

## 1 Epiphytism: a preliminary overview

### Historical notes

Columbus is credited with the first recorded comment on canopy-adapted vegetation; he wrote that tropical trees “have a great variety of branches and leaves, all of them growing from a single root” (Gessner 1956). The earliest known picture of an epiphyte – or, for that matter, reference to American botany – appears in *The Badianus Manuscript*, a Mexican herbal of 1552, written and probably illustrated by the Aztec Indian physician Martinus de la Cruz and translated into Latin by his Indian colleague Juannes Badianus at the College of Santa Cruz (Emmart 1940). The subject was *Vanilla fragrans*, a vining hemiepiphytic orchid. The fruit of this species (*tlilxochitl* in Aztec, meaning “black flower”) was an ingredient in the doctor’s prescription for “The Traveler’s Safeguard,” a mixture of pulverized herbs wrapped in a magnolia leaf and hung around the neck so that the voyager could “catch and inhale the very redolent odor . . .”

By the eighteenth century, ships’ captains and explorers the world over were carrying ornamental plants, epiphytes included, back to Europe. Within decades, a brisk trade had developed; many additional aroids, bromeliads, cacti, orchids, and ferns were imported. Showiness, small size, and easy culture encouraged fads that drove prices to exorbitant levels and prompted more than one collector to lie about where he found his specimens. But scientific interest in these plants did not keep pace; other groups such as carnivores, halophytes, ruderals, and succulents are far better known today. A. F. W. Shimper’s monograph *Die epiphytische Vegetation Amerikas* was a noteworthy exception. This treatise (1888) and related works (e.g., 1884, 1903) published over a long career were major contributions to the study of epiphytes, and in fact remain arguably the most comprehensive treatment to date. Schimper’s skillful accounts of fascinating and unusual adaptations in several epiphytic taxa contain remarkable insight for that time.

Over the next 75 years, occasional papers covered the functional and ecological aspects of epiphytism: absorption by certain bromeliad leaf trichomes (Mez 1904); fauna and nutrition of tank bromeliads (Picado 1913);

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water balance in orchid roots, particularly the role of the velamen–exodermis complex (Haberlandt 1914); osmotica in epiphyte versus host foliage (Harris and Lawrence 1916; Harris 1918); autecology of the epiphytic fern *Polypodium polypodioides* (Fig. 1.6; Pessin 1925); and an overview of New Zealand’s canopy-adapted flora (Oliver 1930). Richards (1952) covered epiphytes in *The Tropical Rain Forest*, and Curtis (1952) cited 170 references on epiphytism in his reviews of common life systems in plants. Other classic writings include Went’s (1940) attempt to explain the factors responsible for host selection, and the identification by Sanford (1969, 1974) and Johansson (1974) of the influence of climate on orchid distribution in Nigeria. Broader coverages are those of Gessner (1956) on water economy and Madison’s (1977) overview. Benzing and Seemann (1978) and Benzing (1983, 1984) considered interactions between epiphytes and their supports and dependent fauna – subjects that provide the second focus for this monograph. A recent surge of reports on epiphyte biology reflects increased interest in tropical forests and an improved climate for biological research in parts of Latin America, Malaysia, Singapore, and several other strategically located areas. Journals now contain papers on physiology, functional anatomy, life history, associated biota, and the effects of epiphytes on nutrient cycling in hosting ecosystems.

### Character and importance of epiphytic vegetation

Epiphytes are responsible for much of the biotic diversity that makes humid tropical forests the most complex of all the world’s terrestrial ecosystems (Gentry and Dodson 1987a). Canopy-based species constitute fully one third – perhaps up to 50% – of the total vascular flora in some pluvial neotropical forests (Fig. 8.4). In addition, the capacity of these sites to accommodate fauna, including the majority of a suspected 30,000,000 insect species worldwide (Erwin 1983), can be attributed in significant measure to the shelter and sustenance provided by epiphytic vegetation. Effects on community dynamics are no less impressive. Green biomass (and presumably photosynthetic capacity as well) of nonvascular and higher plants anchored in tree crowns can rival – probably even exceed – that of phorophytes. Epiphytes display various mechanisms, some novel, for countering drought and acquiring essential ions; such specialization is unexcelled in the plant world. Some animals are preyed upon, others become symbiotic mutualists; out-of-the-ordinary substrata are utilized. Of all wide-ranging plant groups, the tropical forest canopy supports one of the least studied and most important.

A few days' exploration can still yield undescribed epiphytes, primarily in Orchidaceae but also in such sizable families as Araceae and Gesneriaceae.

### The geologic record of epiphytism

Paleontologists have found little evidence of pre-Cenozoic or even early- to mid-Tertiary epiphytism. Araceae and several other families that today contain many epiphytes were well differentiated by the end of the Eocene, but no fossil remains can be unquestionably assigned to their canopy-based lineages. Except for a few doubtful Eocene fossils from southern Europe, Orchidaceae have not been reported in pre-Quaternary sediments (Schmid and Schmid 1977). *Tillandsia*-like pollen has been reported for the Panamanian Eocene (A. Graham pers. comm.), but there is no way to determine the habits of the bromeliads that produced it.

Animal dispersal in so many epiphyte-containing angiosperm families also indicates that tree crowns were colonized only recently by flowering plants. Fleshy fruit, and the bats, birds, and mammals that eat it, first became diverse and abundant in the Paleocene/Eocene (Tiffney 1984). Involvement of early pteridophytes and primitive seed plants in epiphytism is even more obscure. Petrified stems of arborescent lycopods, calamites, and other potential pre-Cretaceous hosts show penetration by alien roots, but these intrusions probably occurred after death; the invading axes appear to belong to other terrestrials. The absence of verified epiphytic angiosperms in ancient geologic deposits and their concentration today in a few large advanced families point to a recent massive expansion (Table 1.1). The present active state of evolution of many tropical orchid clades and other species-rich, canopy-based genera (e.g., *Anthurium*, *Rhododendron*, *Drymonia*, *Peperomia*, *Tillandsia*; Table 1.2), as well as their concentration in geologically young montane habitats, suggests that much epiphyte diversity dates from the Pliocene/Pleistocene.

Canopy colonization was also limited before the rise of Magnoliophyta because this division had to supply most of the substrata. The broadleaf forests at low humid latitudes, where so many epiphytes anchor today, began to develop near the Cretaceous/Tertiary boundary. That was only about 65 million years ago after a shift toward wetter climate fostered extensive multistratal vegetation. Early angiosperms were small and probably restricted to savanna, riverine, and other disturbed habitats. Extant relatives provide a little insight on the nature of early conifers as arboreal habitats: A few modern taxa (*Taxodium* and some *Pinus* spp.) support heavy epiphyte

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**Table 1.1. The systematic distribution of vascular epiphytes**

| Taxa                                     | Genera <sup>a</sup> | Species <sup>a</sup> |
|------------------------------------------|---------------------|----------------------|
| 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 <i>Ophioglossum</i> L.             |                     | 8/30                 |
| Order Polypodiales                       | 87/224              | 2,372/7,565          |
| Family Schizaeaceae                      | 1/4                 | 2/170                |
| Genus <i>Schizaea</i> J. Sm.             |                     | 2/30                 |
| Family Hymenophyllaceae                  | 2/2                 | 400/600              |
| Genus <i>Hymenophyllum</i> J. Sm.        |                     | 250/300              |
| <i>Trichomanes</i> L.                    |                     | 150/300              |
| Family Vittariaceae                      | 9/9                 | 112/112              |
| Genus <i>Ananthacorus</i> Underw.& Maxon |                     | 1/1                  |
| <i>Anetium</i> (Kunze) Splitg.           |                     | 1/1                  |
| <i>Antrophyum</i> Kaulf.                 |                     | 40/40                |
| <i>Hecistopteris</i> J. Sm.              |                     | 1/1                  |
| <i>Monogramma</i> Schkurh.               |                     | 2/2                  |
| <i>Polytaenium</i> Desv.                 |                     | 10/10                |
| <i>Scoliosorus</i> Moore                 |                     | 1/1                  |
| <i>Vaginularia</i> Fee                   |                     | 6/6                  |
| <i>Vittaria</i> J. Sm.                   |                     | 50/50                |
| Family Dennstaedtiaceae                  | 2/18                | 3/370                |
| Genus <i>Lindsaea</i> Dryander ex J. Sm. |                     | 2/150                |
| <i>Oenotrichia</i> Copel.                |                     | 1/4                  |
| Family Dryopteridaceae                   | 10/55               | 292/1,920            |
| Genus <i>Arthropteris</i> J. Sm.         |                     | 15/15                |
| <i>Dryopteris</i> Adans.                 |                     | 1/150                |
| <i>Elaphoglossum</i> Schott              |                     | 250/500              |
| <i>Lastreopsis</i> Ching                 |                     | 1/35                 |
| <i>Lomariopsis</i> Fee                   |                     | 1/45                 |
| <i>Oleandra</i> Cav.                     |                     | 20/40                |
| <i>Polystichum</i> Roth                  |                     | 1/160                |
| <i>Psammiosorus</i> C. Christ.           |                     | 1/1                  |
| <i>Rumohra</i> Raddi                     |                     | 1/2                  |
| <i>Teratophyllum</i> Holtt.              |                     | 1/9                  |
| Family Aspleniaceae                      | 1/7                 | 400/675              |
| Genus <i>Asplenium</i> L.                |                     | 400/650              |
| Family Davalliaceae                      | 8/9                 | 139/150              |
| Genus <i>Araiostegia</i> Copel.          |                     | 12/12                |
| <i>Davallia</i> J. Sm.                   |                     | 40/40                |
| <i>Davallodes</i> (Copel.) Copel.        |                     | 11/11                |
| <i>Humata</i> Cav.                       |                     | 50/50                |
| <i>Nephrolepis</i> Schott                |                     | 15/20                |
| <i>Parasorus</i> Alderwerelt             |                     | 1/1                  |
| <i>Scyphularia</i> Fee                   |                     | 8/8                  |
| <i>Trogostolon</i> Copel.                |                     | 2/2                  |
| Family Blechnaceae                       | 1/9                 | 1/175                |
| Genus <i>Stenochlaena</i> J. Sm.         |                     | 1/5                  |

Table 1.1. (cont.)

| Taxa                                 | Genera <sup>a</sup> | Species <sup>a</sup> |
|--------------------------------------|---------------------|----------------------|
| Family Polypodiaceae                 | 53/65               | 1,023/1,100          |
| Genus <i>Acrosorus</i> Copel.        |                     | 5/5                  |
| <i>Aglaomorpha</i> Schott            |                     | 4/4                  |
| <i>Amphoradenium</i> Desv.           |                     | 6/6                  |
| <i>Anarthropteris</i> Copel.         |                     | 1/1                  |
| <i>Arthromeris</i> (Moore) J. Sm.    |                     | 6/9                  |
| <i>Belvisia</i> Mirbel               |                     | 15/15                |
| <i>Calymmodon</i> Presl              |                     | 25/25                |
| <i>Campyloneurum</i> Presl           |                     | 25/25                |
| <i>Christiopteris</i> Copel.         |                     | 4/4                  |
| <i>Colysis</i> Presl                 |                     | 2/30                 |
| <i>Crypsinus</i> Presl               |                     | 40/40                |
| <i>Dendroconche</i> Copel.           |                     | 2/2                  |
| <i>Diblemma</i> J. Sm.               |                     | 1/1                  |
| <i>Dictymia</i> J. Sm.               |                     | 3/3                  |
| <i>Drymotaenium</i> Makino           |                     | 2/2                  |
| <i>Drynaria</i> (Bory) J. Sm.        |                     | 20/20                |
| <i>Drynariopsis</i> (Copel.) Ching   |                     | 1/1                  |
| <i>Eschatogramme</i> Trev.           |                     | 4/4                  |
| <i>Goniophlebium</i> (Bl.) Presl     |                     | 20/20                |
| <i>Grammatopteridium</i> Alderwerelt |                     | 2/2                  |
| <i>Grammatis</i> Sw.                 |                     | 400/400              |
| <i>Holcosorus</i> Moore              |                     | 3/3                  |
| <i>Holostachyum</i> (Copel.) Ching   |                     | 1/1                  |
| <i>Lecanopteris</i> Reinw.           |                     | 15/15                |
| <i>Lemmaphyllum</i> Presl            |                     | 4/4                  |
| <i>Leptochilus</i> Kaulf.            |                     | 1/1                  |
| <i>Loxogramme</i> (Bl.) Presl        |                     | 25/25                |
| <i>Marginariopsis</i> C. Christ.     |                     | 1/1                  |
| <i>Merinthosorus</i> Copel.          |                     | 2/2                  |
| <i>Microgramma</i> Presl             |                     | 13/13                |
| <i>Microsorium</i> Link              |                     | 40/40                |
| <i>Nematopteris</i> Alderwerelt      |                     | 1/1                  |
| <i>Neocheiropteris</i> C. Christ.    |                     | 3/3                  |
| <i>Neurodium</i> Fee                 |                     | 1/1                  |
| <i>Niphidium</i> J. Sm.              |                     | 4/4                  |
| <i>Oleandropsis</i> Copel.           |                     | 1/1                  |
| <i>Oreogrammatis</i> Copel.          |                     | 1/1                  |
| <i>Paragramma</i> (Bl.) Moore        |                     | 2/2                  |
| <i>Paraleptochilus</i> Copel.        |                     | 2/2                  |
| <i>Photinopteris</i> J. Sm.          |                     | 1/1                  |
| <i>Platycterium</i> Desv.            |                     | 15/15                |
| <i>Pleopeltis</i> /Kunth in HBK      |                     | 10/10                |
| <i>Polypodiopteris</i> Reed          |                     | 3/3                  |
| <i>Polypodium</i> L.                 |                     | 140/150              |
| <i>Prosaptia</i> Presl               |                     | 20/20                |
| <i>Pteropsis</i> Desv.               |                     | 6/6                  |
| <i>Pycnoloma</i> C. Christ.          |                     | 3/3                  |
| <i>Pyrrosia</i> Mirbel               |                     | 100/100              |

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Table 1.1. (cont.)

| Taxa                                       | Genera <sup>a</sup> | Species <sup>a</sup> |
|--------------------------------------------|---------------------|----------------------|
| <i>Scleroglossum</i> Alderwerelt           |                     | 6/6                  |
| <i>Selliguea</i> Bory                      |                     | 4/5                  |
| <i>Solanopteris</i> Copel.                 |                     | 4/4                  |
| <i>Thayeria</i> Copel.                     |                     | 1/1                  |
| <i>Thylacopteris</i> Kunze ex Mett.        |                     | 2/2                  |
| Subclass Psilotidae                        | 2/2                 | 8/9                  |
| Order Psilotales                           | 2/2                 | 8/9                  |
| Family Psilotaceae                         | 2/2                 | 8/9                  |
| Genus <i>Psilotum</i> Sw.                  |                     | 2/2                  |
| <i>Tmesipteris</i> Bernh.                  |                     | 6/7                  |
| Class Lycopodiopsida                       | 2/4                 | 205/1,251            |
| Order Lycopodiales                         | 1/2                 | 200/401              |
| Family Lycopodiaceae                       | 1/2                 | 200/401              |
| Genus <i>Lycopodium</i> L.                 |                     | 200/400              |
| Order Selaginellales                       | 1/1                 | 5/700                |
| Family Selaginellaceae                     | 1/1                 | 5/700                |
| Genus <i>Selaginella</i> Beauv.            |                     | 5/700                |
| Division Cycadophyta                       | 2/10                | 2/155                |
| Class Cycadopsida                          | 2/10                | 2/155                |
| Order Cycadales                            | 2/10                | 2/155                |
| Family Zamiaceae                           | 2/7                 | 2/125                |
| Genus <i>Zamia</i> L.                      |                     | 2/35                 |
| 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 <i>Gnetum</i> 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 <i>Drimys</i> J. R. & G. Forst. s.l. |                     | 6/70                 |
| Order Piperales                            | 2/20                | 710/1,782            |
| Family Piperaceae                          | 2/10                | 710/3,100            |
| Genus <i>Peperomia</i> Ruiz & Pav.         |                     | 700/1,000            |
| <i>Piper</i> L.                            |                     | 10/2,000             |
| Order Ranunculales                         | 1/148               | 1/3,148              |
| Family Ranunculaceae                       | 1/50                | 1/2,000              |
| Genus <i>Thalictrum</i> 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 <i>Antiaropsis</i> K. Schum.         |                     | 1/1                  |
| <i>Coussapoa</i> Aubl.                     |                     | 20/45.               |
| <i>Ficus</i> L.                            |                     | 500/800              |
| <i>Pourouma</i> Aubl.                      |                     | 1/50                 |
| Family Urticaceae                          | 3/45                | 40/700               |
| Genus <i>Elatostema</i> Gaudich.           |                     | 10/200               |

Table 1.1. (cont.)

| Taxa                                       | Genera <sup>a</sup> | Species <sup>a</sup> |
|--------------------------------------------|---------------------|----------------------|
| <i>Pilea</i> Lindl.                        |                     | 20/400               |
| <i>Procris</i> Comm. ex Juss.              |                     | 10/20                |
| Order Myricales                            | 1/3                 | 1/50                 |
| Family Myricaceae                          | 1/3                 | 1/50                 |
| Genus <i>Myrica</i> 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 <i>Aporocactus</i> Lem.              |                     | 6/6                  |
| <i>Cryptocereus</i> Alex.                  |                     | 1/2                  |
| <i>Disocactus</i> Lindl.                   |                     | 7/7                  |
| <i>Eccremocactus</i> Britton & Rose        |                     | 3/3                  |
| <i>Epiphyllum</i> Haworth                  |                     | 21/21                |
| <i>Heliocereus</i> (Berg.) Britton & Rose  |                     | 5/5                  |
| <i>Hylocereus</i> (Berg.) Britton & Rose   |                     | 18/20                |
| <i>Lymanbensonia</i> Kimm.                 |                     | 1/1                  |
| <i>Mediocactus</i> Britton & Rose          |                     | 2/2                  |
| <i>Nopalxochia</i> Britton & Rose          |                     | 1/1                  |
| <i>Pfeiffera</i> Salm-Dyck                 |                     | 1/1                  |
| <i>Rhipsalis</i> Gaertn.                   |                     | 58/65                |
| <i>Schlumbergera</i> Lem.                  |                     | 6/6                  |
| <i>Selenicereus</i> (Berg.) Britton & Rose |                     | 13/17                |
| <i>Strophocactus</i> Britton & Rose        |                     | 1/1                  |
| <i>Weberocereus</i> Britton & Rose         |                     | 3/3                  |
| <i>Werckleocereus</i> Britton & Rose       |                     | 2/2                  |
| <i>Wilmattea</i> Britton & Rose            |                     | 1/1                  |
| Family Caryophyllaceae                     | 2/75                | 2/2,000              |
| Genus <i>Arenaria</i> L.                   |                     | 1/250                |
| <i>Stellaria</i> 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 <i>Marcgravia</i> L.                 |                     | 50/55                |
| <i>Marcgraviastrum</i> Bedell, ined.       |                     | 10/15                |
| <i>Norantea</i> Aubl.                      |                     | 1/2                  |
| <i>Ruyschia</i> Jacq.                      |                     | 7/7                  |
| <i>Sarcopera</i> Bedell, ined.             |                     | 4/10                 |
| <i>Schwartzia</i> Vell.                    |                     | 8/14                 |
| <i>Souroubea</i> Aubl.                     |                     | 9/19                 |
| Family Clusiaceae                          | 6/50                | 92/1,200             |
| Genus <i>Clusia</i> L.                     |                     | 85/145               |
| <i>Clusiella</i> Planch. & Triana          |                     | 3/7                  |
| <i>Havetiopsis</i> Planch. & Triana        |                     | 1/5                  |
| <i>Odematopus</i> Planch. & Triana         |                     | 1/10                 |
| <i>Quapoya</i> Aubl.                       |                     | 1/3                  |
| <i>Renggeria</i> Meisn.                    |                     | 1/3                  |
| Order Malvales                             | 3/225               | 6/3,300              |
| Family Elaeocarpaceae                      | 1/10                | 1/400                |
| Genus <i>Sericolea</i> Schlecht.           |                     | 1/20                 |

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Table 1.1. (cont.)

| Taxa                                          | Genera <sup>a</sup> | Species <sup>a</sup> |
|-----------------------------------------------|---------------------|----------------------|
| Family Bombacaceae                            | 2/25                | 5/200                |
| Genus <i>Ceiba</i> Mill.                      |                     | 1/10                 |
| <i>Spirotheca</i> Ulbrich                     |                     | 4/4                  |
| Order Nepenthales                             | 1/8                 | 6/193                |
| Family Nepenthaceae                           | 1/1                 | 6/75                 |
| Genus <i>Nepenthes</i> L.                     |                     | 6/75                 |
| Order Violales                                | 1/276               | 30/4,818             |
| Family Begoniaceae                            | 1/4                 | 30/1,000             |
| Genus <i>Begonia</i> L.                       |                     | 30/900               |
| Order Ericales                                | 37/174              | 673/4,044            |
| Family Epacridaceae                           | 1/30                | 1/400                |
| Genus <i>Prionotes</i> R. Br.                 |                     | 1/1                  |
| Family Ericaceae                              | 36/122              | 672/3,500            |
| Genus <i>Agapetes</i> D. Don ex G. Don        |                     | 60/80                |
| <i>Anthopterus</i> W. J. Hook.                |                     | 3/6                  |
| <i>Anthopteropsis</i> A. C. Sm.               |                     | 1/1                  |
| <i>Calopteryx</i> A. C. Sm.                   |                     | 1/2                  |
| <i>Cavendishia</i> Lindl.                     |                     | 75/100               |
| <i>Ceratostema</i> Juss.                      |                     | 16/23                |
| <i>Costera</i> J. J. Sm.                      |                     | 8/8                  |
| <i>Demosthenesia</i> A. C. Sm.                |                     | 6/11                 |
| <i>Didonica</i> Luteyn & Wilbur               |                     | 2/2                  |
| <i>Dimorphanthera</i> F. Muell.               |                     | 25/71                |
| <i>Diogenesia</i> Sleum.                      |                     | 5/13                 |
| <i>Diplycosia</i> Bl.                         |                     | 61/98                |
| <i>Disterigma</i> Niedenzu ex Drude           |                     | 15/30                |
| <i>Gaultheria</i> Kalm ex L.                  |                     | 8/200                |
| <i>Gonocalyx</i> Planch. & Lind. ex A. C. Sm. |                     | 6/8                  |
| <i>Killipiella</i> A. C. Sm.                  |                     | 2/2                  |
| <i>Lateropora</i> A. C. Sm.                   |                     | 2/3                  |
| <i>Lyonia</i> Nutt.                           |                     | 1/35                 |
| <i>Macleania</i> W. J. Hook.                  |                     | 25/45                |
| <i>Mycerinus</i> A. C. Sm.                    |                     | 1/3                  |
| <i>Oreanthes</i> Benth.                       |                     | 4/4                  |
| <i>Orthaea</i> Kl.                            |                     | 20/31                |
| <i>Pellegrinnia</i> Sleum.                    |                     | 1/4                  |
| <i>Pernettyopsis</i> King & Gamble            |                     | 1/1                  |
| <i>Plutarchia</i> A. C. Sm.                   |                     | 6/12                 |
| <i>Psammisia</i> Kl.                          |                     | 25/55                |
| <i>Rhododendron</i> L.                        |                     | 112/850              |
| <i>Rusbya</i> Britton                         |                     | 1/1                  |
| <i>Satyria</i> Kl.                            |                     | 20/23                |
| <i>Semiramisa</i> Kl.                         |                     | 2/4                  |
| <i>Siphonandra</i> Kl.                        |                     | 1/1                  |
| <i>Spherospermum</i> Poepp. & Endl.           |                     | 18/22                |
| <i>Themistoclesia</i> Kl.                     |                     | 22/31                |
| <i>Thibaudia</i> Ruiz & Pav.                  |                     | 20/60                |
| <i>Utleia</i> Wilbur & Luteyn                 |                     | 1/1                  |
| <i>Vaccinium</i> L.                           |                     | 95/450               |

Table 1.1. (cont.)

| Taxa                                      | Genera <sup>a</sup> | Species <sup>a</sup> |
|-------------------------------------------|---------------------|----------------------|
| Order Ebenales                            | 1/87                | 1/1,752              |
| Family Sapotaceae                         | 1/70                | 1/800                |
| Genus <i>Bumelia</i> Sw.                  |                     | 1/60                 |
| Order Primulales                          | 4/64                | 28/2,100             |
| Family Myrsinaceae                        | 4/30                | 28/1,000             |
| Genus <i>Cybianthus</i> Mart.             |                     | 5/40                 |
| <i>Embelia</i> Burm.                      |                     | 5/130                |
| <i>Grammadenia</i> Benth.                 |                     | 6/15                 |
| <i>Myrsine</i> 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 <i>Ackama</i> A. Cunn.              |                     | 1/3                  |
| <i>Weinmannia</i> L.                      |                     | 2/170                |
| Family Pittosporaceae                     | 1/9                 | 5/200                |
| Genus <i>Pittosporum</i> Banks ex Soland. |                     | 5/150                |
| Family Grossulariaceae                    | 1/25                | 1/350                |
| Genus <i>Phyllonoma</i> Willd. ex Schult. |                     | 1/8                  |
| Family Crassulaceae                       | 3/25                | 5/900                |
| Genus <i>Echeveria</i> DC.                |                     | 2/150                |
| <i>Kalanchoe</i> Adans.                   |                     | 1/200                |
| <i>Sedum</i> L.                           |                     | 2/600                |
| Family Saxifragaceae                      | 2/40                | 4/700                |
| Genus <i>Hydrangea</i> L.                 |                     | 2/80                 |
| <i>Quintinia</i> A. DC.                   |                     | 2/20                 |
| Family Rosaceae                           | 1/100               | 3/3,000              |
| Genus <i>Pyrus</i> L.                     |                     | 3/30                 |
| Order Myrtales                            | 37/445              | 671/7,205            |
| Family Alzateaceae                        | 1/1                 | 1/1                  |
| Genus <i>Alzatea</i>                      |                     | 1/1                  |
| Family Myrtaceae                          | 2/140               | 7/3,000              |
| Genus <i>Mearnsia</i> Merr.               |                     | 4/7                  |
| <i>Metrosideros</i> Banks ex Gaertn.      |                     | 3/60                 |
| Family Onagraceae                         | 1/17                | 15/675               |
| Genus <i>Fuchsia</i>                      |                     | 15/100               |
| Family Melastomataceae                    | 33/180              | 648/4,770            |
| Genus <i>Adelobotrys</i> DC.              |                     | 21/25                |
| <i>Anerinckleistus</i> Korth.             |                     | 1/1                  |
| <i>Backeria</i> Bakh. f.                  |                     | 2/2                  |
| <i>Blakea</i> P. Br.                      |                     | 98/100               |
| <i>Calvoa</i> J. D. Hook                  |                     | 4/18                 |
| <i>Catanthera</i> F. Muell.               |                     | 16/16                |
| <i>Clidemia</i> D. Don                    |                     | 11/145               |
| <i>Creochiton</i> Bl.                     |                     | 4/6                  |
| <i>Dalenia</i> Korth.                     |                     | 2/2                  |
| <i>Dicellandra</i> J. D. Hook.            |                     | 1/3                  |
| <i>Diplectria</i> Reichb.                 |                     | 4/4                  |
| <i>Dissochaeta</i> Bl.                    |                     | 20/20                |
| <i>Graffenrieda</i> DC.                   |                     | 2/40                 |

10      **Epiphytism: a preliminary overview**

Table 1.1. (cont.)

| Taxa                                      | Genera <sup>a</sup> | Species <sup>a</sup> |
|-------------------------------------------|---------------------|----------------------|
| <i>Gravesia</i> Naud.                     |                     | 13/110               |
| <i>Hypenanthus</i> Bl.                    |                     | 4/4                  |
| <i>Kendrickia</i> J. D. Hook.             |                     | 1/1                  |
| <i>Leandra</i> Raddi                      |                     | 4/200                |
| <i>Macrolenes</i> Naud. ex Miq.           |                     | 20/20                |
| <i>Medinilla</i> Gaudich.                 |                     | 300/400              |
| <i>Miconia</i> Ruiz & Pav.                |                     | 11/1,000             |
| <i>Monolena</i> Triana                    |                     | 6/15                 |
| <i>Myrianthemum</i> Gilg                  |                     | 1/1                  |
| <i>Neodissochaeta</i> Bakh. f.            |                     | 10/10                |
| <i>Omphalopus</i> Naud.                   |                     | 1/1                  |
| <i>Ossaea</i> DC.                         |                     | 2/100                |
| <i>Pachycentria</i> Bl.                   |                     | 8/8                  |
| <i>Phainantha</i> Gleason                 |                     | 4/4                  |
| <i>Plethiandra</i> J. D. Hook.            |                     | 6/6                  |
| <i>Pleiochiton</i> Naud.                  |                     | 7/7                  |
| <i>Pogonantha</i> Bl.                     |                     | 1/1                  |
| <i>Preussiella</i> Gilg                   |                     | 2/2                  |
| <i>Topobea</i> Aubl.                      |                     | 59/60                |
| <i>Triolena</i> Naud.                     |                     | 2/18                 |
| Order Cornales                            | 1/16                | 3/140                |
| Family Cornaceae                          | 1/11                | 3/100                |
| Genus <i>Griselinia</i> G. Forst.         |                     | 3/6                  |
| Order Celastrales                         | 3/119               | 4/2,149              |
| Family Celastraceae                       | 2/50                | 3/800                |
| Genus <i>Euonymus</i> L.                  |                     | 2/175                |
| <i>Microtropis</i> Wall.                  |                     | 1/70                 |
| Family Aquifoliaceae                      | 1/4                 | 1/400                |
| Genus <i>Ilex</i> L.                      |                     | 1/400                |
| Order Rhamnales                           | 2/67                | 4/1,670              |
| Family Vitaceae                           | 2/11                | 4/700                |
| Genus <i>Pterisanthes</i> Bl.             |                     | 2/20                 |
| <i>Tetrastigma</i> Planch.                |                     | 2/90                 |
| Order Sapindales                          | 3/500               | 3/5,346              |
| Family Aceraceae                          | 1/2                 | 1/112                |
| Genus <i>Acer</i> L.                      |                     | 1/110                |
| Family Burseraceae                        | 1/18                | 1/600                |
| Genus <i>Dacryodes</i> Vahl               |                     | 1/50                 |
| Family Anacardiaceae                      | 1/70                | 1/600                |
| Genus <i>Spondias</i> L.                  |                     | 1/12                 |
| Order Geraniales                          | 1/25                | 5/2,154              |
| Family Balsaminaceae                      | 1/2                 | 5/451                |
| Genus <i>Impatiens</i> L.                 |                     | 5/450                |
| Order Apiales                             | 11/370              | 80/3,700             |
| Family Araliaceae                         | 9/70                | 78/700               |
| Genus <i>Didymopanax</i> Decne. & Planch. |                     | 1/40                 |
| <i>Motherwellia</i> F. Muell.             |                     | 1/1                  |
| <i>Oreopanax</i> Decne. & Planch.         |                     | 1/120                |
| <i>Pentapanax</i> Seem.                   |                     | 2/15                 |
| <i>Polyscias</i> J. R. & G. Forst         |                     | 5/80                 |
| <i>Pseudopanax</i> C. Koch                |                     | 2/6                  |