mart.	Gesneriaceae	100	110	91
Pyrrosia Mirbel	Polypodiaceae	100	100	100
Rhaphidophora Hassk.	Araceae	100	100	100

epiphytic species. Thus 95 percent of the total number of epiphytic genera contain less than half of all the epiphytic species. Of those genera 55 percent have fewer than five epiphytic species while 26 percent contain only one.

The Orchidaceae, probably the largest family of flowering plants, contains over ten times more species of epiphytes and over eight times more genera of epiphytes than any other family of vascular plants (TABLE 3). Orchids constitute the majority of both epiphytic genera and species (TABLE 3) and account for 23 of the 43 largest epiphytic genera (TABLE 4). The reason for the phenomenal speciation in orchids and especially the explosive radiation of the epiphytic habit has been debated elsewhere (e.g., Benzing, 1981; Dressler, 1981; Benzing & Atwood, 1984; Gentry & Dodson, 1986) and will not be discussed here.

In summary, epiphytes constitute an important component of the vascular plants, especially within the ferns and angiosperms, not only in terms of numbers of taxa, but with regards to biological diversity as well. As our knowledge of the taxonomy of tropical plants increases, new

accounts of epiphytes will undoubtedly be added to the list provided here. Further investigation of the ecology, reproductive biology, physiology and morphology of epiphytes is needed. Studies in these areas are still in their initial phases in comparison to those of their terrestrially-rooted relatives.

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