

# Occurrence of crassulacean acid metabolism in Colombian orchids determined by leaf carbon isotope ratios

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Many Orchidaceae, especially those occupying periodically dry, epiphytic microhabitats in the humid tropics, are believed to engage in the water-conserving crassulacean acid metabolism (CAM) photosynthetic pathway. However, the photosynthetic pathway has been studied in only *c.* 5% of all orchid species. Here we extend the survey to 1079 orchid species, mainly from Colombia, by assessing the presence of CAM based on the carbon isotopic signature ( $\delta^{13}\text{C}$  values) of herbarium specimens. Ninety-six species, representing 8.9% of those analysed, had  $\delta^{13}\text{C}$  values less negative than  $-20\%$ , indicating CAM. Epiphytism was the predominant life form (75.2% of species sampled), and 9.4% of these epiphytes showed a CAM-type isotopic signature. Isotope values suggested CAM in 19 terrestrial orchid species, 14 species from high elevation (2000–3400 m) and species from six genera that were previously unknown to engage in CAM (*Jacquinilla*, *Meiracyllium*, *Pabstiella*, *Psychopsis*, *Pterostemma* and *Solenidium*). We conclude that CAM is the major pathway of carbon acquisition in a small but broadly distributed fraction of tropical orchids and is more prevalent at lower elevations.

ADDITIONAL KEYWORDS: Andes – climate – Colombia –  $\delta^{13}\text{C}$  – epiphytes – Orchidaceae – photosynthetic pathway – WorldClim.

## INTRODUCTION

Orchidaceae are one of the two largest families of vascular plants, with 899 genera and 30 105 species worldwide (<http://plantsoftheworldonline.org>, 2019), and represent *c.* 8% of all vascular plant species. Orchids are especially known for their spectacular floral diversity and intricate adaptations to pollinators (Nilson, 1992; Cozzolino & Widmer, 2005; Gaskett, 2011). Orchids are also an outstanding example of adaptive radiation (Chase *et al.*, 2003), with species occupying distinct habitats and showing different growth forms, including soil-rooted terrestrial plants, lithophytic and epiphytic species that live independently of soil. Orchids are cosmopolitan in distribution and most diverse in the tropics, where they are typically found as epiphytes (Chase *et al.*,

2003, 2015; Cribb *et al.*, 2003, Cribb & Govaerts, 2005, Christenhusz & Byng, 2016). Orchids occur in a wide range of habitats, from wet tropical forest to dry forest, from sea level to elevations approaching 5000 m and from cool to hot biomes, although their distribution varies greatly among continents (Cribb *et al.*, 2003, Cribb & Govaerts, 2005). New species of orchids are described every year, especially in the remote tropical biodiversity hotspots of the world (Joppa *et al.*, 2011).

The water-conserving CAM pathway has been estimated to occur in *c.* 7% of all vascular plant species and has been demonstrated in *c.* 400 genera in 35 families (Winter & Smith, 1996; Holtum *et al.*, 2007; Winter, Holtum & Smith, 2015). Improving estimates of the number of CAM species requires detailed screening of species-rich families with large expected numbers of CAM species, such as Orchidaceae, and from regions of the world where orchids are highly diverse, such as the Andes of Colombia. It is currently estimated that up to

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50% of Neotropical orchid species show some degree of CAM (Silvera, Santiago & Winter, 2005; Silvera *et al.*, 2010), although only *c.* 5% of orchids worldwide have been screened for the presence of CAM, by stable carbon isotope composition, titratable acidity or CO<sub>2</sub> gas exchange.

In this study, we surveyed the orchid flora of Colombia for the occurrence of CAM using the leaf carbon isotopic signature ( $\delta^{13}\text{C}$  value) of herbarium specimens. Colombia is home to an estimated 4270 orchid species from *c.* 274 genera, representing *c.* 15% of the total number of orchid species. Moreover, *c.* 1572 orchid species in Colombia are considered endemic (Betancur *et al.*, 2015), and nearly 10% of orchid species in Colombia are under threat of extinction (Calderón-Sáenz, 2006). The rise of the Andes during the Cenozoic (van der Hammen & Hooghiemstra, 2001) resulted in a variety of ecosystems and climate zones, offering a unique opportunity to explore patterns of CAM distribution in relation to microclimate and habitat. In particular, Colombian orchid species span a wide range of climatic zones and biomes, from sea level to nearly 4000 m in the Andean summits, including lowland wet and dry forests, cloud forests and paramos. Colombia has two recognized hotspots of biological diversity, the tropical Andes with 20 000 endemic plant species and the Chocó/Darién region with 2250 endemic species (Myers *et al.*, 2000). Building on a previous isotopic survey of 1002 orchid species from Panama and Costa Rica (Silvera *et al.*, 2010), we ask how CAM is distributed across orchids of Colombia and whether CAM occurs at sites of high orchid diversity in the Andes. Finally, we provide further clues on the relationships between CAM occurrence, biogeography and climate and their role in orchid diversification.

## MATERIAL AND METHODS

### SITE DESCRIPTION

The Andes of South America harbour a large proportion of the world's plant species (Myers *et al.*, 2000; Pérez-Escobar *et al.*, 2017), with orchids being one of the most diverse plant groups (Gentry & Dodson, 1987). The Andes of Colombia and Ecuador are the richest in orchid species (Cribb *et al.*, 2003). In the northern Andes, > 50% of all vascular epiphytic species are orchids (Pérez-Escobar *et al.*, 2017), many of which are endemic (Cribb & Govaerts, 2005).

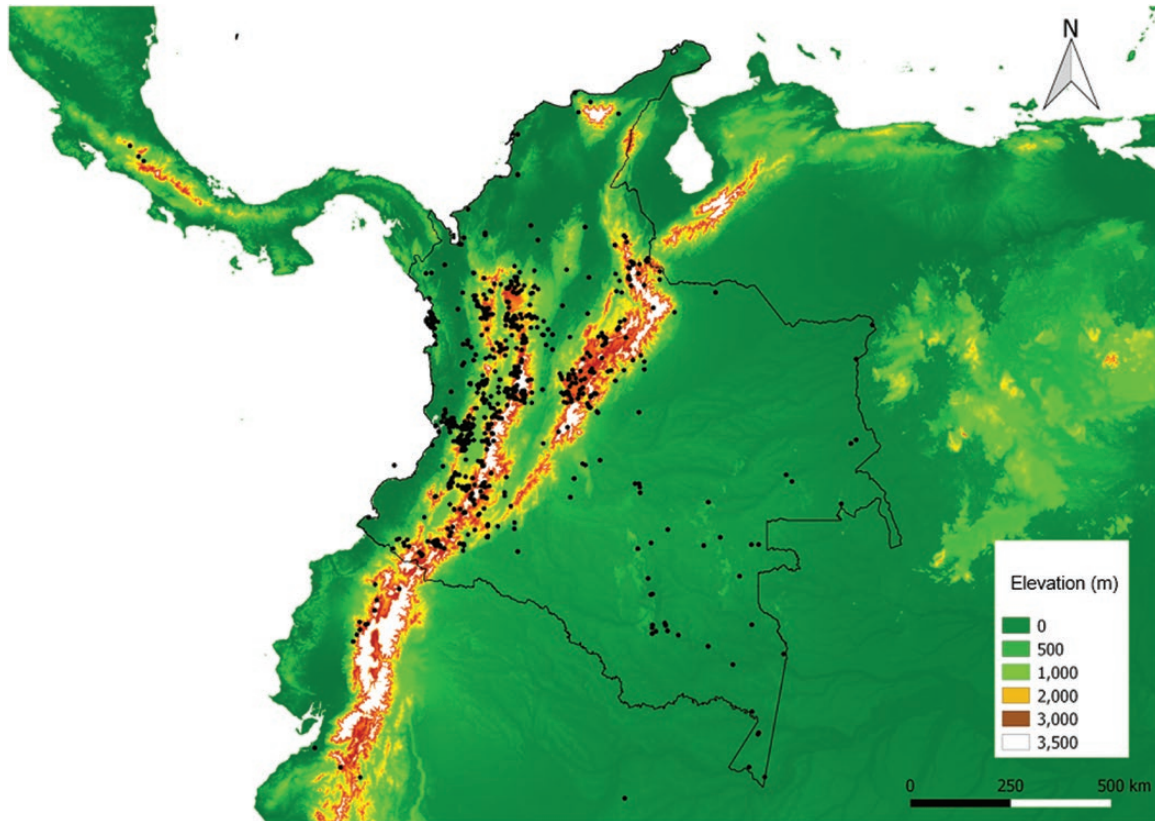
In Colombia, three Andean mountain ranges split the country into a series of plains and valleys. Abrupt changes in habitats occur in response to elevational changes in temperature, solar radiation, soil characteristics and precipitation. Vegetation

types change accordingly, from tropical lowland forest to cloud forest and paramo (a cold high-elevation grassland and wetland ecosystem with high diversity) (Cleef, 2005). The Caribbean region includes patches of dry forest, including the isolated massif of the Sierra Nevada de Santa Marta at 5700 m elevation, which hosts ecosystems that range from xeric at the base and cold and snowy at the top. The Pacific region is, in contrast, one of the wettest regions of the world, with up to 12 m of rainfall annually, and it hosts one of the most diverse forests of the tropics in the Chocó region. Finally, towards the east, close to the border with Venezuela, an extensive grassland known as Llanos is intermingled with seasonally inundated forest along the Orinoco River basin and the Amazon forest and other seasonally inundated tropical forests in the southeast. In this study, we surveyed herbarium specimens from orchid species corresponding to all these ecosystems (Fig. 1).

### SPECIES SAMPLING

To assess the relative abundance and distribution of C<sub>3</sub> and CAM photosynthesis in orchids from Colombia we measured foliar  $\delta^{13}\text{C}$  of 1192 herbarium specimens. Specimens included 178 genera and 1079 orchid species (excluding duplicates). These included 1056 species from Colombia and 23 species from other countries, including Ecuador (14), Bolivia (three), El Salvador (one), Costa Rica (four) and Brazil (one). The complete list of taxa, taxonomic authority, accession and voucher details, carbon isotope ratio and ecological information are provided in Table 1.

Leaf samples were obtained from 18 Colombian herbaria: Andes Herbarium (ANDES), Universidad de Antioquia Herbarium (HUA), Federico Medem Bogotá Herbarium (FMB), Pontificia Universidad Javeriana Herbarium (HPUJ), Joaquín Antonio Uribe Botanical Garden Herbarium (JAUM), Luis Sigifredo Espinal Tascón Herbarium (CUVC), Universidad del Cauca Herbarium (CAUP), Universidad del Tolima Herbarium Dendrology section (TOLI)/Dendrology sec), Universidad del Tolima General Herbarium (TOLI), José Cuatrecasas Arumi Valle Herbarium (VALLE), Universidad de Caldas Herbarium (FAUC), Universidad del Quindío Herbarium (HUQ), Colombian Amazonian Herbarium (COAH), Chocó Herbarium (CHOCÓ), Juan María Céspedes Botanical Garden Herbarium (TULV), Guillermo Piñeres Botanical Garden Foundation Herbarium (JBGP), Llanos Herbarium (LLANOS) and the personal collection of R. T. González (Pers. Coll. Univer. del Pacífico) and Pablo Stevenson (ANDES/P. stevenson Coll.). Because we sampled all orchid species available at each herbarium, certain



**Figure 1.** Geographical locations for 1079 orchid species from 1192 samples analysed in this study. Data points were provided from samples with sufficient georeferenced information.

genera were over-represented (e.g. *Epidendrum* L.). Likewise, species from tropical cloud and rainforests with greater species richness were particularly abundant in our analysis. Some geographical regions in Colombia are not well represented in herbaria collections, such as Orinoquia, Amazonas and the Atlantic coast (Fig. 1).

From each herbarium specimen *c.* 5 mg of mature dry leaf tissue from the leaf lamina was taken for carbon isotope determination. Only mature leaves were collected to reduce the variability of  $\delta^{13}\text{C}$  values associated with leaf developmental stage (Cernusak *et al.*, 2009). For each sample, we recorded collection number, herbarium code, geographical coordinates, elevation, growth form (epiphyte, lithophyte or terrestrial) and collection locality. We followed nomenclatural changes from The Plant List (<http://www.theplantlist.org/>) and provide in parentheses the name originally recorded in the herbarium specimens where these are now considered synonyms. We also included in the species count samples of uncertain taxonomic status, labelled 'cf.' and 'aff.'. Species with a name that has not been validly published yet are included with an asterisk in Table 1. Species classification into subfamilies,

tribes and subtribes of Orchidaceae followed the classification schemes of Chase *et al.* (2015) and Freudenstein & Chase (2015). Abbreviations for authorities follow The International Plant Names Index (IPNI) (2012).

#### CARBON ISOTOPE ANALYSIS

From each herbarium sample, the  $^{13}\text{C}:^{12}\text{C}$  ratio was determined by isotope ratio mass spectrometry at the Smithsonian Tropical Research Institute using a Flash HT elemental analyser coupled to a Delta V Isotope Ratio spectrometer through a ConFlo III interface (Thermo Scientific, Bremen, Germany), with a precision of  $\pm 0.02\text{‰}$ . Isotopic signature ( $\delta^{13}\text{C}$ ) was calculated relative to the internationally accepted standard Vienna Pee Dee Belemnite (VPDB) from *Belemnitella americana* (Cernusak *et al.*, 2013; Crayn *et al.*, 2015) using the formula:

$$\delta^{13}\text{C} (\text{‰}) = \left[ \frac{(^{13}\text{C}/^{12}\text{C} \text{ sample})}{(^{13}\text{C}/^{12}\text{C} \text{ standard})} - 1 \right] \times 1000$$

Plants were classified as  $\text{C}_3$  if their isotopic values were more negative than  $-20\text{‰}$  and as CAM if

**Table 1.**  $\delta^{13}\text{C}$  values for 1079 orchid species from 1192 herbarium specimens comprising 1056 species from Colombia and 23 species from Ecuador, Bolivia, El Salvador, Costa Rica and Brazil. Elevation and growth form (G) are provided from information extracted from the herbarium sheet label. E refers to epiphytes, T to terrestrial forms and L to lithophytes. Country is indicated next to the herbarium acronyms only for samples collected outside of Colombia. Number of species for each genus is provided in parentheses, followed by the number of species with CAM-type isotopic signatures ( $\delta^{13}\text{C}$  values less negative than  $-20\%$ ) over the total number of species analysed and by the percentage of species with CAM-type isotopic signatures for that taxon based on our survey.

Taxon	Accession/Voucher details‡	$\delta^{13}\text{C}$ (‰)	G	Elevation (m)
<b>ORCHIDACEAE</b>				
<b>SUBFAMILY CYPRIPEIDIOIDEAE</b>				
<b><i>Cypripedium</i> L. (61; 0/1 = 0%)</b>				
<i>C. acaule</i> Aiton (= <i>Fissipes acaulis</i> (Aiton) Small)	MOH 1 (JAUM)	-27.1		
<b><i>Paphiopedilum</i> Pfitzer (139; 0/1 = 0%)</b>				
<i>P. insigne</i> (Wall. ex Lindl.) Pfitzer	J. F. Restrepo 997 (CAUP)	-25.6	E	1884
<b><i>Phragmipedium</i> Rolfe (25; 0/3 = 0%)</b>				
<i>P. andreettae</i> P.J.Cribb & Pupulin	J. F. Restrepo 609 (CAUP)	-31.0	E	1000
<i>P. longifolium</i> (Rchb.f. & Warsz.) Rolfe	B. R. Ramírez & D. Macías 18477 (CUVC)	-31.1	T	175
<i>P. schlimii</i> (Rchb.f.) Rolfe	J. Betancur, <i>et al.</i> 12730 (CUVC)	-30.9	T	1709
<b><i>Selenipedium</i> Rchb.f. (5; 0/1 = 0%)</b>				
<i>S. chica</i> Rchb.f.	N. Pino, <i>et al.</i> 112 (CHOCO)	-30.5	T	85
<b>SUBFAMILY EPIDENDROIDEAE</b>				
<b>Subtribe Coelogyninae (0/2 = 0%)</b>				
<b><i>Coelogyne</i> Lindl. (198; 0/1 = 0%)</b>				
<i>C. cristata</i> Lindl.	J. F. Restrepo 479 (CAUP)	-27.5	E	1884
<b>Tribe Arethuseae</b>				
<b>Subtribe Arethuseae</b>				
<b><i>Arundina</i> Blume (2; 0/1 = 0%)</b>				
<i>A. graminifolia</i> (D.Don) Hochr.	B.R. Ramírez, <i>et al.</i> 12461 (FMB)	-27.5	T	100
<b>Tribe Collabieae</b>				
<b><i>Spathoglottis</i> (48; 0/1 = 0%)</b>				
<i>S. plicata</i> Blume	L. F. Rojas & C. Rojas 9 (LLANOS)	-31.0	T	593
<b>Tribe Cymbidieae</b>				
<b>Subtribe Catasetinae</b>				
<b><i>Catasetum</i> Rich. ex Kunth (187; 0/6 = 0%)</b>				
<i>C. bicolor</i> Klotzsch	M. Ospina 157 (JAUM)	-29.8	E	27
<i>C. aff. callosum</i> Lindl.	L. F. Rojas & C. Rojas 7 (LLANOS)	-30.3	E	593
<i>C. discolor</i> Lindl.	M. V. Arbeláez & F. Suerogue 238 (HUA)	-31.4	E	225
<i>C. ochraceum</i> Lindl.	V. Londoño, <i>et al.</i> 70 (CUVC)	-22.9	T	1145
<i>C. tabulare</i> Lindl.	L. F. Prado & J. Contreras 323 (FMB)	-27.5	E	200
<i>C. aff. viridiflavum</i> Hook.	D. Cárdenas 1803 (JAUM)	-30.3	E	175
<b><i>Clowesia</i> Lindl. (8; 0/1 = 0%)</b>				
<i>C. warczewitzii</i> (Lindl. & Paxton) Dodson	N. Pino, <i>et al.</i> 581 (CHOCO)	-27.3	E	285
<b><i>Cycnoches</i> Lindl. (34; 0/2 = 0%)</b>				
<i>C. aff. chlorochilon</i> Klotzsch	J. Brand & A. Cogollo 96 (JAUM)	-29.8	E	80
<i>C. densiflorum</i> Rolfe	P. Ortiz-Valdivieso & S. Restrepo 588 (HPUJ)	-31.3	E	1500
<b><i>Galeandra</i> Lindl. (38; 0/4 = 0%)</b>				
<i>G. baueri</i> Lindl. (= <i>Galeandra cristata</i> Lindl.)	Anon. <i>s.n.</i> (JAUM)	-26.7		
<i>G. beyrichii</i> Rchb.f.	M. Rincón 1205 (TOLI)	-31.1	T	801
<i>G. devoniana</i> Schomb. ex Lindl.	A. Rudas, <i>et al.</i> 7180 (COAH)	-28.2	T	80
<i>G. dives</i> Rchb.f. & Warsz.	J. A. Sánchez 1132 (TOLI)	-31.8	E	230
<b>Subtribe Coeliopsidinae</b>				
<b><i>Peristeria</i> Hook. (13; 0/1 = 0%)</b>				



Table 1. Continued

Taxon	Accession/Voucher details‡	$\delta^{13}\text{C}$ (‰)	G	Elevation (m)
<i>P. elata</i> Hook.	J. P. Tobón 1353 (JAUM)	-29.2	T	1600
<b>Subtribe Cymbidiinae</b>				
<b>Cymbidium Sw. (79; 0/1 = 0%)</b>				
<i>C. sp.</i>	C. Barbosa 1762 (FMB)	-29.4	T	957
<b>Subtribe Cyrtopodiinae</b>				
<b>Cyrtopodium R.Br. (48; 0/3 = 0%)</b>				
<i>C. andersonii</i> (Lamb. ex Andrews) R.Br. in W.T.Aiton	D. Cárdenas, <i>et al.</i> 6541 (COAH)	-26.9	L	399
<i>C. cristatum</i> Lindl.	J. Zarucchi & C. Barbosa 3638 (FMB)	-29.2	T	90
<i>C. paniculatum</i> (Ruiz & Pav.) Garay	A. Niessen & O. De La Roque <i>s.n.</i> (CUVC)	-25.2	L	
<b>Subtribe Eriopsidinae</b>				
<b>Eriopsis Lindl. (5; 0/2 = 0%)</b>				
<i>E. biloba</i> Lindl.	M. V. Arbeláez & F. Sueroque 172 (COAH)	-27.9	E	225
<i>E. sp.</i>	C. Barbosa 7631 (313) (FMB)	-25.5	E	463
<b>Subtribe Eulophiinae</b>				
<b>Eulophia R.Br. (206; 0/1 = 0%)</b>				
<i>E. alta</i> Fawc. & Rendle	P. Stevenson 1903 (ANDES/P. stevenson Coll.)	-31.7	T	350
<b>Oeceoclades Lindl. (37; 1/1 = 100%)</b>				
<i>O. maculata</i> (Lindl.) Lindl.	D. Tuberquía, <i>et al.</i> 2109 (HUA)	-16.2	T	920
<b>Subtribe Maxillariinae</b>				
<b>Anguloa Ruiz &amp; Pav. (13; 0/5 = 0%)</b>				
<i>A. clowesii</i> Lindl.	G. I. Alzate & J. M. Estrada 12 (FAUC)	-26.5	E	2150
<i>A. dubia</i> Rchb.f.	E. Domínguez & N. Urán 32 (JAUM)	-27.0	E	2000
<i>A. uniflora</i> Ruiz & Pav.	J. F. Restrepo 994 (CAUP)	-27.6	E	1884
<i>A. virginalis</i> Linden ex Schltr.	J. F. Restrepo 995 (CAUP)	-26.9	E	1500
<i>A. xruckeri</i> Lindl.	J. F. Restrepo 996 (CAUP)	-25.8	E	1884
<b>Bifrenaria Lindl. (21; 0/1 = 0%)</b>				
<i>B. longicornis</i> Lindl. [= <i>Adipe longicornis</i> (Lindl.) M. Wolff]	M. Córdoba, <i>et al.</i> 2133 (FMB)	-30.7	E	200
<i>B. longicornis</i> Lindl.	O. Mohr & M. Sosa 15 (COAH)	-31.5	E	108
<b>Camariidium Lindl. (81; 0/5 = 0%)</b>				
<i>C. bracteatum</i> Schltr. [= <i>Maxillaria bracteata</i> (Schltr.) Ames & Correll]	K. Barringer & J. Utlej 3382A (HUA) Costa Rica	-22.7	E	1768
<i>C. carinulatum</i> (Rchb.f.) M.A. Blanco (= <i>Maxillaria carinulata</i> Rchb.f.)	G. M. Urreta 274b (HPUJ)	-27.1	E	1100
<i>C. exaltatum</i> Kraenzl. [= <i>Maxillaria exaltata</i> (Kraenzl.) C. Schweinf.]	P. Ortiz-Valdivieso 4172 (HPUJ)	-29.7	E	400
<i>C. ochroleucum</i> Lindl.	J. Betancur, <i>et al.</i> 5390 (COAH)	-33.3	E	1585
<i>C. ochroleucum</i> Lindl. (= <i>Maxillaria camaridii</i> Rchb.f.)	P. Stevenson 2170 (ANDES/P. stevenson Coll.)	-28.3	E	350
<i>C. vestitum</i> (Sw.) Lindl. [= <i>Maxillaria parviflora</i> (Poepp. & Endl.) Garay]	G. M. Urreta 159 (HUA)	-26.0	E	100
<i>C. vestitum</i> (Sw.) Lindl. [= <i>Maxillaria conferta</i> (Griseb.) C. Schweinf. ex León]	G. M. Urreta 159 (JAUM)	-26.1	E	100
<b>Christensonella Szlach., Mytnik, Górnjak &amp; Śmiszek (16; 0/1 = 0%)</b>				
<i>C. uncatata</i> (Lindl.) Szlach., Mytnik, Górnjak & Śmiszek	R. Callejas, <i>et al.</i> 5242 (HUA)	-32.1	E	360

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>C. uncata</i> (Lindl.) Szlach, Mytnik, Górniak & Śmiszek (= <i>Maxillaria uncata</i> Lindl.)	G. M. Urreta 155 (HUA)	-28.9	E	75
<b><i>Cryptocentrum</i> Benth. (20; 0/8 = 0%)</b>				
<i>C. flavum</i> Schltr.	L. P. Botero & G. E. Páez 49 (TOLI)	-27.1	E	80
<i>C. gracillimum</i> Ames & C.Schweinf.	G. Bolaños & M. Rada 1 (TOLI)	-24.5	E	1519
<i>C. latifolium</i> Schltr.	O. Pérez & E. Parra 151 (CUVC)	-26.9	E	1600
<i>C. lehmannii</i> (Rchb.f.) Garay	A. Cogollo & J. G. Ramírez 3244 (JAUM)	-27.9	E	832.5
<i>C. aff. peruvianum</i> (Cogn.) C. Schweinf. (= <i>C. aff. hoppi</i> Schltr.)	O. Pérez & E. Parra 793 (CUVC)	-34.2	E	1900
<i>C. standleyi</i> Ames	O. Pérez, <i>et al.</i> 376 (VALLE)	-29.8	E	150
<i>C. sp1.</i>	H. Mendoza, <i>et al.</i> 7453 (FMB)	-26.3	E	2000
<i>C. sp2.</i>	M. Rincón 142 ((TOLI)/Dendrology sec.)	-30.0	E	100
<b><i>Cyrtidiorchis</i> Rauschert (5; 0/2 = 0%)</b>				
<i>C. frontinoensis</i> (Garay) Rauschert	L. Rodríguez, <i>et al.</i> 39 (VALLE)	-29.0	E	1500
<i>C. rhomboglossa</i> (F.Lehm. & Kraenzl.) Rauscher	S. Espinal & J. E Ramos 2902 (CUVC)	-25.1	E	1750
<b><i>Heterotaxis</i> Lindl. (14; 1/3 = 33.3%)</b>				
<i>H. discolor</i> (Lodd. ex Lindl.) Ojeda & Carnevali (= <i>Maxillaria discolor</i> Rchb.)	G. M. Urreta 158b (HPUJ)	-31.6	E	50
<i>H. equitans</i> (Schltr.) Ojeda & Carnevali	P. Silverstone & N. Paz 3228 (CUVC)	-13.9	E	950
<i>H. equitans</i> (Schltr.) Ojeda & Carnevali [= <i>Maxillaria equitans</i> (Schltr.) Garay]	J. Cano <i>s.n.</i> (JAUM)	-14.9	E	224
<i>H. villosa</i> (Barb.Rodr.) F.Barros	M. P. Galeano, <i>et al.</i> 514 (COAH)	-33.4	E	185
<b><i>Hylaeorchis</i> Carnevali &amp; G.A.Romero (1; 0/1 = 0%)</b>				
<i>H. petiolaris</i> (Schltr.) Carnevali & G.A.Romero [= <i>Bifrenaria rudolfii</i> (Hoehne) Carnevali & G.A.Romero]	S. Madriñan & C. E. Barbosa 924 (FMB)	-35.6	E	200
<b><i>Inti</i> M.A.Blanco (2; 0/2 = 0%)</b>				
<i>I. bicallosa</i> (Rchb.f.) M.A.Blanco [= <i>Maxillaria bicallosa</i> (Rchb.f.) Garay]	G. M. Urreta 157c (HPUJ)	-23.9	E	70
<i>I. chartacifolia</i> (Ames & C.Schweinf.) M.A.Blanco (= <i>Maxillaria chartacifolia</i> Ames & C.Schweinf.)	G. M. Urreta 282B (HPUJ)	-25.7	E	50
<b><i>Lycaste</i> Lindl. (45; 0/4 = 0%)</b>				
<i>L. macrophylla</i> Lindl.	M. de Fraume 12 (FAUC)	-26.4	T	2103
<i>L. xniesseniae</i> Oakeley	J. F. Restrepo 628 (CAUP)	-27.6	E	1884
<i>L. schilleriana</i> Rchb.f.	J. F. Restrepo 455 (CAUP)	-26.3	E	1884
<i>L. xytriophora</i> Linden & Rchb.f.	J. F. Restrepo 630 (CAUP)	-27.3	E	1884
<b><i>Mapinguari</i> Carnevali &amp; R.B.Singer (5; 0/1 = 0%)</b>				
<i>M. neophyllus</i> (Rchb.f.) Baumbach (= <i>Maxillaria neophylla</i> Rchb.f.)	D. Benítez & G. Londoño 413 (JAUM)	-27.7	E	2670
<b><i>Maxillaria</i> Ruiz &amp; Pav. (320; 0/39 = 0%)</b>				
<i>M. aequiloba</i> Schltr.	H. C. Vera 3 (CUVC)	-28.4	E	1930
<i>M. amesiana</i> Mast.	P. Ortiz-Valdivieso 447 (HPUJ)	-24.3	E	1800
<i>M. anatomorum</i> Rchb.f.	J. S. García-Revelo & A. D. García-Ramírez 20 (CUVC)	-34.2	E	2212
<i>M. cf. atrorubens</i> *	P. Silverstone-Sopkin, <i>et al.</i> 3931 (CUVC)	-23.8	E	2424
<i>M. brachybulbon</i> Schltr.	G. M. Urreta 152A (HPUJ)	-31.7	E	100
<i>M. cauae</i> Garay	J. F. Restrepo 336 (CAUP)	-27.6	E	1400
<i>M. caulina</i> Schltr.	P. A. Silverstone, <i>et al.</i> 4349 (CUVC)	-28.9	E	2525

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>M. ecuadorensis</i> Schltr.	D. A. García-Ramírez & J. S. García-Revelo 66 (CUVC)	-33.6	E	2099
<i>M. embreei</i> Dodson	R. Callejas 7188 (HUA)	-26.4	E	1850
<i>M. cf. embreei</i> Dodson	L. A. de Escobar, <i>et al.</i> 8648 (HUA)	-29.3	T	1700
<i>M. fletcheriana</i> Rolfe	J. F. Restrepo 472 (CAUP)	-27.9	E	1884
<i>M. floribunda</i> Lindl.	B. E. Salgado-Negret 89 (CAUP)	-27.8	E	2500
<i>M. fractiflexa</i> Rchb.f.	J. Betancur, <i>et al.</i> 12718 (CUVC)	-29.6	T	2200
<i>M. grandiflora</i> Lindl.	C. Acevedo, <i>et al.</i> 2939 (FMB)	-30.9	T	2600
<i>M. hennisiana</i> Schltr.	E. P. Killip & J. Cuatrecasas 38950 (VALLE)	-30.6	E	0
<i>M. langlassei</i> Schltr.	D. A. García-Ramírez & J. S. García-Revelo 22 (CUVC)	-31.9	E	1605
<i>M. lepidota</i> Lindl.	J. L. Zarucchi, <i>et al.</i> 5640 (HUA)	-31.3	E	1830
<i>M. aff. longicaulis</i> Schltr.	O. Pérez, <i>et al.</i> 1004 (CUVC)	-27.9	E	1800
<i>M. longipetala</i> Ruiz & Pav. [= <i>Lycaste longipetala</i> (Ruiz & Pav.) Garay]	C. Berrio, <i>et al.</i> 48 (HUQ)	-31.5	T	2870
<i>M. cf. longissima</i> Lindl.	P. A. Silverstone, <i>et al.</i> 2865 (CUVC)	-32.7	E	2310
<i>M. luteoalba</i> Lindl.	Y. Rueda-Valoyes & J. García-Arias 9 (CHOCO)	-29.4	T	86.9
<i>M. marmoliana</i> Dodson	Mejía-Rosero & Pino-Andrade 28 (CHOCO)	-28.4	E	44
<i>M. meridensis</i> Lindl.	R. Callejas & M. V Arbeláez 9597 (HUA)	-28.1	T	1800
<i>M. nanegalensis</i> Rchb.f.	D. A. García-Ramírez 84 (CUVC)	-28.5	E	2186
<i>M. nigropunctata</i> *	J. F. Restrepo 623 (CAUP)	-26.7	E	1884
<i>M. parkeri</i> Hook.	R. Arévalo 325 (COAH)	-31.9	E	500
<i>M. pentura</i> Lindl.	MOH 73 (JAUM)	-27.6	T	1900
<i>M. pleiantha</i> Schltr.	P. Ortiz-Valdivieso 4339 (HPUJ)	-25.9		
<i>M. pleuranthoides</i> (Schltr.) Garay	B. R. Ramírez 7513 (CAUP)	-28.4	T	3100
<i>M. porrecta</i> Lindl.	D. Cárdenas, <i>et al.</i> 13315 (COAH)	-32.3	E	350
<i>M. porrecta</i> Lindl. (= <i>M. brunnea</i> Linden & Rchb.f.)	J. S. García-Revelo & A. D. García-Ramírez 46 (CUVC)	-30.9	E	2072
<i>M. pseudoreichenheimiana</i> Dodson	A.H. Gentry, <i>et al.</i> 47814 (CUVC)	-30.4	E	100
<i>M. reichenheimiana</i> Rchb.f.	J. F. Restrepo 622 (CAUP)	-31.1	E	1884
<i>M. ringens</i> Rchb.f.	J. F. Restrepo & N. Erazo 170 (CAUP)	-35.7	E	1750
<i>M. cf. rodrigueziana</i> J.T.Atwood & Mora-Ret.	P. Silverstone-Sopkin, <i>et al.</i> 3850 (CUVC)	-30.7	T	2070
<i>M. rotundilabia</i> C.Schweinf.	V. H. Grande, <i>et al.</i> 122 (HUQ)	-31.9	E	3160
<i>M. setigera</i> Lindl.	L. Rodríguez 70 (CUVC)	-31.1	E	700
<i>M. setigera</i> Lindl. (= <i>M. leptosepala</i> Hook.)	Mejía-Rosero & Pino-Andrade 9 (CHOCO)	-30.5	E	0
<i>M. speciosa</i> Rchb.f.	T. B. Croat 56721 (JAUM)	-26.2	T	1960
<i>M. subulifolia</i> Schltr.	J. Betancur, <i>et al.</i> 13073 (HUA)	-27.2	E	1600
<i>M. triloris</i> É.Morren	J. A. Echeverri-Garzón 12 (FAUC)	-26.8	E	3100
<b>Maxillariella</b> M.A.Blanco & Carnevali (45; 0/9 = 0%)				
<i>M. cf. alba</i> (Hook.) M.A.Blanco & Carnevali [= <i>Maxillaria cf. alba</i> (Hook.) Lindl.]	N. F. Alzate 401 (CUVC)	-29.2	E	1800
<i>M. arbuscula</i> (Lindl.) M.A.Blanco & Carnevali (= <i>Maxillaria arbuscula</i> Rchb.f.)	J. F. Restrepo 304 (CAUP)	-29.3	E	1700
<i>M. cassapensis</i> (Rchb.f.) M.A.Blanco & Carnevali (= <i>Maxillaria ramosa</i> Ruiz & Pav.)	N. H. Ospina-Calderón 305 (CUVC)	-32.7	E	1537
<i>M. graminifolia</i> (Kunth) M.A.Blanco & Carnevali (= <i>Maxillaria graminifolia</i> Rchb.f.)	MOH s.n. (JAUM)	-28.9	E	2421

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>M. guareimensis</i> (Rchb.f.) M.A.Blanco & Carnevali (= <i>Maxillaria guareimensis</i> Rchb.f.)	P. Viveros, <i>et al.</i> 106 (HUQ)	-35.3	E	1100
<i>M. cf. infausta</i> (Rchb.f.) M.A.Blanco & Carnevali (= <i>Maxillaria cf. infausta</i> Rchb.f.)	J. Cuatrecasas 14903 (VALLE)	-29.5	E	1011
<i>M. lawrenceana</i> (Rolfe) M.A.Blanco & Carnevali [= <i>Maxillaria lawrenceana</i> (Rolfe) Garay & Dunst. in Dunst. & Garay]	O. Meneses, <i>et al.</i> 346 (CUVC)	-26.7	E	1230
<i>M. procurrens</i> (Lindl.) M.A.Blanco & Carnevali (= <i>Maxillaria procurrens</i> Lindl.)	P. Viveros, <i>et al.</i> 28 (HUQ)	-29.8	E	1650
<i>M. spilotantha</i> (Rchb.f.) M.A.Blanco & Carnevali	M. Rincón 380 ((TOLI)/Dendrology sec.)	-32.2	E	2580
<b><i>Mormolyca</i> Fenzl (23; 0/6 = 0%)</b>				
<i>M. acutifolia</i> (Lindl.) M.A.Blanco (= <i>Maxillaria acutifolia</i> Lindl.)	G. M. Urreta 171b (HPUJ)	-29.5	E	50
<i>M. cf. hedwigiae</i> (Hamer & Dodson) M.A.Blanco (= <i>Maxillaria cf. hedwigiae</i> Hamer & Dodson)	O. Pérez & M. Kolanowska 1052 (VALLE)	-30.7	E	100
<i>M. lehmanii</i> (Rolfe) M.A.Blanco (= <i>Chrysocycnis lehmanii</i> Rolfe)	J. E. Ramos 5837 (CUVC)	-25.6	E	2200
<i>M. rufescens</i> (Lindl.) M.A.Blanco (= <i>Maxillaria rufescens</i> Lindl.)	J. Cuatrecasas 15707 (VALLE)	-29.8	E	27.5
<i>M. schlimii</i> (Linden & Rchb.f.) M.A.Blanco (= <i>Chrysocycnis schlimii</i> Linden & Rchb.f.)	M. Ospina 704 (JAUM)	-26.5	E	2085
<i>M. tenuibulba</i> (Christenson) M.A.Blanco (= <i>Maxillaria tenuibulba</i> Christenson)	J. A. Vargas-Figueroa 161 (CUVC)	-30.2	E	1807
<b><i>Neomoorea</i> Rolfe (1; 0/1 = 0%)</b>				
<i>N. sp.</i>	H. Mendoza, <i>et al.</i> 10283 (FMB)	-31.7	E	350
<b><i>Ornithidium</i> Salisb. ex R.Br. (54; 0/12 = 0%)</b>				
<i>O. adendrobium</i> (Rchb.f.) M.A.Blanco & Ojeda (= <i>Maxillaria adendrobium</i> (Rchb.f.) Dressler)	P. Ortiz-Valdivieso 4315 (HPUJ)	-29.7	E	1300
<i>O. affine</i> (Poepp. & Endl.) M.A.Blanco & Ojeda	C. Londoño, <i>et al.</i> 1153 (COAH)	-31.5	E	250
<i>O. aggregatum</i> Rchb.f. (= <i>Maxillaria aggregata</i> Lindl.)	C. Barbosa 2859 (FMB)	-30.4	E	3211
<i>O. cf. aggregatum</i> Rchb.f.	P. Stevenson, <i>et al.</i> 3288 (ANDES/P. stevenson Coll.)	-28.9	E	1900
<i>O. aureum</i> Poepp. & Endl.	W. Devia, <i>et al.</i> 4101 (TULV)	-26.9	E	250
<i>O. aureum</i> Poepp. & Endl. [= <i>Maxillaria aurea</i> (Poepp. & Endl.) L.O.Williams]	F. González 324 (FMB)	-26.8	T	2398
<i>O. cf. fulgens</i> Rchb.f. [= <i>Maxillaria cf. fulgens</i> (Rchb.f.) L.O.Williams]	P. A. Morales, <i>et al.</i> 654 (HUA)	-30.0	T	2454
<i>O. montezumae</i> Arévalo & Christenson	D. A. García-Ramírez 134 (CUVC)	-29.7	T	2200
<i>O. nubigenum</i> Rchb.f. [= <i>Maxillaria nubigena</i> (Rchb.f. ex Walp) C.Schweinf.]	B. R. Ramírez, <i>et al.</i> 14978 (FMB)	-27.0	E	2000
<i>O. pastoense</i> Schltr. (= <i>Maxillaria deuteropastensis</i> P.Ortiz)	E. Rentería, <i>et al.</i> 3848 (JAUM)	-29.7	T	1300
<i>O. pendens</i> (Pabst) Senghas (= <i>Maxillaria pendens</i> Pabst)	P. Ortiz-Valdivieso 121 (HPUJ)	-26.9	E	1700
<i>O. pendulum</i> (Poepp. & Endl.) Cogn. [= <i>Maxillaria pendula</i> (Poepp. & Endl.) C.Schweinf.]	P. Ortiz-Valdivieso 292 (HPUJ)	-22.5		
<i>O. serrulatum</i> Lindl. (= <i>Maxillaria alticola</i> C.Schweinf.)	J. L. Zarucchi & F. J. Roldán 7280 (HUA)	-27.0	T	2300
<b><i>Pityphyllum</i> Schltr. (5; 0/1 = 0%)</b>				
<i>P. laricinum</i> (Kraenzl.) Schltr.	J. Betancur, <i>et al.</i> 5173 (COAH)	-31.0	E	1400
<i>P. laricinum</i> (Kraenzl.) Schltr.	M. Schneider 498 (HUA)	-27.9	L	2000
<b><i>Rhetinantha</i> M.A.Blanco (13; 0/2 = 0%)</b>				



Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>R. acuminata</i> (Lindl.) M.A.Blanco	P. Stevenson, <i>et al.</i> 3013 (ANDES/P. stevenson Coll.)	-30.9	E	1900
<i>R. acuminata</i> (Lindl.) M.A.Blanco (= <i>Maxillaria acuminata</i> Lindl.)	P. Ortiz-Valdivieso 112 (HPUJ)	-32.6	E	2050
<i>R. friedrichsthalii</i> (Rchb.f.) M.A.Blanco	G. Reina, <i>et al.</i> 1124 (CUVC)	-24.8	E	1842
<b>Sauvetea Szlach. (11; 0/2 = 0%)</b>				
<i>S. alpestris</i> (Lindl.) Szlach. (= <i>Maxillaria chlorochila</i> F.Lehm. & Kraenzl.)	P. Ortiz-Valdivieso 4290 (HPUJ)	-31.9	E	1800
<i>S. aff. alpestris</i> (Lindl.) Szlach. (= <i>Maxillaria aff. alpestris</i> Lindl.)	P. Stevenson, <i>et al.</i> 3213 (ANDES/P. stevenson Coll.)	-27.4	E	1900
<b>Sudamerlycaste Archila (44; 0/5 = 0%)</b>				
<i>S. ciliata</i> (Ruiz & Pav.) Archila [= <i>Lycaste ciliata</i> (Ruiz & Pav.) Veitch]	P. Viveros, <i>et al.</i> 32 (HUQ)	-30.7	E	1650
<i>S. fimbriata</i> (Poepp. & Endl.) Archila	N. H. Ospina-Calderón 346 (CUVC)	-29.1	E	1413
<i>S. fimbriata</i> (Poepp. & Endl.) Archila [= <i>Ida fimbriata</i> (Poepp. & Endl.) A.Ryan & Oakeley]	Arend 3218 (FMB)	-28.3	E	1613
<i>S. fulvescens</i> (Hook.) Archila	J. F. Restrepo 602 (CAUP)	-28.1	E	1500
<i>S. grandis</i> (A.Ryan & Oakeley) Archila	V. H. Grande, <i>et al.</i> 123 (HUQ)	-25.8	T	2800
<i>S. sp.</i>	P. Silverstone 1066 (TULV)	-25.5	E	1550
<b>Teuscheria Garay (7; 0/1 = 0%)</b>				
<i>T. pickiana</i> (Schltr.) Garay	J. Cuatrecasas 14901 (VALLE)	-26.2	E	1040
<b>Trigonidium Lindl. (13; 0/5 = 0%)</b>				
<i>T. aff. egertonianum</i> Bateman	O. Pérez & M. Kolanowska 1047 (CUVC)	-26.9	E	100
<i>T. obtusum</i> Lindl.	C. Barbosa 7543 (225) (COAH)	-33.3	E	463
<i>T. riopalenquense</i> Dodson	M. Rincón 127 ((TOLI)/Dendrology sec.)	-30.8	E	100
<i>T. sp1.</i>	J. F. Restrepo 490 (CAUP)	-27.3	E	1884
<i>T. sp2.</i>	C. Barbosa 7379 (61) (FMB)	-31.6	E	
<b>Xylobium Lindl. (31; 0/7 = 0%)</b>				
<i>X. corrugatum</i> Rolfe	Anon. <i>s.n.</i> (VALLE)	-27.7		
<i>X. foveatum</i> G.Nicholson	P. Silverstone-Sopkin, <i>et al.</i> 8623 (CUVC)	-24.9	E	950
<i>X. leontoglossum</i> Benth. ex Rolfe	H. Mendoza, <i>et al.</i> 14621 (FMB)	-31.4	E	2150
<i>X. pallidiflorum</i> G.Nicholson	E. Escobar 236 (VALLE)	-29.9	E	1550
<i>X. variegatum</i> (Ruiz & Pav.) Garay & Dunst.	L. Rivas & D. Herrera 19 (HUQ)	-30.7	E	1495
<i>X. cf. variegatum</i> (Ruiz & Pav.) Garay & Dunst. (= <i>X. cf. truxillense</i> Rolfe)	P. Viveros, <i>et al.</i> 129 (HUQ)	-28.9	E	1100
<i>X. sp.</i>	M. Rincón 402 ((TOLI)/Dendrology sec.)	-31.5	E	100
<b>Subtribe Oncidiinae</b>				
<b>Aspasia Lindl. (7; 0/1 = 0%)</b>				
<i>A. epidendroides</i> Lindl.	E. Rentería, <i>et al.</i> 4852 (JAUM)	-30.2	E	10
<b>Brassia R.Br. in W.T.Aiton (63; 0/11 = 0%)</b>				
<i>B. allenii</i> (L.O.Williams ex C.Schweinf.) [= <i>Ada allenii</i> (L.O.Williams ex C.Schweinf.) N.H.Williams]	G. M. Urreta 205 (HPUJ)	-30.4	E	523
<i>B. andina</i> (Rchb.f.) M.W.Chase (= <i>Brachtia andina</i> Rchb.f.)	B. E. Salgado-Negret 395 (CAUP)	-27.8	T	2900
<i>B. arcuigera</i> Rchb.f. (= <i>B. antherotes</i> Rchb.f.)	D. A. García-Ramírez 102 (CUVC)	-30.5	E	2580
<i>B. aurantiaca</i> (Lindl.) M.W.Chase (= <i>Ada aurantiaca</i> Lindl.)	P. Ortiz-Valdivieso 272 (HPUJ)	-29.2	E	1600
<i>B. aff. bidens</i> Lindl.	J. Espina 852 (JBGp)	-27.6	T	130
<i>B. brevis</i> (Kraenzl.) M.W.Chase	M. Rincón 306 (TOLI)	-29.1	E	2600

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>B. euodes</i> Rchb.f. [= <i>Ada elegantula</i> (Rchb.f.) N.H.Williams]	D. A. García-Ramírez 94 (CUVC)	-29.9	E	2307
<i>B. euodes</i> Rchb.f. [= <i>Ada euodes</i> (Rchb.f.) D.E.Benn. & Christenson]	O. Pérez, <i>et al.</i> 1068 (CUVC)	-30.8	E	1800
<i>B. forgetiana</i> Sander	P. Silverstone-Sopkin & N. Paz 8815 (CUVC)	-27.2	E	22
<i>B. glumacea</i> Lindl. [= <i>Ada glumacea</i> (Lindl.) N.H.Williams]	D. Bonilla 3 (TOLI)	-28.0	E	1590
<i>B. ocanensis</i> Lindl. [= <i>Ada ocanensis</i> (Lindl.) N.H.Williams]	P. Stevenson & C. Prada 3120 (ANDES/P. stevenson Coll.)	-28.9	E	1900
<i>B. verrucosa</i> Bateman	G. I. Alzate, <i>et al.</i> 9 (FAUC)	-26.4	E	900
<b><i>Caucaea</i> Schltr. (9; 0/4 = 0%)</b>				
<i>C. olivacea</i> (Kunth) N.H.Williams & M.W.Chase	M. J. Rodríguez & M. E. Pantoja 40 (CAUP)	-26.0	E	3206
<i>C. olivacea</i> (Kunth) N.H.Williams & M.W.Chase (= <i>Oncidium cucullatum</i> Lindl.)	S. Espinal & J. E Ramos 3282 (CUVC)	-23.4	E	3000
<i>C. olivacea</i> (Kunth) N.H.Williams & M.W.Chase (= <i>Oncidium olivaceum</i> Kunth)	C. Restrepo & A. Duque 224 (CUVC)	-28.2	E	2900
<i>C. radiata</i> Mansf.	D. Bonilla 41 (TOLI)	-30.0	E	2900
<i>C. sanguinolenta</i> (Lindl.) N.H.Williams & M.W.Chase	M. Rincón 149 (TOLI)	-29.4	E	2600
<i>C. sanguinolenta</i> (Lindl.) N.H.Williams & M.W.Chase [= <i>C. mimetica</i> (Stacy) N.H.Williams & M.W.Chase]	V. H. Grande, <i>et al.</i> 68 (HUQ)	-26.9	E	2800
<i>C. cf. sanguinolenta</i> (Lindl.) N.H.Williams & M.W.Chase (= <i>Oncidium cf. mimeticum</i> Stacy)	G. Arbeláez, <i>et al.</i> 659 (HUQ)	-24.3	E	2750
<b><i>Cischweinfia</i> Dressler &amp; N.H.Williams (10; 0/1 = 0%)</b>				
<i>C. sp.</i>	J. Cuatrecasas 15049 (VALLE)	-29.8	E	1040
<b><i>Comparettia</i> Poepp. &amp; Endl. (76; 3/3 = 100%)</b>				
<i>C. falcata</i> Poepp. & Endl.	S. Galán & K. Cárdenas 40 (FMB)	-15.0	E	1878
<i>C. macroplectron</i> Rchb.f. & Triana	P. Rodríguez 3 (HPUJ)	-11.9	E	1650
<i>C. ottonis</i> (Klotzsch) M.W.Chase & N.H.Williams (= <i>Scelochilus ottonis</i> Klotzsch)	M. Rincón 287 (TOLI)	-15.5	E	2800
<b><i>Cuitlauzina</i> Lex. (7; 0/1 = 0%)</b>				
<i>C. sp.</i> (= <i>Osmoglossum</i> Schltr.)	Anon. (CAUP)	-29.1		
<b><i>Cyrtochiloides</i> N.H.Williams &amp; M.W.Chase (3; 0/1 = 0%)</b>				
<i>C. ochmatochila</i> (Rchb.f.) N.H.Williams & M.W.Chase (= <i>Oncidium ochmatochilum</i> Rchb.f.)	G. Reina, <i>et al.</i> 1557 (CUVC)	-28.4	E	1300
<b><i>Cyrtochilum</i> Kunth (131; 0/31 = 0%)</b>				
<i>C. cf. aemulum</i> Kraenzl.	J. L. Luteyn, <i>et al.</i> 12249 (CUVC)	-29.2	T	1750
<i>C. angustatum</i> (Lindl.) Dalström	P. Silverstone-Sopkin, <i>et al.</i> 10139 (CUVC) Ecuador	-28.9	E	2990
<i>C. annulare</i> Kraenzl.	T. Hinestroza & A. L. Montoya 438 (JAUM)	-25.3	E	438
<i>C. annulare</i> Kraenzl. (= <i>C. monachicum</i> Kraenzl.)	P. Ortiz-Valdivieso 486 (HPUJ)	-27.7	E	2500
<i>C. auropurpureum</i> (Rchb.f.) Dalström (= <i>Odontoglossum auropurpureum</i> Rchb.f.)	P. Ortiz-Valdivieso 4037 (HPUJ)	-23.5	T	2975
<i>C. cimiciferum</i> (Rchb.f.) Dalström [= <i>Oncidium cimiciferum</i> (Rchb.f.) Beer]	P. Ortiz-Valdivieso 168a (HPUJ)	-23.7	E	2450
<i>C. densiflorum</i> Kraenzl.	P. Ortiz-Valdivieso 375 (HPUJ)	-28.5	T	2800
<i>C. diceratum</i> Kraenzl.	P. Ortiz-Valdivieso 475 (HPUJ)	-25.5	T	2800

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>C. cf. dipterum</i> Kraenzl. (= <i>Odontoglossum cf. dipterum</i> Lindl.)	P. Viveros, <i>et al.</i> 321 (HUQ)	-27.1	T	2900
<i>C. divaricatum</i> (Lindl.) Dalström	E. Domínguez 668 ((TOLI)/Dendrology sec.)	-24.1	E	2580
<i>C. divaricatum</i> (Lindl.) Dalström [= <i>Oncidium costatum</i> (Lindl.) Beer]	P. Ortiz-Valdivieso 165 (HPUJ)	-30.1	E	2300
<i>C. examinans</i> Kraenzl.	D. A. García-Ramírez & J. S. García-Revelo 15 (CUVC)	-30.2	T	2321
<i>C. exasperatum</i> Kraenzl.	Anon. <i>s.n.</i> (HPUJ)	-23.9		
<i>C. flexuosum</i> Kunth	H. Silva 299 (HPUJ)	-26.1	E	2000
<i>C. flexuosum</i> Kunth (= <i>Oncidium trulla</i> Rchb.f.)	P. Ortiz-Valdivieso 484 (HPUJ)	-28.0	E	2300
<i>C. funis</i> Kraenzl.	P. Ortiz-Valdivieso & L. Ortiz 4193 (HPUJ)	-24.7	T	3200
<i>C. halteratum</i> Kraenzl. (= <i>C. superbiens</i> Kraenzl.)	A. J. Negret 2144 (CAUP)	-25.7	E	2300
<i>C. halteratum</i> Kraenzl.	A. Cogollo, <i>et al.</i> 11355 (JAUM)	-26.1	E	2555
<i>C. halteratum</i> Kraenzl. (= <i>C. superbiens</i> Kraenzl.)	P. Ortiz-Valdivieso 487 (HPUJ)	-26.9	E	2700
<i>C. ioplocon</i> (Rchb.f.) Dalström	J. Farfán, <i>et al.</i> 1066 (FMB)	-29.1	T	2850
<i>C. ixioides</i> Lindl. (= <i>Odontoglossum ixioides</i> Lindl.)	S. Restrepo 100 (HPUJ)	-26.7	T	2675
<i>C. longifolium</i> Kraenzl.	M. Ospina 130 (JAUM)	-26.5	T	2500
<i>C. meirax</i> (Rchb.f.) Dalström	P. Ortiz-Valdivieso <i>s.n.</i> (HPUJ)	-28.7	E	1697
<i>C. murinum</i> Kraenzl. (= <i>Oncidium murinum</i> Rchb.f.)	S. Restrepo 108 (HPUJ)	-23.9	E	2450
<i>C. myanthum</i> Kraenzl. (= <i>Odontoglossum myanthum</i> Lindl. in Benth.)	P. Ortiz-Valdivieso 326 (HPUJ)	-24.6	E	2500
<i>C. orgyale</i> Kraenzl.	J. Farfán & E. Farfán 1123 (FMB)	-27.4	E	2450
<i>C. pardinum</i> Lindl.	E. Rentería 3906 (HUA)	-29.5	E	3372
<i>C. pardinum</i> Lindl. (= <i>Odontoglossum spathaceum</i> Lindl.)	P. Ortiz-Valdivieso 612 (HPUJ)	-24.3	T	3483
<i>C. porrigens</i> Kraenzl. (= <i>Oncidium saltabundum</i> Rchb.f.)	P. Ortiz-Valdivieso 380 (HPUJ)	-23.8	E	2050
<i>C. ramosissimum</i> (Lindl.) Dalström (= <i>Odontoglossum ramosissimum</i> Lindl.)	P. Ortiz-Valdivieso 522 (HPUJ)	-23.8	E	2400
<i>C. revolutum</i> (Lindl.) Dalström	A. Giraldo 7836 (CUVC)	-28.4	T	3300
<i>C. revolutum</i> (Lindl.) Dalström (= <i>Odontoglossum lindenii</i> Lindl.)	P. Ortiz-Valdivieso 30 (HPUJ)	-25.7		
<i>C. serratum</i> Kraenzl.	P. Silverstone-Sopkin, <i>et al.</i> 9803 (CUVC) Ecuador	-29.2	E	1900
<i>C. tenense</i> Kraenzl.	M. Ospina 163 (JAUM)	-25.9	E	2400
<i>C. tetracopis</i> Kraenzl.	J. Farfán, <i>et al.</i> 1090 (FMB)	-27.9	E	2550
<i>C. trifurcatum</i> Kraenzl.	M. I. Guarín 89 (VALLE)	-24.4	E	2724
<i>C. ventilabrum</i> Kraenzl.	J. L. Zarucchi, <i>et al.</i> 5701 (HUA)	-28.5	T	2010
<i>C. ventilabrum</i> Kraenzl. (= <i>Oncidium carderi</i> Rchb.f.)	G. Hincapié 113 (HPUJ)	-25.3	E	2450
<i>C. weirii</i> (Rchb.f.) Dalström (= <i>Odontoglossum weirii</i> Rchb.f.)	A. Fernández-Pérez, <i>et al.</i> 30180 (FMB)	-25.3	E	2890
<b><i>Erycina</i> Lindl. (7; 0/4 = 0%)</b>				
<i>E. crista-galli</i> (Rchb.f.) N.H. Williams & M.W. Chase [= <i>Psycmorchis crista-galli</i> (Rchb.f.) Dodson]	R. Callejas, <i>et al.</i> 6672 (HUA)	-27.4	E	910
<i>E. glossomystax</i> (Rchb.f.) N.H. Williams & M.W. Chase [= <i>Psycmorchis glossomystax</i> (Rchb.f.) Dodson & Dressler]	J. J. Pipoly <i>s.n.</i> (FMB)	-21.9	E	215
<i>E. pumilio</i> (Rchb.f.) N.H. Williams & M.W. Chase	L. M. Quiñones, <i>et al.</i> 238 (LLANOS)	-23.2	E	1235
<i>E. pusilla</i> (L.) N.H. Williams & M.W. Chase	M. Rodríguez & J. del Águila 40 (COAH)	-24.2	E	99

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<b>Fernandezia Ruiz &amp; Pav. (51; 0/11 = 0%)</b>				
<i>F. crystallina</i> (Lindl.) M.W.Chase	V. H. Grande, <i>et al.</i> 83 (HUQ)	-31.8	E	2600
<i>F. crystallina</i> (Lindl.) M.W.Chase (= <i>Pachyphyllum crystallinum</i> Lindl.)	F. Alzate, <i>et al.</i> 3207 (HUA)	-27.8	E	3550
<i>F. cf. distichoides</i> M.W.Chase (= <i>Pachyphyllum cf. distichum</i> Kunth)	O. Pérez, <i>et al.</i> 1038 (CUVC)	-25.8	E	3200
<i>F. hartwegii</i> (Rchb.f.) Garay & Dunst.	R. Londoño, <i>et al.</i> 364 (HUA)	-25.7	E	3115
<i>F. hispidula</i> (Rchb.f.) M.W.Chase [= <i>Pachyphyllum hispidulum</i> (Rchb.f.) Garay & Dunst. in Dunst. & Garay]	A. L. Montoyam, <i>et al.</i> 483 (HUA)	-24.1	E	3000
<i>F. lanceolata</i> (L.O.Williams) Garay & Dunst.	O. Marulanda, <i>et al.</i> 444 (HUA)	-26.9	E	2904
<i>F. micrangis</i> (Schltr.) M.W.Chase	M. Rincón 343 (TOLI)	-31.8	E	3000
<i>F. pastii</i> (Rchb.f.) M.W.Chase (= <i>Pachyphyllum pastii</i> Rchb.f.)	M. E. Fernández, <i>et al.</i> 192 (JAUM)	-23.8	E	3120
<i>F. peperomioides</i> (Kraenzl.) M.W.Chase (= <i>Pachyphyllum peperomioides</i> Kraenzl.)	L. Perdomo & S. Díaz 569 (CAUP)	-26.6	E	2990
<i>F. sanguinea</i> (Lindl.) Garay & Dunst.	J. L. Zarucchi & A. E. Brant 5322 (HUA)	-27.7	E	2970
<i>F. squarrosa</i> (Lindl.) M.W.Chase (= <i>Pachyphyllum squarrosum</i> Lindl.)	R. Callejas, <i>et al.</i> 7621 (HUA)	-32.3	E	3400
<i>F. sp.</i>	C. Barbosa 9436 (146) (FMB)	-26.0	E	
<b>Ionopsis Kunth (6; 1/2 = 50%)</b>				
<i>I. satyrioides</i> Rchb.f.	A. Cogollo 1100 (HUA)	-30.3	E	370
<i>I. utricularioides</i> (Sw.) Lindl.	Ohba, <i>et al.</i> 315 (FMB)	-15.8	E	354
<b>Lockhartia Hook. (27; 1/5 = 20%)</b>				
<i>L. acuta</i> Rchb.f.	P. Stevenson 1935 (ANDES/P. stevenson Coll.)	-21.1	E	375
<i>L. amoena</i> Endrés & Rchb.f.	J. F. Restrepo 289 (CAUP)	-28.5	E	1650
<i>L. longifolia</i> Schltr. (= <i>L. hogglossa</i> Schltr.)	S. Espinal, <i>et al.</i> 3735 (CUVC)	-28.4	E	2100
<i>L. aff. longifolia</i> Schltr.	G. Reina, <i>et al.</i> 1751 (CUVC)	-30.9	E	2187
<i>L. sp.</i>	L. M. Moreno 497 (FMB)	-14.9	E	10
<b>Macroclinium Barb.Rodr. ex Pfitzer (40; 0/1 = 0%)</b>				
<i>M. sp.</i>	D. Macías, <i>et al.</i> 2207 (CAUP)	-26.6	E	737.5
<b>Miltonia Lindl. (18; 0/1 = 0%)</b>				
<i>M. spectabilis</i> Lindl.	J. Home 157 (CUVC)	-28.7	E	1450
<b>Miltoniopsis God.-Leb. (5; 0/2 = 0%)</b>				
<i>M. roezlii</i> (Rchb.f.) God.-Leb.	M. Ospina 368 (JAUM)	-30.5	E	1349
<i>M. vexillaria</i> G.Nicholson	S. Hoyos, <i>et al.</i> 2402 (JAUM)	-30.3	E	705
<b>Notylia Lindl. (56; 3/3 = 100%)</b>				
<i>N. albida</i> Klotzsch	MOH 371 (JAUM)	-11.2	E	1349
<i>N. incurva</i> Lindl.	C. Barbosa 4750 (156) (FMB)	-12.8	E	64
<i>N. aff. pentachne</i> Rchb.f.	M. Rincón 143 ((TOLI)/Dendrology sec.)	-15.4	E	140
<b>Oliveriana Rchb.f. (6; 0/2 = 0%)</b>				
<i>O. egregia</i> Rchb.f.	MOH 983 (JAUM)	-25.4	T	2500
<i>O. lehmannii</i> Garay	P. A. Silverstone, <i>et al.</i> 4637 (CUVC)	-27.9	E	2750
<b>Oncidium Sw. (324; 0/40 = 0%)</b>				
<i>O. abortivum</i> Rchb.f.	MOH 151 (JAUM)	-29.6	E	2722
<i>O. adelaidae</i> Königer	D. A. García-Ramírez 116 (CUVC)	-28.1	E	2050
<i>O. anthocrene</i> Rchb.f.	P. Ortiz-Valdivieso 643 (HPUJ)	-25.9	E	246
<i>O. aristuliferum</i> (Kraenzl.) M.W.Chase & N.H.Williams (= <i>Sigmatostalix aristulifera</i> Kraenzl.)	D. A. García-Ramírez 117 (CUVC)	-29.7	E	2150



Table 1. Continued

Taxon	Accession/Voucher details‡	$\delta^{13}\text{C}$ (‰)	G	Elevation (m)
<i>O. baueri</i> Lindl.	H. Mendoza, <i>et al.</i> 14430 (FMB)	-29.5	E	1200
<i>O. boothianum</i> Rchb.f.	P. Ortiz-Valdivieso 4303 (HPUJ)	-28.7	E	2183
<i>O. candelabrum</i> Linden [= <i>Otoglossum coronarium</i> (Lindl.) Garay & Dunst.]	MOH 62-5 (JAUM)	-27.6	E	2500
<i>O. chiripeodium</i> *	J. F. Restrepo 383 (CAUP) Costa Rica	-28.4	E	1884
<i>O. chrysomorphum</i> Lindl.	E. Parra & O. Pérez 149 (CUVC)	-25.9	E	1600
<i>O. cirrhosum</i> Beer (= <i>Odontoglossum cirrhosum</i> Lindl.)	N. Paz 353 (CUVC)	-29.8	E	1800
<i>O. citrinum</i> Lindl.	P. Ortiz-Valdivieso & R. Cortés 550 (HPUJ)	-29.5	E	800
<i>O. constrictum</i> Beer (= <i>Odontoglossum constrictum</i> Lindl.)	D. A. García-Ramírez & J. S. García-Revelo 73 (CUVC)	-32.7	E	2146
<i>O. crinitum</i> (Rchb.f.) M.W.Chase & N.H.Williams	M. Rincón 325 (TOLI)	-26.9	E	2600
<i>O. cristatum</i> Beer (= <i>Odontoglossum cristatum</i> Lindl.)	P. Ortiz-Valdivieso 587 (HPUJ)	-23.5	E	2600
<i>O. cuculligerum</i> (Schltr.) M.W.Chase & N.H.Williams [= <i>Sigmatostalix cuculligera</i> (Schltr.) Garay]	W. Hincapié & O. Pérez 143 (CUVC)	-29.1	E	1600
<i>O. cultratum</i> Lindl. (= <i>O. jamesonii</i> Rchb.f.)	P. Ortiz-Valdivieso & L. J. Ortiz 4206 (HPUJ)	-25.2	T	3000
<i>O. dactyliferum</i> Garay & Dunst.	J. M. MacDougal, <i>et al.</i> 4478 (CUVC)	-24.1	E	3385
<i>O. epidendroides</i> Beer (= <i>Odontoglossum epidendroides</i> Kunth)	P. Ortiz-Valdivieso 482 (HPUJ)	-30.3	E	2200
<i>O. cf. fuscatum</i> Rchb.f.	G. M. Urreta 269d (HPUJ)	-24.7	E	750
<i>O. gloriosum</i> (Linden & Rchb.f.) M.W.Chase & N.H.Williams (= <i>Odontoglossum gloriosum</i> Linden & Rchb.f.)	L. V. Sánchez & R. Moreno 65 (HPUJ)	-27.2	E	3000
<i>O. gramineum</i> (Poepp. & Endl.) M.W.Chase & N.H.Williams (= <i>Sigmatostalix graminea</i> Rchb.f.)	F. Quevedo & J. V. Ruedas 2183 (FMB)	-25.2	E	2200
<i>O. hapalotyle</i> Schltr.	P. Ortiz-Valdivieso 611 (HPUJ)	-25.5	E	1460
<i>O. harryanum</i> (Rchb.f.) M.W.Chase & N.H.Williams (= <i>Odontoglossum harryanum</i> Rchb.f.)	P. Ortiz-Valdivieso 692 (HPUJ)	-24.7	E	1865
<i>O. hastilabium</i> (Lindl.) Beer	MOH 308 (JAUM)	-25.7	E	1691
<i>O. heteranthum</i> Poepp. & Endl.	P. A. Villa & K. Quintero 92 (HUQ)	-27.9	E	1700
<i>O. lehmannii</i> (Rchb.f.) M.W.Chase & N.H.Williams (= <i>Odontoglossum cristatellum</i> Rchb.f.)	C. Acevedo, <i>et al.</i> 176 (FMB)	-28.8	E	2530
<i>O. luteopurpureum</i> Beer (= <i>Odontoglossum luteopurpureum</i> Lindl.)	J. Farfán & E. Farfán 1128 (FMB)	-27.2	E	2450
<i>O. mirandum</i> (Rchb.f.) M.W.Chase & N.H.Williams (= <i>Odontoglossum mirandum</i> Rchb.f.)	P. Ortiz-Valdivieso & S. Restrepo 570 (HPUJ)	-25.6	E	2400
<i>O. nebulosum</i> Lindl. (= <i>O. klotzschianum</i> Rchb.f.)	H. Mendoza, <i>et al.</i> 14430 (JAUM)	-25.0	E	1200
<i>O. obryzatum</i> Rchb.f. & Warsz.	G. M. Urreta 217b (HPUJ)	-26.8	E	0
<i>O. ornithocephalum</i> Lindl.	L. M. Álvarez 4157 (FAUC)	-32.3	E	2737
<i>O. ornithocephalum</i> Lindl.	A. Prieto, <i>et al.</i> 1429 (FMB)	-29.4	E	2903
<i>O. ornithorhynchum</i> Kunth (= <i>O. pyramidale</i> Lindl.)	O. Pérez, <i>et al.</i> 1028 (CUVC)	-25.5	E	3200
<i>O. pictum</i> Kunth	O. Pérez & E. Parra 231 (VALLE)	-28.4	E	1800
<i>O. poikilostalix</i> (Kraenzl.) M.W.Chase & N.H.Williams (= <i>Sigmatostalix guatemalensis</i> Schltr.)	J. F. Restrepo 614 (CAUP)	-24.6	E	1884
<i>O. praeinitens</i> (Rchb.f.) M.W.Chase & N.H.Williams (= <i>Odontoglossum praeinitens</i> Rchb.f.)	P. Ortiz-Valdivieso 585 (HPUJ)	-25.6	E	2000

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>O. roseum</i> Beer (= <i>Cochlioda rosea</i> (Lindl.) Benth. & Hook.f.)	J. F. Restrepo 322 (CAUP)	-27.6	E	1884
<i>O. sceptrum</i> (Rchb.f. & Warsz.) M.W.Chase & N.H.Williams (= <i>Odontoglossum sceptrum</i> Rchb.f. & Warsz.)	M. Correa & D. Yarcé 1630 (JAUM)	-28.1	E	2600
<i>O. sphacelatum</i> Lindl.	C. Ríos, <i>et al.</i> 8 (FAUC)	-23.4	E	2300
<i>O. tipuloides</i> Rchb.f.	D. A. García-Ramírez 139 (CUVC)	-27.9	T	1870
<i>O. tripudians</i> (Rchb.f. & Warsz.) M.W.Chase & N.H.Williams (= <i>Odontoglossum tripudians</i> Rchb.f. & Warsz.)	P. Ortiz-Valdivieso 604 (HPUJ)	-25.4	E	2600
<b><i>Ornithocephalus</i> Hook. (49; 5/5 = 100%)</b>				
<i>O. bicornis</i> Lindl.	P. V. Trujillo-Q 6418 (HUA)	-13.2	E	417
<i>O. escobarianus</i> (Garay) Toscano & Dressler	L. A. de Escobar, <i>et al.</i> 7986 (HUA)	-13.4	E	1850
<i>O. cf. gladiatus</i> Hook.	D. A. Giraldo-Cañas 775 (HUA)	-13.1	E	800
<i>O. urceilabris</i> (P.Ortiz & R.Escobar) Toscano & Dressler	D. M. Munar, <i>et al.</i> 1752 (CAUP)	-16.4	E	2457
<i>O. sp.</i>	P. Stevenson, <i>et al.</i> 2950 (ANDES/P. stevenson Coll.)	-16.7	E	1900
<b><i>Otoglossum</i> (Schltr.) Garay &amp; Dunst. (14; 0/5 = 0%)</b>				
<i>O. arminii</i> (Rchb.f.) Garay & Dunst.	J. S. García-Revelo & A. D. García-Ramírez 18 (CUVC)	-29.4	T	2245
<i>O. aff. chiriquense</i> (Rchb.f.) Garay & Dunst.	H. Mendoza & H. Gómez 376 (FMB)	-27.3	E	2700
<i>O. globuliferum</i> (Kunth) N.H.Williams & M.W.Chase (= <i>Oncidium globuliferum</i> Kunth)	H. C. Villalobos & A. H. Gentry 2894 (JBGp)	-26.7	E	980
<i>O. globuliferum</i> (Kunth) N.H.Williams & M.W.Chase	H. Esquivel 2210 (TOLI)	-26.8	T	2000
<i>O. scansor</i> (Rchb.f.) Carnevali & I.Ramírez	M. Rincón 23558 (VALLE)	-24.3	E	2280
<i>O. serpens</i> (Lindl.) N.H.Williams & M.W.Chase (= <i>Oncidium serpens</i> Lindl.)	E. Carvajalino 128 (HPUJ)	-27.7	E	2200
<b><i>Plectrophora</i> H.Focke (10; 1/1 = 100%)</b>				
<i>P. alata</i> (Rolfe) Garay	L. Rivas & D. Herrera 24 (HUQ)	-13.4	E	1500
<b><i>Psychopsis</i> Raf. (4; 1/1 = 100%)</b>				
<i>P. papilio</i> (Lindl.) H.G.Jones	J. Espina & F. García 2446 (CHOCO)	-14.9	E	40
<b><i>Pterostemma</i> Kraenzl. (3; 1/1 = 100%)</b>				
<i>P. antioquiense</i> F.Lehm. & Kraenzl.	D. M. & P. Estrada 13 (HUA)	-16.9	E	2200
<b><i>Rodriguezia</i> Ruiz &amp; Pav. (48; 3/3 = 100%)</b>				
<i>R. granadensis</i> Rchb.f.	T. Hinestroza & A. L. Montoya 467 (JAUM)	-12.7	E	1400
<i>R. lanceolata</i> Ruiz & Pav.	C. Barbosa <i>s.n.</i> (FMB)	-13.2	E	41
<i>R. lanceolata</i> Ruiz & Pav. (= <i>R. secunda</i> Kunth)	E. P. Killip & J. Cuatrecasas 39170 (VALLE)	-11.5	E	400
<i>R. venusta</i> Rchb.f.	L. F. Rojas & C. Rojas 8 (LLANOS)	-13.8	E	384
<b><i>Rossioglossum</i> (Schltr.) Garay &amp; G.C.Kenn. (9; 0/1 = 0%)</b>				
<i>R. ampliatum</i> (Lindl.) M.W.Chase & N.H.Williams (= <i>Oncidium ampliatum</i> Lindl.)	P. Ortiz-Valdivieso 4343 (HPUJ)	-28.4	E	2220
<b><i>Solenidium</i> Lindl. (3; 1/1 = 100%)</b>				
<i>S. racemosum</i> Lindl.	D. A. García-Ramírez 122 (CUVC)	-17.9	E	1670
<b><i>Systemoglossum</i> Schltr. (5; 0/1 = 0%)</b>				
<i>S. cf. ecuadorensis</i> (Garay) Dressler & N.H.Williams	P. Viveros & E. Flórez 320 (HUQ)	-28.7	E	1900
<b><i>Telipogon</i> Kunth (205; 0/5 = 0%)</b>				
<i>T. hausmannianus</i> Rchb.f.	C. Berrío, <i>et al.</i> 67 (HUQ)	-28.9	E	3040

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>T. lehmannii</i> Schltr.	B. E. Salgado-Negret 350 (CAUP)	-25.5	T	2900
<i>T. nervosus</i> Druce	L. Rodríguez & J. Rodríguez 75 (CUVC)	-25.1	E	2950
<i>T. papilio</i> Rchb.f. & Warsz.	B. R. Ramírez & M. S. González I 5276 (CAUP)	-27.7	E	3000
<i>T. pulcher</i> Rchb.f.	J. Cuatrecasas 19506 (VALLE)	-25.6	E	1840
<b>Trichocentrum Poepp. &amp; Endl. (72; 3/3 = 100%)</b>				
<i>T. carthagenense</i> (Jacq.) M.W.Chase & N.H.Williams	M. P. Córdoba, <i>et al.</i> 8028 (FMB)	-15.0	E	77
<i>T. carthagenense</i> (Jacq.) M.W.Chase & N.H.Williams (= <i>Oncidium carthagenense</i> Sw.)	P. Ortiz-Valdivieso 143 (HPUJ)	-14.3	E	850
<i>T. cebolleta</i> (Jacq.) M.W.Chase & N.H.Williams	J. P. Tobón <i>s.n.</i> (JAUM)	-13.8	E	100
<i>T. pulchrum</i> Poepp. & Endl.	J. F. Restrepo 600 (CAUP)	-13.6	E	1700
<b>Trichopilia Lindl. (40; 0/4 = 0%)</b>				
<i>T. fragrans</i> Rchb.f.	B. R. Ramírez & A. L. Jojoa 5823 (CAUP)	-23.9	E	2075
<i>T. hennisiana</i> Kraenzl.	J. F. Restrepo 987 (CAUP)	-27.7	E	1650
<i>T. laxa</i> Rchb.f.	J. F. Restrepo 594 (CAUP)	-30.9	E	1780
<i>T. laxa</i> Rchb.f.	P. A. Viveros, <i>et al.</i> 43 (HUQ)	-27.9	E	1650
<i>T. sp.</i>	J. Cuatrecasas 23984 (VALLE)	-30.0	E	1400
<b>Trizeuxis Lindl. (1; 1/1 = 100%)</b>				
<i>T. falcata</i> Lindl.	J. Zarucchi, <i>et al.</i> 5116 (HUA)	-13.4	E	1030
<b>Vitekorchis Romowicz &amp; Szlach. (4; 0/1 = 0%)</b>				
<i>V. aurifera</i> (Rchb.f.) J.M.H.Shaw (= <i>Oncidium auriferum</i> Rchb.f.)	MOH 61-8 (JAUM)	-26.2	E	2500
<b>Zelenkoa M.W.Chase &amp; N.H.Williams (1; 0/1 = 0%)</b>				
<i>Z. onusta</i> (Lindl.) M.W.Chase & N.H.Williams (= <i>Oncidium onustum</i> Lindl.)	W. F. Higuera 14 (HPUJ)	-28.2	T	3250
<b>Subtribe Stanhopeinae</b>				
<b>Acineta Lindl. (17; 0/4 = 0%)</b>				
<i>A. antioquiæ</i> Schltr.	D. Tuberquía, <i>et al.</i> 877 (JAUM)	-30.5	T	1883
<i>A. erythroantha</i> Rchb.f.	P. Ortiz-Valdivieso 304 (HPUJ)	-25.8	E	2000
<i>A. hennisiana</i> Schltr.	P. Ortiz-Valdivieso 4277 (HPUJ)	-25.6	E	3000
<i>A. superba</i> Rchb.f.	A. Niessen & O. De La Roque <i>s.n.</i> (CUVC)	-26.2	E	1000
<b>Braemia Jenny (1; 0/1 = 0%)</b>				
<i>B. vittata</i> (Lindl.) Jenny	D. E. Álvarez, <i>et al.</i> 3709 (JAUM)	-33.4	E	119
<b>Coryanthes Hook. (53; 0/2 = 0%)</b>				
<i>C. flava</i> G.Gerlach	G. M. Urreta 292b (HPUJ)	-28.2	E	0
<i>C. mastersiana</i> F.Lehm.	J. G. Ramírez & D. Cárdenas 659 (HUA)	-28.4	E	485
<b>Gongora Ruiz &amp; Pav. (71; 0/4 = 0%)</b>				
<i>G. chocoensis</i> Jenny	G. Reina, <i>et al.</i> 1843 (CUVC)	-30.3	E	340
<i>G. cf. gratulabunda</i> Rchb.f.	O. Pérez & E. Parra 219 (VALLE)	-31.5	E	1600
<i>G. quinquenervis</i> Ruiz & Pav.	J. Espina 600 (JBGP)	-29.5	E	130
<i>G. sp.</i>	H. Mendoza, <i>et al.</i> 14402 (FMB)	-35.7	E	1000
<b>Polycynis Rchb.f. (17; 0/2 = 0%)</b>				
<i>P. lehmannii</i> Rolfe	J. Cuatrecasas 15024 (VALLE)	-25.1	E	1040
<i>P. sp.</i>	H. Mendoza, <i>et al.</i> 8890 (CAUP)	-33.4	E	1000
<b>Schlimia Regel (8; 0/1 = 0%)</b>				
<i>S. jasminodora</i> Planch. & Linden	MOH 65-18 (JAUM)	-30.8	E	2167
<b>Sievekingia Rchb.f. (16; 0/2 = 0%)</b>				

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>S. reichenbachiana</i> Rolfe	A. J. Negret <i>s.n.</i> (CAUP)	-30.3	E	639
<i>S. suavis</i> Rchb.f.	Mejía-Rosero & Pino-Andrade 18 (CHOCO)	-31.5	E	45
<b><i>Stanhoepa</i> J.Frost ex Hook. (65; 0/6 = 0%)</b>				
<i>S. jenischiana</i> F.Kramer ex Rchb.f.	J. F. Restrepo 462 (CAUP)	-28.9	E	1884
<i>S. platyceras</i> Rchb.f.	A. Niessen & O. De La Roque <i>s.n.</i> (CUVC)	-33.2	E	1100
<i>S. pulla</i> Rchb.f.	G. M. Urreta 203a (HPUJ)	-28.6	E	100
<i>S. reichenbachiana</i> Roetzl ex Rchb.f.	P. Ortiz-Valdivieso 305 (HPUJ)	-25.3	E	1600
<i>S. shuttleworthii</i> Rchb.f.	T. Londoño, <i>et al. s.n.</i> (FAUC)	-24.4	E	2150
<i>S. tricornis</i> Lindl.	O. Pérez & E. Parra 229 (VALLE)	-25.8	E	1600
<b>Subtribe Zygotetalinae</b>				
<b><i>Chaubardiella</i> Garay (8; 0/1 = 0%)</b>				
<i>C. sp.</i>	W. Devia, <i>et al.</i> 3431 (TULV)	-30.5	E	130
<b><i>Chondroscaphe</i> (Dressler) Senghas &amp; G.Gerlach (16; 0/2 = 0%)</b>				
<i>C. amabilis</i> (Schltr.) Senghas & G.Gerlach (= <i>Chondrorhyncha amabilis</i> Schltr.)	A. Cogollo & J. G. Ramírez 3115 (JAUM)	-32.9	E	1312
<i>C. cf. chesteronii</i> (Rchb.f.) Senghas & G.Gerlach (= <i>Chondrorhyncha cf. chesteronii</i> Rchb.f.)	A. Cogollo, <i>et al.</i> 6948 (JAUM)	-34.1	E	1450
<b><i>Dichaea</i> Lindl. (119; 0/14 = 0%)</b>				
<i>D. brachypoda</i> Rchb.f.	J. E. Ramos 1938 (CUVC)	-30.8	E	1990
<i>D. camaridioides</i> Schltr.	L. A. de Escobar, <i>et al.</i> 4912 (HUA)	-31.2	E	1850
<i>D. humilis</i> Cogn.	G. M. Urreta 180 (HUA)	-31.0	E	50
<i>D. hystricina</i> Rchb.f.	J. F. Negret 317 (CAUP)	-23.2	E	1650
<i>D. latifolia</i> Lindl.	O. Pérez, <i>et al.</i> 638 (CUVC)	-30.6	E	1800
<i>D. morrisii</i> Fawc. & Rendle	P. Stevenson, <i>et al.</i> 2934 (ANDES/P. stevenson Coll.)	-34.1	E	1900
<i>D. muricata</i> Lindl.	E. Barrera 37 (FMB)	-27.4	E	1207
<i>D. muricata</i> Lindl. (= <i>D. moritzii</i> Rchb.f.)	M. Ospina 583 (JAUM)	-28.4	E	2262
<i>D. panamensis</i> Lindl.	G. M. Urreta 177 (HUA)	-28.7	E	50
<i>D. cf. pendula</i> (Aubl.) Cogn.	O. Pérez & E. Parra 180 (CUVC)	-31.4	E	1600
<i>D. powellii</i> Schltr.	A. Cogollo, <i>et al.</i> 2525 (JAUM)	-28.5	E	1355
<i>D. rendlei</i> Gleason	A. V. Gutiérrez 304 (HUA)	-24.1	E	200
<i>D. richii</i> Dodson	R. Fonnegra, <i>et al.</i> 369a (HUA)	-29.7	E	450
<i>D. splitgerberi</i> Rchb.f.	Anon. <i>s.n.</i> (COAH)	-34.5		
<i>D. tenuifolia</i> Schltr. (= <i>D. undulifolia</i> Dodson)	A. Cogollo, <i>et al.</i> 4119 (JAUM)	-34.7	E	1355
<i>D. tenuifolia</i> Schltr. (= <i>D. undulifolia</i> Dodson)	J. S. García-Revelo & A. D. García-Ramírez 41 (CUVC)	-28.0	E	2241
<b><i>Huntleya</i> Bateman ex Lindl. (14; 0/2 = 0%)</b>				
<i>H. meleagris</i> Lindl.	J. Cuatrecasas 19626 (VALLE)	-28.4	E	981
<i>H. sp.</i>	A. Juncosa & A. H. Gentry 716 (JAUM)	-30.3	E	350
<b><i>Kefersteinia</i> Rchb.f. (68; 0/2 = 0%)</b>				
<i>K. graminea</i> Rchb.f.	M. de Fraume & Álvarez y Gallego 179 (HUQ)	-29.2	E	2250
<i>K. tolimensis</i> Schltr.	M. Rincón 300 (TOLI)	-28.1	E	3000
<b><i>Koellensteinia</i> Rchb. f. (17; 0/1 = 0%)</b>				
<i>K. graminea</i> (Lindl.) Rchb.f.	D. Cárdenas, <i>et al.</i> 22392 (COAH)	-33.4	E	150
<b><i>Ostyalis</i> Schltr. (4; 0/1 = 0%)</b>				
<i>O. brachystalix</i> Schltr.	J. Duivenvoorden, <i>et al.</i> 1345 (COAH)	-30.9	T	164
<b><i>Pescatoria</i> Rchb.f. (25; 0/3 = 0%)</b>				



Table 1. Continued

Taxon	Accession/Voucher details‡	$\delta^{13}\text{C}$ (‰)	G	Elevation (m)
<i>P. coelestis</i> (Rchb.f.) Dressler (= <i>Bollea coelestis</i> Rchb.f.)	O. Pérez & E. Parra 0798-2 (CUVC)	-31.3	E	1900
<i>P. dayana</i> Rchb.f.	P. Silverstone & N. Paz 7333 (CUVC)	-30.2	E	1100
<i>P. klabochorum</i> Rchb.f.	S. Arias-Guerrero, <i>et al.</i> 146 (CUVC)	-34.3	E	1310
<b>Warreopsis</b> Garay (4; 0/1 = 0%)				
<b>Warczewiczella</b> Rchb.f. (11; 0/1 = 0%)				
<i>W. purpurea</i> P.Ortiz	B. E. Salgado-Negret 344 (CAUP)	-29.9	T	2900
<i>W. marginata</i> Rchb.f.	W. Devia, <i>et al.</i> 4265 (TULV)	-33.7	E	100
<b>Tribe Epidendreae</b> Lindl.				
<b>Subtribe Blettiinae</b>				
<b>Bletia</b> Ruiz & Pav. (39; 0/1 = 0%)				
<i>B. purpurea</i> (Lam.) DC.	M. Ospina 62-1 (JAUM)	-28.3	T	1700
<b>Chysis</b> Lindl. (10; 0/1 = 0%)				
<i>C. sp.</i>	P. A. Silverstone-Sopkin, <i>et al.</i> 4350 (CHOCO)	-24.1	E	2525
<b>Subtribe Calypsoinae</b>				
<b>Govenia</b> Lindl. (24; 0/3 = 0%)				
<i>G. fasciata</i> Lindl.	V. H. Grande, <i>et al.</i> 97 (HUQ)	-26.7	T	2600
<i>G. fasciata</i> Lindl.	D. A. García-Ramírez 114 (CUVC)	-27.9	T	1900
<i>G. sodiroi</i> Schltr.	G. Reina, <i>et al.</i> 1750 (CUVC)	-29.9	T	2187
<i>G. superba</i> (La Llave & Lex.) Lindl. (= <i>Maxillaria aff. superba</i> Lex.)	J. Cuatrecasas 23642 (VALLE)	-26.0	T	2450
<b>Subtribe Coeliinae</b>				
<b>Coelia</b> Lindl. (5; 0/1 = 0%)				
<i>C. macrostachya</i> Lindl.	M. Ospina 599 (JAUM)	-27.6	T	2038
<b>Subtribe Laeliinae</b>				
<b>Arpophyllum</b> Lex. (4; 0/1 = 0%)				
<i>A. giganteum</i> Hartw. ex Lindl.	P. Ortiz-Valdivieso 896 (HPUJ)	-25.9	E	1702
<b>Brassavola</b> R.Br. (21; 1/1 = 100%)				
<i>B. nodosa</i> Lindl.	M. Códoba & N. Chávez 8100 (FMB)	-13.9	E	78
<b>Cattleya</b> Lindl. (151; 6/7 = 85.7%)				
<i>C. dowiana</i> var. <i>aurea</i> (Linden) B.S.Williams & T.Moore (= <i>C. aurea</i> Linden)	G. M. Urreta 22b (HPUJ)	-12.9	E	20
<i>C. mendelii</i> Dombroin	E. Carvajalino 134 (HPUJ)	-12.8	E	1600
<i>C. quadricolor</i> Lindl.	E. Aldana 18 (TOLI)	-14.6	E	1049
<i>C. schroederiae</i> Rchb.f.	G. Reina, <i>et al.</i> 1484 (CUVC)	-33.9	E	635
<i>C. trianae</i> Linden & Rchb.f.	C. Ortíz 145 (HPUJ)	-13.6	E	1400
<i>C. violacea</i> (Kunth) Rolfe	M. P. Galeano, <i>et al.</i> 1885 (HPUJ)	-16.0	E	272
<i>C. warszewiczii</i> Rchb.f.	A. Cogollo & J. Alzate 2296 (JAUM)	-12.8	E	1243
<b>Dimerandra</b> Schltr. (8; 0/4 = 0%)				
<i>D. elegans</i> (H.Focke) Siegerist	D. Sanín & N. Castaño 1565 (JAUM)	-27.2	E	213
<i>D. stenopetala</i> Schltr.	N. López & F. Solano-Manco 4695 (JAUM)	-28.0	E	86
<i>D. emarginata</i> (G.Mey.) Hoehne	A. Dueñas, <i>et al.</i> 3264 (FMB)	-27.7	E	371
<i>D. latipetala</i> Siegerist	G. Tadri-Zocher 232 (CUVC)	-29.1	E	58
<b>Dinema</b> Lindl. (1; 0/1 = 0%)				
<i>D. polybulbon</i> Lindl.	W. D. Stevens & A. Grijalva 15801 (HUA)	-27.6	E	1372
<b>Encyclia</b> Hook. (165; 5/5 = 100%)				
<i>E. aspera</i> Schltr.	N. H. Opsina 293 (CUVC)	-13.4	E	1627
<i>E. betancourtiana</i> Carnevali & I.Ramírez	A. Castaño 49 (TULV)	-16.2	E	1085
<i>E. ceratistes</i> Schltr.	P. Silverstone-Sopkin & N. Paz 6938 (CUVC)	-15.2	E	1140
<i>E. leucantha</i> Schltr.	F. Mijares, <i>et al.</i> 614 (FMB)	-14.8	E	129

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>E. profusa</i> (Rolfe) Dressler & G.E.Pollard	D. Cabrera, <i>et al.</i> 1778 (FMB)	-15.7	E	762
<b><i>Epidendrum</i> L. (1435; 33/191 = 17.3%)</b>				
<i>E. acuminatum</i> Ruiz & Pav.	R. Bernal, <i>et al.</i> 1939 (HUQ)	-28.2	E	2796
<i>E. aff. aenigmaticum</i> Hágsater & Dodson	D. Gamba & T. Cano 100 (CUVC)	-31.5	E	2450
<i>E. agathosmicum</i> Rchb.f. (= <i>E. calothyrsus</i> Schltr.)	G. Reina & C. Lopera 1738 (CUVC)	-29.2	E	1402
<i>E. aggregatum</i> Lindl.	M. I. Guarín 70 (VALLE)	-26.8	E	1985
<i>E. alexii</i> Hágsater & Dodson	B. R. Ramírez & J. A. Cuayal M 4509 (CAUP)	-29.6	T	3100
<i>E. alpicola</i> Rchb.f.	V. H. Grande, <i>et al.</i> 94 (HUQ)	-21.2	E	2800
<i>E. alpicola</i> Rchb.f.	M. Ospina 218 (JAUM)	-26.0	E	2412
<i>E. cf. alpicola</i> Rchb.f.	M. Rincón 51 (TOLI)	-31.1	E	2600
<i>E. alsum</i> Ridl.	C. Acevedo, <i>et al.</i> 8685 (FMB)	-28.6	T	1500
<i>E. ampelomelanoxeros</i> Hágsater, E.Santiago & E.Parra	C. López 75 (TULV)	-20.6	T	3400
<i>E. aff. ampelosphatum</i> Hágsater & Dodson	S. Sarria, <i>et al.</i> 268 (CUVC)	-22.8	E	3350
<i>E. amplexirisaraldense</i> Hágsater & E.Santiago	A. F. Bohórquez, <i>et al.</i> 507 (FAUC)	-28.9	E	3126
<i>E. anceps</i> Jacq.	F. Silverstone-Sopkin, <i>et al.</i> 5195 (CUVC)	-18.3	E	940
<i>E. anchicayanum</i> Hágsater & Dodson	N. Paz, <i>et al.</i> 602 (CUVC)	-13.4	T	700
<i>E. angustatum</i> (T.Hashim.) Dodson	M. Rincón 93 (TOLI)	-21.5	E	1800
<i>E. angustilobum</i> Fawc. & Rendle [= <i>E. latifolium</i> (Lindl.) Garay & H.R.Sweet]	Mejía-Rosero & Pino-Andrade 6 (CHOCO)	-27.2	E	44
<i>E. angustissimum</i> Lindl.	S. Sarria, <i>et al.</i> 285 (CUVC)	-24.6	E	3350
<i>E. apaganum</i> Mansf.	Anon. 5626 (CHOCO)	-24.8	E	245
<i>E. arachnoglossum</i> Rchb.f. ex André	J. Cuatrecasas & R. Echeverry 27626 (TOLI)	-20.6	T	2420
<i>E. arevaloi</i> (Schltr.) Hágsater	M. Correa, <i>et al.</i> 1313 (JAUM)	-27.5	T	2730
<i>E. arnoldii</i> Schltr.	C. López 73 (TULV)	-30.7	T	3400
<i>E. aura-usecheae</i> Hágsater, Rinc.-Useche & O.Pérez	O. Pérez & E. Parra 1162 (CUVC)	-17.3	L	2600
<i>E. avicula</i> Lindl.	L. E. Urrego, <i>et al.</i> 274 (HUA)	-20.7	E	122
<i>E. cf. avicula</i> Lindl. (= <i>Lanium avicula</i> Lindl. ex Benth.)	J. Espina & M. Mosquera 2363 (CHOCO)	-23.1	E	126
<i>E. aylacotoglossum</i> Hágsater	M. Rincón 277 (TOLI)	-27.7	E	2600
<i>E. bangii</i> Rolfe (= <i>E. macrostachyum</i> Lindl.)	C. Chaparro 119 (FMB)	-29.8	T	2000
<i>E. barbayanum</i> Kraenzl.	J. Farfán, <i>et al.</i> 1168 (FMB)	-20.9	E	2180
<i>E. bispathulatum</i> Hágsater, O.Pérez & E.Santiago	O. Pérez & E. Parra 164 (CUVC)	-13.7	E	1600
<i>E. blepharistes</i> Barker ex Lindl.	M. Rincón 299 (TOLI)	-26.0	E	2500
<i>E. aff. blepharistes</i> Barker ex Lindl. (= <i>E. aff. funkii</i> Rchb.f.)	H. Vargas 17 (HUA)	-28.2	E	2300
<i>E. cf. bogotense</i> Schltr.	M. Rincón 156 (TOLI)	-24.3	T	3500
<i>E. braccigerum</i> Rchb.f.	B. R. Ramírez 12037 (CAUP)	-21.6	T	2900
<i>E. bracteolatum</i> C.Presl	L. A. de Escobar 897 (HUA) Ecuador	-17.0	E	30
<i>E. brevicernuum</i> Hágsater & Dodson	T. Hinestroza & A. L. Montoya 414 (JAUM)	-27.2	E	2500
<i>E. buenaventurae</i> F.Lehm. & Kraenzl.	A. Cogollo, <i>et al.</i> 4160 (JAUM)	-27.2	E	1300
<i>E. calanthum</i> Rchb.f. & Warsz.	J. Chuiquillo, <i>et al.</i> 5 (LLANOS)	-16.5	E	627
<i>E. calyptratatum</i> F.Lehm. & Kraenzl.	D. Bonilla 57 (TOLI)	-32.4	E	1596
<i>E. campyloglossum</i> P.Ortiz & Hágsater	B. Villanueva & F. Fernández 1167 (TOLI)	-28.1	E	67
<i>E. cf. caquetanum</i> Schltr.	J. E. Ramos, <i>et al.</i> 2509 (CUVC)	-19.2	T	1100
<i>E. carchiense</i> Hágsater & Dodson	O. Pérez, <i>et al.</i> 1079 (CUVC)	-25.1	E	1800
<i>E. carmelense</i> Hágsater & Dodson	H. Sánchez & F. Lehmann 368 (CUVC)	-28.0	E	3300
<i>E. cf. catillus</i> Rchb.f. & Warsz.	S. Garzón 10 (CUVC)	-16.9	E	1800

Table 1. Continued

Taxon	Accession/Voucher details‡	$\delta^{13}\text{C}$ (‰)	G	Elevation (m)
<i>E. cernuum</i> Kunth	O. Pérez, <i>et al.</i> 439 (CUVC)	-25.8	T	3800
<i>E. chioneum</i> Lindl.	E. Rentería, <i>et al.</i> 5322 (HUA)	-27.0	T	3009
<i>E. chioneum</i> Lindl.	H. Bernal & A. Hernández 1303 (FMB)	-23.1	T	3300
<i>E. chlorops</i> Rchb.f.	A. F. Bohórquez, <i>et al.</i> 135 (FAUC)	-28.1	E	3224
<i>E. chortophyllum</i> Schltr.	J. Cuatrecasas 20037 (VALLE)	-22.0	E	3640
<i>E. chortophyllum</i> Schltr.	D. Bonilla 1 (TOLI)	-29.3	E	3000
<i>E. cf. ciliare</i> L.	N. López & F. Solano-Manco 4701 (JAUM)	-24.1	E	86
<i>E. cimanum</i> Dodson	V. Zak 941 (JAUM) Ecuador	-28.7	T	3180
<i>E. cirrhochilum</i> F.Lehm. & Kraenzl.	A. Cogollo, <i>et al.</i> 3368 (FMB)	-25.7	E	900
<i>E. cf. cleistocoleum</i> Hágsater & E.Santiago	C. Barbosa 5979 (HUA)	-31.2	E	1385
<i>E. aff. coriifolium</i> Lindl.	O. Pérez & E. Sánchez 259 (VALLE)	-30.1	T	1600
<i>E. coronatum</i> Ruiz & Pav.	J. G. Ramírez & D. Cárdenas 662 (JAUM)	-19.2	E	485
<i>E. coryophorum</i> (Kunth) Rchb.f.	M. Rincón 264 (TOLI)	-24.3	E	2600
<i>E. cottoniiflorum</i> (Rchb.f.) Hágsater	J. Cuatrecasas 18160 (VALLE)	-26.6	E	2295
<i>E. cristatum</i> Ruiz & Pav.	López-Figueiras 8098 (VALLE)	-18.2	E	1072
<i>E. cuatrecasasii</i> Garay	O. Pérez & M. Kolanowska 1049 (CUVC)	-27.8	E	100
<i>E. cylindraceum</i> Lindl.	J. Farfán, <i>et al.</i> 1141 (FMB)	-30.5	E	3250
<i>E. cylindrostachys</i> Rchb.f. & Warsz.	M. Rincón 268 (TOLI)	-26.8	E	2600
<i>E. cylindrostachys</i> Rchb.f. & Warsz.	D. Benítez & F. J. Toro 967 (JAUM)	-27.6	E	2600
<i>E. decurviflorum</i> Schltr.	J. Farfán, <i>et al.</i> 1071 (FMB)	-27.7	T	2800
<i>E. dendrobii</i> Rchb.f. (= <i>E. pileatum</i> Rchb.f.)	O. Pérez & M. Kolanowska 1053 (CUVC)	-26.2	T	1500
<i>E. densiflorum</i> Hook.	N. H. Ospina-Calderón 294 (CUVC)	-28.2	T	1500
<i>E. aff. difforme</i> Jacq.	MOH 286 (JAUM)	-17.8	E	72
<i>E. diothonaeoides</i> Schltr.	V. H. Grande, <i>et al.</i> 101 (HUQ)	-24.7	E	2850
<i>E. cf. dolichorhachis</i> Hágsater & Dodson	L. M. Álvarez-Mejía & A. F. Bohórquez 3905 (FAUC)	-30.5	E	3688
<i>E. elleanthoides</i> Schltr.	J. S. García-Revelo & A. D. García-Ramírez 29 (CUVC)	-31.7	E	2169
<i>E. embreei</i> Dodson	J. F. Restrepo 369 (CAUP)	-25.0	E	1884
<i>E. envigadoense</i> Hágsater	V. H. Grande, <i>et al.</i> 95 (HUQ)	-30.5	E	2800
<i>E. erosum</i> Ames & C.Schweinf.	C. Barbosa 1523 (FMB)	-24.9	E	3079
<i>E. escobarianum</i> Garay	O. Pérez & M. Kolanowska 1016 (VALLE)	-29.4	E	1800
<i>E. eugenii</i> Schltr.	S. Sarria 528 (CUVC)	-27.9	E	3350
<i>E. excisum</i> Lindl.	A. Idárraga, <i>et al.</i> 3740 (HUA)	-29.0	E	2595
<i>E. excisum</i> Lindl.	B. R. Ramírez, <i>et al.</i> 12489 (FMB)	-28.2	E	2400
<i>E. cf. ferrugineum</i> Ruiz & Pav.	G. McPherson, <i>et al.</i> 12928 (HUA)	-24.2	E	2150
<i>E. fimbriatum</i> Kunth	B. Sánchez & J. Hernández 715 (FMB)	-29.8	T	2550
<i>E. fimbriatum</i> Kunth	P. Stevenson, <i>et al.</i> 2987 (ANDES/P. stevenson Coll.)	-32.6	L	1900
<i>E. flexuosum</i> G.Mey. (= <i>E. imatophyllum</i> Lindl.)	I. Borsic 77 (HUQ)	-14.6	E	1100
<i>E. flexuosum</i> G.Mey.	E. Rentería, <i>et al.</i> 1898 (HUA)	-15.4	E	700
<i>E. frigidum</i> Linden ex Lindl.	M. Schneider 134 (HUA)	-25.6	T	3062
<i>E. frutex</i> Rchb.f.	Anon. 1280 (FMB)	-23.5	T	3108
<i>E. fruticosum</i> Pav. ex Lindl. (= <i>E. fastigiatum</i> Lindl.)	P. Silverstone-Sopkin 962 (CUVC)	-23.6	E	2200
<i>E. fruticulum</i> Schltr.	B. R. Ramírez 170 (CAUP)	-29.7	E	2901

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>E. aff. fusagasugaense</i> E.Parra, Hágsater & L.Sánchez	M. Rincón 260 (TOLI)	-21.5	E	1800
<i>E. gaertelmaniae</i> Hágsater & O.Pérez	O. Pérez, <i>et al.</i> 1034 (CUVC)	-27.6	T	3200
<i>E. aff. garayi</i> Løjtnant	J. E. Ramos, <i>et al.</i> 1568 (CUVC)	-34.1	T	1760
<i>E. gastropodium</i> Rchb.f.	C. Luer & R. Escobar 8414 (JAUM)	-25.2	E	2850
<i>E. geminiflorum</i> Kunth	C. Acevedo, <i>et al.</i> 324 (FMB)	-23.5	T	2000
<i>E. gentryi</i> Dodson	G. Galeano, <i>et al.</i> 4586 (CHOCO)	-35.1	E	200
<i>E. globiflorum</i> F.Lehm. & Kraenzl.	M. Ospina 40 (JAUM)	-29.1	E	3300
<i>E. globiflorum</i> F.Lehm. & Kraenzl. (= <i>E. restrepoanum</i> A.D.Hawkes)	M. Rincón 74 (TOLI)	-25.5	E	3400
<i>E. goodspeedianum</i> A.D.Hawkes	J. Cuatrecasas 22444 (VALLE)	-26.4	T	2225
<i>E. gratissimum</i> (Rchb.f.) Hágsater & Dodson	H. Mendoza, <i>et al.</i> 14775 (FMB)	-26.7	E	2050
<i>E. gratissimum</i> (Rchb.f.) Hágsater & Dodson (= <i>Diothonea gratissima</i> Rchb.f.)	P. Gómez, <i>et al.</i> 9 (HUQ)	-25.2		1800
<i>E. hesperium</i> Hágsater & E.Santiago	D. A. García-Ramírez & O. Pérez-Escobar 106 (CUVC)	-31.8	T	1730
<i>E. aff. hymenodes</i> Lindl.	W. Devia, <i>et al.</i> 10795 (TULV)	-36.0	T	1840
<i>E. ibaguense</i> Kunth	L. P. Romero, <i>et al.</i> 64 (FMB)	-17.6	T	1455
<i>E. igneum</i> Hágsater	D. A. García-Ramírez 130A (CUVC)	-19.4	E	1870
<i>E. ionodesme</i> Schltr.	D. Benítez, <i>et al.</i> 869 (JAUM)	-31.9	T	2400
<i>E. ionophyllum</i> P.Ortiz	O. Pérez & E. Parra 174 (VALLE)	-27.3	E	1600
<i>E. jamiesonis</i> Rchb.f. (= <i>E. evectum</i> Hook.f.)	V. Zak & J. Jaramillo 2056 (JBGPEcuador)	-13.5	T	2850
<i>E. jamiesonis</i> Rchb.f.	M. Hermann & R. Castillo 429 (CUVC) Ecuador	-13.8	E	2850
<i>E. jejunum</i> Rchb.f.	J. Betancur & A. Gil 7942 (CHOCO)	-30.9	E	0
<i>E. jejunum</i> Rchb.f. (= <i>E. dentiferum</i> Ames & C.Schweinf.)	A. Cogollo, <i>et al.</i> 2897 (JAUM)	-28.5	E	890
<i>E. jejunum</i> Rchb.f. (= <i>E. dentiferum</i> Ames & C.Schweinf.)	O. Pérez 144 (CUVC)	-28.9	E	1600
<i>E. kerryae</i> Hágsater & L.Sánchez	M. Ospina 154 (JAUM)	-20.3	E	27
<i>E. klotzschianum</i> Rchb.f.	J. Farfán & E. Buitrago 1097 (FMB)	-29.7	T	2900
<i>E. lacustre</i> Lindl.	O. Pérez, <i>et al.</i> 1066 (CUVC)	-31.3	E	1800
<i>E. lagenomorphum</i> Hágsater & Dodson	A. Cogollo, <i>et al.</i> 2993 (JAUM)	-31.8	E	800
<i>E. lanipes</i> Lindl.	J. L. Zarucchi, <i>et al.</i> 7031 (HUA)	-27.8	E	1200
<i>E. leeanum</i> (Rchb.f.) Hágsater	M. A. Rebolledo 13 (FMB)	-30.2	E	350
<i>E. leucochilum</i> Link, Klotzsch & Otto	J. C. Bermúdez 24 (CUVC)	-26.5	E	1984
<i>E. leucochilum</i> Link, Klotzsch & Otto	A. Rudas, <i>et al.</i> 2164 (FMB)	-29.9	E	100
<i>E. leucochilum</i> Link, Klotzsch & Otto (= <i>E. longiflorum</i> Kunth)	D. Hartman 484 (CUVC)	-22.9	E	2000
<i>E. lima</i> Lindl.	J. Cuatrecasas 14794 (VALLE)	-22.9	T	2800
<i>E. lindae</i> Hágsater & Dodson	J. S. García-Revelo & A. D. García-Ramírez 36 (CUVC)	-29.4	E	2160
<i>E. littorale</i> Hágsater & Dodson	J. Cuatrecasas 21570 (VALLE)	-19.8	E	5
<i>E. longicolle</i> Lindl.	M. Sánchez & P. Miraña 537 (COAH)	-30.3	E	108
<i>E. luckei</i> I.Bock	J. Zarucchi, <i>et al.</i> 5029 (HUA)	-17.8	E	140
<i>E. macrocarpum</i> Rich.	C. Guerrero 7 (COAH)	-20.0	E	638
<i>E. macrogastrum</i> Kraenzl.	J. Cuatrecasas 20874 (VALLE)	-19.3	T	2900
<i>E. cf. mancum</i> Lindl.	J. Farfán, <i>et al.</i> 1139 (FMB)	-29.5	E	3300
<i>E. megagastrum</i> Lindl.	J. Cuatrecasas 19252 (VALLE)	-23.1	T	3050
<i>E. megalospathum</i> (Rchb.f.) (= <i>E. rhodochilum</i> (Schltr.) Hágsater & Dodson)	M. Rincón 110 (TOLI)	-31.2	E	2500
<i>E. cf. megalospathum</i> Rchb.f.	C. Barbosa 1394 (FMB)	-26.4	E	2811
<i>E. melinanthum</i> Schltr.	T. A. Medina 1394 (TOLI)	-18.2	T	2021



Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>E. microphyllum</i> Lindl.	P. Stevenson 474 (ANDES/P. Stevenson Coll.)	-20.5	E	300
<i>E. microphyllum</i> Lindl. (= <i>Lanium microphyllum</i> Lindl. ex Benth.)	F. Alonso, <i>et al.</i> 9280 (HUA)	-24.4	E	515
<i>E. misasii</i> Hágsater (= <i>Oerstedella viridiflora</i> Hágsater)	P. Ortiz-Valdivieso 739 (HPUJ)	-26.1	E	1104
<i>E. muricatoides</i> Hágsater & Dodson	G. Reina, <i>et al.</i> 1589 (CUVC)	-30.5	T	1378
<i>E. mutisii</i> Hágsater	J. J. Hernández, <i>et al.</i> 275 (HUA)	-19.5	E	670
<i>E. nocturnum</i> Jacq.	A. Rudas, <i>et al.</i> 2190 (FMB)	-27.8	E	100
<i>E. nora-mesae</i> Hágsater & O.Pérez	P. Silverstone-Sopkin, <i>et al.</i> 2987 (CUVC)	-32.2	E	2260
<i>E. cf. oreogena</i> Schltr.	L. Cortés 50 (CUVC)	-24.3	T	3257
<i>E. oxycalyx</i> Hágsater & Dodson	J. S. García-Revelo & A. D. García-Ramírez 30 (CUVC)	-28.2	E	2157
<i>E. pachycoleum</i> Hágsater, O.Pérez & E.Santiago	M. Rincón 154 (TOLI)	-26.4	E	3500
<i>E. palaciosii</i> Hágsater & Dodson	MOH 776 (JAUM)	-30.4	T	2501
<i>E. paniculatum</i> Ruiz & Pav.	J. Betancur, <i>et al.</i> 9850 (FMB)	-28.9	T	2800
<i>E. paniculatum</i> Ruiz & Pav. (= <i>E. laeve</i> Lindl.)	M. Rincón 281 (TOLI)	-29.0	E	2600
<i>E. paniculatum</i> Ruiz & Pav. (= <i>E. laeve</i> Lindl.)	V. H. Grande, <i>et al.</i> 80 (HUQ)	-32.7	E	2600
<i>E. paranthicum</i> Rchb.f.	L. A. de Escobar, <i>et al.</i> 8075 (HUA)	-28.5	E	1850
<i>E. pastoense</i> Schltr.	L. Cortés 0 (CUVC)	-23.8	T	3450
<i>E. paternale</i> *	O. Pérez & E. Parra 1105 (VALLE)	-19.0	T	2600
<i>E. pazii</i> Hágsater	D. A. García-Ramírez & J. S. García-Revelo 68 (CUVC)	-27.1	T	2121
<i>E. peperomia</i> Rchb.f.	H. Cuadros 663 (TULV)	-15.6	E	1200
<i>E. peperomia</i> Rchb.f. (= <i>E. porpax</i> Rchb.f.)	J. Cuatrecasas 19497 (VALLE)	-17.2	E	1840
<i>E. peperomia</i> Rchb.f. (= <i>E. lambeauanum</i> De Wild.)	G. Reina, <i>et al.</i> 1127 (CUVC)	-15.7	E	1841
<i>E. aff. peraltum</i> Schltr.	D. Hartman 529 (CUVC)	-32.9	E	2600
<i>E. piliferum</i> Rchb.f.	P. A. Viveros, <i>et al.</i> 20 (HUQ)	-29.9	E	1650
<i>E. pittieri</i> Ames	L. Cortés 30A (CUVC)	-24.1	T	3375
<i>E. platytilum</i> Schltr.	A.H. Gentry, <i>et al.</i> 47990 (CUVC)	-26.1	E	19
<i>E. polyanthostachyum</i> Hágsater, E.Santiago & García-Ram.	D. A. García-Ramírez 180 (CUVC)	-28.6	E	2033
<i>E. porphyreum</i> Lindl.	J. Farfán 873 (FMB)	-30.9	T	2900
<i>E. porphyreum</i> Lindl. (= <i>E. cf. spathatum</i> Schltr.)	N. F. Alzate 716 (FAUC)	-25.7	E	2276
<i>E. porquerense</i> F.Lehm. & Kraenzl.	G. Reina & C. Lopera 1737 (CUVC)	-20.9	E	1402
<i>E. cf. praetervisum</i> Rchb.f.	Anon. <i>s.n.</i> (CAUP)	-26.5	E	1698
<i>E. prostratum</i> (Lindl.) Cogn.	A. Cogollo & R. Borja 1609 (JAUM)	-18.7	E	376
<i>E. pseudonocturnum</i> Hágsater & Dodson	T. B. Croat & D. Bay 75652 (CUVC)	-26.9	E	45
<i>E. ptoticum</i> Hágsater	J. Cuatrecasas 18144 (VALLE)	-13.0	E	2295
<i>E. purpurascens</i> H.Focke	D. Cárdenas, <i>et al.</i> 21188 (COAH)	-23.4	T	400
<i>E. radicans</i> Pav. ex Lindl.	R. González, <i>et al.</i> 2108 (FMB)	-15.7	T	828
<i>E. ramosum</i> Jacq.	O. Pérez & E. Parra 168 (CUVC)	-26.9	E	1600
<i>E. renzii</i> Garay & Dunst.	C. E. Ceballos & V. Lasso 230 (CAUP)	-30.4	E	1800
<i>E. repens</i> Cogn.	P. Silverstone-Sopkin, <i>et al.</i> 9944 (CUVC) Ecuador	-27.7	E	1725
<i>E. cf. rhizomaniacum</i> Rchb.f.	C. E. Ceballos & V. Lasso 3556 (CAUP)	-31.6	T	2100
<i>E. rhodovandoides</i> Hágsater	P. A. Morales, <i>et al.</i> 627 (HUA)	-28.8	E	2456
<i>E. rhombochilum</i> L.O.Williams	J. Cuatrecasas 18950 (VALLE)	-23.7	T	3425
<i>E. rigidiflorum</i> Schltr.	J. Cuatrecasas 18949 (VALLE)	-25.0	T	3425
<i>E. rocalderianum</i> P.Ortiz & Hágsater	J. Cuatrecasas 16471 (VALLE)	-24.9	E	28
<i>E. rostrigerum</i> Rchb.f.	J. Cuatrecasas 14797 (VALLE)	-22.6	E	2800
<i>E. rugulosum</i> Schltr.	G. McPherson & F. J. Roldán 13267 (HUA)	-29.7	E	1900

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>E. ruizianum</i> Steud.	G. Reina, <i>et al.</i> 1543 (CUVC)	-15.5	E	1107
<i>E. aff. santalarense</i> Ames	D. Hartman 3 (CUVC)	-23.7	E	1500
<i>E. saxatile</i> Lindl. (= <i>E. fractiflexum</i> Barb.Rodr.)	D. A. García-Ramírez 125 (CUVC)	-31.1	T	2100
<i>E. scabrum</i> Ruiz & Pav.	M. Schneider 322 (HUA)	-27.0	T	3200
<i>E. aff. scharfii</i> Hágsater & Dodson	P. Silverstone 676 (TULV)	-21.5	E	2000
<i>E. schistochilum</i> Schltr.	D. Gamba 66 (CUVC)	-16.7	E	2700
<i>E. schlimii</i> Rchb.f.	P. A. Morales, <i>et al.</i> 619 (HUA)	-26.9	E	2417
<i>E. schneideri</i> Hágsater	A. M. Benavides, <i>et al.</i> 4027 (HUA)	-31.5	E	2436
<i>E. scutella</i> Lindl.	J. Farfán, <i>et al.</i> 1077 (FMB)	-26.4	E	3195
<i>E. aff. scytocladium</i> Schltr.	P. Stevenson, <i>et al.</i> 3279 (ANDES/P. stevenson Coll.)	-33.8	E	1900
<i>E. secundum</i> Jacq. (= <i>E. dolichopus</i> Schltr.)	L. M. Álvarez, <i>et al.</i> 38 (CUVC)	-18.0	T	2000
<i>E. secundum</i> Jacq. (= <i>E. elongatum</i> Jacq.)	G. M. Rodríguez, <i>et al.</i> 1293 (FMB)	-18.2	T	2695
<i>E. cf. secundum</i> Jacq. (= <i>E. cf. coroicoense</i> Schltr.)	M. Hermann 304 (CUVC) Bolivia	-17.5	E	2330
<i>E. cf. secundum</i> Jacq. (= <i>E. cf. brachyphyllum</i> Lindl.)	M. Hermann 318 (CUVC) Bolivia	-17.1	T	1300
<i>E. silverstonei</i> Hágsater	D. A. García-Ramírez & J. S. García-Revelo 23 (CUVC)	-31.4	E	1604
<i>E. sinuosum</i> Lindl.	C. Acevedo, <i>et al.</i> 2920 (FMB)	-32.1	E	2600
<i>E. siphonosepalum</i> Garay & Dunst.	D. Hartman 2 (CUVC)	-21.1	E	1500
<i>E. sigsaense</i> Hágsater	J. Farfán, <i>et al.</i> 1151 (FMB)	-31.9	E	3214
<i>E. smaragdinum</i> Lindl.	Anon. 609 (FAUC)	-22.5	E	1341
<i>E. sophonitoides</i> F.Lehm. & Kraenzl.	O. Duque 391 (JAUM)	-30.4	E	2500
<i>E. stellidiforme</i> Hágsater & Dodson	M. Rincón 305 (TOLI)	-22.6	E	2500
<i>E. cf. sterroanthum</i> Schltr.	P. A. Silverstone, <i>et al.</i> 4504 (CUVC)	-26.1	E	3050
<i>E. aff. stramineum</i> Lindl.	C. Luer, <i>et al.</i> 7540 (JAUM)	-30.0	E	3150
<i>E. strobiliferum</i> Rchb.f.	J. E. Ramos, <i>et al.</i> 2520 (CUVC)	-17.3	E	500
<i>E. subpurum</i> Rchb.f.	L. A. de Escobar, <i>et al.</i> 4199 (HUQ)	-27.8	E	2000
<i>E. summerhayesii</i> Hágsater	O. Pérez & E. Parra 142 (VALLE)	-22.7	E	1600
<i>E. sympetalostele</i> Hágsater & L.Sánchez	N. Pino, <i>et al.</i> 68 (CHOCO)	-26.5	E	49
<i>E. tipuloideum</i> Lindl.	N. F. Alzate 585 (FAUC)	-27.2	E	1480
<i>E. tolimense</i> Lindl.	M. Rincón 348 (TOLI)	-32.7	E	3400
<i>E. torquatum</i> Lindl.	M. L. Delgado & A. Quenguan 54 (FMB)	-26.6	E	3402
<i>E. tulcanense</i> Hágsater & Dodson	L. Cortés 70 (CUVC)	-18.5	T	3100
<i>E. cf. umbelliferum</i> J.F.Gmel (= <i>E. cf. chlorocorymbos</i> Schltr.)	D. Cárdenas, 1379 (JAUM)	-27.4	E	267
<i>E. unguiculatum</i> (C.Schweinf.) Garay & Dunst.	A. H. Gentry, <i>et al.</i> 59509 (CUVC)	-26.1	E	1700
<i>E. vesicicaule</i> L.O.Williams	M. Rincón 64 (TOLI)	-33.2	E	3600
<i>E. vinctinum</i> Lindl.	O. Pérez & E. Parra 523 (VALLE)	-29.6	E	1860
<i>E. cf. vulcanicola</i> A.H.Heller	J. Cuatrecasas 18211 (VALLE)	-25.9	E	2160
<i>E. wallisii</i> Rchb.f.	G. Reina, <i>et al.</i> 1138 (CUVC)	-28.9	E	1697
<i>E. wallisii</i> Rchb.f. (= <i>Oerstedella wallisii</i> (Rchb.f.) Hágsater)	P. Ortiz-Valdivieso 214 (HPUJ)	-28.1	E	337
<i>E. weerakitianum</i> Hágsater, O.Pérez & E.Santiago	D. A. García-Ramírez 121 (CUVC)	-26.6	E	2176
<i>E. xanthinum</i> Lindl.	Anon. s.n. (TOLI)	-15.2	T	810
<i>E. xylostachyum</i> Lindl.	C. Acevedo, <i>et al.</i> 6957 (FMB)	-30.3	T	2570
<i>E. yumboënsis</i> Hágsater, O.Pérez & E.Santiago	J. S. García-Revelo & A. D. García-Ramírez 13 (CUVC)	-26.9	E	2169
<i>E. zipaquiranum</i> Schltr.	H. Sánchez & J. Hernández 588 (FMB)	-28.8	E	3120
<b><i>Homalopetalum</i> Rolfe (7; 0/1 = 0%)</b>				
<i>H. sp.</i>	Anon. 84 (HUQ)	-32.2	E	1650
<b><i>Jacquiniella</i> Schltr. (12; 1/2 = 50%)</b>				
<i>J. globosa</i> (Jacq.) Schltr.	D. A. Giraldo-Cañas 406 (HUA)	-27.0	E	1000

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>J. teretifolia</i> (Sw.) Britton	J. Cuatrecasas 17813 (VALLE)	-17.9	E	630
<b><i>Laelia</i> Lindl. (23; 3/3 = 100%)</b>				
<i>L. lueddemanii</i> (Prill.) L.O.Williams in Woodson & Schery	Orquídeas del Valle 10 (CUVC)	-13.9	E	1016
<i>L. marginata</i> (Lindl.) L.O.Williams	A. Van Dulmen 303 (COAH)	-17.2	E	200
<i>L. undulata</i> (Lindl.) L.O.Williams	G. Reina, <i>et al.</i> 1485 (CUVC)	-15.4	E	310
<b><i>Meiracyllium</i> Rchb.f. (2; 1/1 = 100%)</b>				
<i>M. trinasutum</i> Rchb.f.	F. Hamer 63 (JAUM) El Salvador	-13.1	E	700
<b><i>Nidema</i> Britton &amp; Millsp. (2; 0/1 = 0%)</b>				
<i>N. ottonis</i> Britton & Millsp.	J. G. Ramírez & D. Cárdenas 140 (HUA)	-25.0	E	600
<b><i>Prosthechea</i> Knowles &amp; Westc. (119; 0/14 = 0%)</b>				
<i>P. aemula</i> (Lindl.) W.E.Higgins	R. López C & O. J. Rodríguez 2445 (COAH)	-28.0	E	191
<i>P. chacaoensis</i> (Rchb.f.) W.E.Higgins	L. Rodríguez 68 (CUVC)	-30.9	E	700
<i>P. crassilabia</i> (Poepp. & Endl.) Carnevali & I.Ramírez	R. Arévalo 198 (COAH)	-22.8	E	500
<i>P. crassilabia</i> (Poepp. & Endl.) Carnevali & I.Ramírez (= <i>P. longipes</i> (Rchb.f.) Chiron)	J. Cuatrecasas 21941 (VALLE)	-28.3	E	2691
<i>P. fragrans</i> (Sw.) W.E.Higgins	J. Rubiano 27 (FMB)	-26.5	E	1200
<i>P. fragrans</i> (Sw.) W.E.Higgins (= <i>Encyclia fragrans</i> (Sw.) Dressler)	Anon. <i>s.n.</i> (FAUC)	-22.9		
<i>P. gilbertoi</i> (Garay) W.E.Higgins	MOH 703 (JAUM)	-25.2	E	1940
<i>P. grammatoglossa</i> (Rchb.f.) W.E.Higgins	O. Pérez & E. Parra 658 (CUVC)	-27.6	E	1800
<i>P. livida</i> (Lindl.) W.E.Higgins	G. Reina & C. Lopera 1745 (CUVC)	-24.4	E	1402
<i>P. livida</i> (Lindl.) W.E.Higgins (= <i>Encyclia livida</i> (Lindl.) Dressler)	J. F. Restrepo 349 (CAUP)	-26.3	E	1000
<i>P. megahybos</i> (Schltr.) Dodson & Hágsater [= <i>P. squamata</i> (Porto & Brade) W.E.Higgins ex Withner]	P. A. Villa & K. Quintero 45 (HUQ)	-32.2	E	1700
<i>P. mejia</i> (Withner & P.A.Harding) W.E.Higgins	D. A. García-Ramírez 120 (CUVC)	-25.0	E	1850
<i>P. pygmaea</i> (Hook.) W.E.Higgins	J. G. Ramírez & D. Cárdenas 1829 (HUA)	-29.7	E	685
<i>P. sceptra</i> (Lindl.) W.E.Higgins (= <i>Epidendrum sceptra</i> Lindl.)	P. Stevenson 961 (ANDES/P. stevenson Coll.)	-26.6	E	350
<i>P. sceptra</i> (Lindl.) W.E.Higgins	A. J. Negret 349 (CAUP)	-26.2	E	1700
<i>P. cf. tigrina</i> (Lindl.) W.E.Higgins	E. L. Velásquez, & T. Hinestroza 12 (JAUM)	-26.5	E	2400
<i>P. vespa</i> (Vell.) W.E.Higgins	A. Prieto, <i>et al.</i> 1106 (FMB)	-30.8	E	2200
<i>P. sp.</i> (= <i>Anacheilium</i> sp. Hoffmanns.)	J. L. Fernández 12277 (FMB)	-23.6	E	2300
<b><i>Scaphyglottis</i> Poepp. &amp; Endl. (68; 0/16 = 0%)</b>				
<i>S. aurea</i> (Rchb.f.) Foldats	D. Hartman 631 (CUVC)	-30.4	T	2500
<i>S. bidentata</i> (Lindl.) Dressler	L. F. Rojas & C. Rojas 4 (LLANOS)	-30.5	E	537
<i>S. bidentata</i> (Lindl.) Dressler (= <i>Hexisea bidentata</i> Lindl.)	P. Stevenson 1343 (ANDES/P. stevenson Coll.)	-30.3	E	350
<i>S. bilineata</i> Schltr.	B. Villanueva 1117 (TOLI)	-33.4	E	70
<i>S. dunstervillei</i> (Garay) Foldats	MOH 753 (JAUM)	-28.2	E	2023
<i>S. gentryi</i> Dodson & Monsalve	A. H. Gentry, <i>et al.</i> 59593 (CUVC)	-29.9	E	50
<i>S. graminifolia</i> Poepp. & Endl.	J. Brand & M. Escobar 778 (JAUM)	-28.6	E	11
<i>S. leucantha</i> Rchb.f. (= <i>S. suriens</i> Schltr.)	O. Pérez, <i>et al.</i> 635 (CUVC)	-33.4	E	100
<i>S. longicaulis</i> S.Watson	MOH 277 (JAUM)	-28.3	E	22
<i>S. minutiflora</i> Ames & Correll	E. P. Killip & J. Cuatrecasas 38949 (VALLE)	-29.4	E	0

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>S. prolifera</i> Cogn. (= <i>S. cuneata</i> Schltr.)	E. Forero & R. Jaramillo 5299 (CHOCO)	-28.4	E	125
<i>S. aff. prolifera</i> Cogn.	C. L. Orozco, <i>et al.</i> 865 (HUA)	-29.7	E	1100
<i>S. propinqua</i> C.Schweinf.	A. H. Gentry, <i>et al.</i> 53653 (CUVC)	-33.5	E	500
<i>S. punctulata</i> (Rchb.f.) C.Schweinf.	M. Ospina 18 (JAUM)	-25.0	E	2500
<i>S. sickii</i> Pabst	Mejía-Rosero & Pino-Andrade 23 (CHOCO)	-25.9	E	44
<i>S. sickii</i> Pabst (= <i>S. signata</i> I.Bock)	J. F. Restrepo 608 (CAUP)	-27.6	E	1884
<i>S. stellata</i> Lodd. ex Lindl.	R. López, <i>et al.</i> 808 (COAH)	-28.0	E	290
<i>S. triloba</i> B.R.Adams	J. F. Restrepo 340 (CAUP)	-27.4	E	1000
<b>Subtribe Pleurothallidinae</b>				
<b><i>Acianthera</i> Scheidw. (201; 5/11 = 45.5%)</b>				
<i>A. adeodata</i> P.Ortíz, O.Pérez & E.Parra	O. Pérez & E. Parra 802 (CUVC)	-14.6	E	1900
<i>A. agathophylla</i> (Rchb.f.) Pridgeon & M.W.Chase (= <i>Pleurothallis agathophylla</i> Rchb.f.)	Mejía-Rosero & Pino-Andrade 12 (CHOCO)	-17.2	E	44
<i>A. boliviana</i> (Rchb.f.) Pridgeon & M.W.Chase (= <i>Pleurothallis boliviana</i> Rchb.f.)	M. Lewis 882091 (JAUM) Bolivia	-14.6	E	2450
<i>A. capillaris</i> (Lindl.) Pridgeon & M.W.Chase [= <i>Pleurothallis floribunda</i> (Lindl.) Lindl.]	O. Duque & J. Serna 2345 (JAUM)	-31.5	E	1900
<i>A. casapensis</i> (Lindl.) Pridgeon & M.W.Chase	J. Cuatrecasas 20513 (VALLE)	-18.1	E	1680
<i>A. casapensis</i> (Lindl.) Pridgeon & M.W.Chase (= <i>Pleurothallis casapensis</i> Lindl.)	M. A. Correa & F. Cardona 1087 (JAUM)	-23.2	E	2472
<i>A. casapensis</i> (Lindl.) Pridgeon & M.W.Chase (= <i>Pleurothallis chamensis</i> Lindl.)	NA 18 (FMB)	-27.9	E	2400
<i>A. decurrens</i> (Poepp. & Endl.) Pridgeon & M.W.Chase (= <i>Pleurothallis decurrens</i> Poepp. & Endl.)	J. L. Zarucchi, <i>et al.</i> 5665 (CHOCO)	-29.4	E	1870
<i>A. miqueliana</i> (H.Focke) Pridgeon & M.W.Chase (= <i>Pleurothallis miqueliana</i> Lindl.)	A. Van Dulmen 292 (COAH)	-16.1	E	200
<i>A. ramosa</i> (Barb.Rodr.) F.Barros (= <i>Pleurothallis ramosa</i> Barb.Rodr.)	S. Espinal & J. E Ramos 3138 (CUVC)	-26.6	E	2150
<i>A. rodrigoii</i> (Luer) Luer	T. Hinestroza & A. L. Montoya P 425 (JAUM)	-27.2	E	2300
<i>A. sicaria</i> (Lindl.) Pridgeon & M.W.Chase (= <i>Pleurothallis sicaria</i> Lindl.)	J. S. García-Revelo & D. A. García-Ramírez 59 (CUVC)	-27.9	E	1982
<i>A. wagneriana</i> (Klotzsch) Pridgeon & M.W.Chase (= <i>Pleurothallis wagneriana</i> Klotzsch)	M. de Fraume & Álvarez y Gallego 487 (FAUC)	-27.6	E	2250
<b><i>Anathallis</i> Barb.Rodr. (147; 0/3 = 0%)</b>				
<i>A. acuminata</i> (Kunth) Pridgeon & M.W.Chase	N. F. Alzate 684 (FAUC)	-23.6	E	3370
<i>A. acuminata</i> (Kunth) Pridgeon & M.W.Chase (= <i>Pleurothallis acuminata</i> (Kunth) Lindl.)	D. Hartman 617 (CUVC)	-32.3		3100
<i>A. ramulosa</i> (Lindl.) Pridgeon & M.W.Chase	A. J. Negret 146 (CAUP)	-28.5	E	2000
<i>A. sclerophylla</i> (Lindl.) Pridgeon & M.W.Chase	I. et Pinto 2185 (COAH)	-27.4	E	780
<i>A. sclerophylla</i> (Lindl.) Pridgeon & M.W.Chase (= <i>Pleurothallis listrostachys</i> Rchb.f.)	C. Alcázar-Caicedo 507 (CAUP)	-28.7	E	1870
<b><i>Barbosella</i> Schltr. (19; 0/1 = 0%)</b>				
<i>B. cucullata</i> (Lindl.) Schltr.	C. Luer & R. Escobar 8432 (JAUM)	-28.6	E	3150
<b><i>Brachionidium</i> Lindl. (73; 0/3 = 0%)</b>				
<i>B. imperiale</i> Luer & R.Escobar	P. Silvertone-Sopkin, <i>et al.</i> 1662 (CUVC)	-30.6	T	1970
<i>B. parvifolium</i> Lindl.	D. M. Bonilla 2 (TOLI)	-32.3	E	3000
<i>B. tuberculatum</i> Lindl.	S. L. Díaz-Ibarra 2025 (CAUP)	-26.9	E	3330
<b><i>Crocodelanthe</i> Rchb.f. &amp; Warsz. (Unresolved; 0/2 = 0%)</b>				
<i>C. elegans</i> (Kunth) Luer	M. Schneider 626 (HUA)	-24.3	E	2300



Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>C. sp.</i>	H. Mendoza, <i>et al.</i> 14445 (FMB)	-25.3	E	1000
<b><i>Draconanthes</i> (Luer) Luer (11; 0/1 = 0%)</b>				
<i>D. aberrans</i> (Schltr.) Luer	C. Luer & R. Escobar 8388 (JAUM)	-27.6	T	3200
<b><i>Dracula</i> Luer (125; 0/13 = 0%)</b>				
<i>D. alcithoe</i> Luer & R. Escobar	P. Stevenson & F. Henao 3374 (ANDES/P. stevenson Coll.)	-33.5	E	1900
<i>D. andreetae</i> (Luer) Luer	F. A. Silverstone-Sopkin 3010 (CUVC)	-28.9	E	2175
<i>D. benedictii</i> (Rchb.f.) Luer	N. Peláez & E. Buitrago 307 (JAUM)	-29.6	E	2450
<i>D. chimaera</i> (Rchb.f.) Luer	P. A. Silverstone, <i>et al.</i> 5119 (CUVC)	-29.9	E	1999
<i>D. chiroptera</i> Luer & Malo	J. F. Restrepo 373 (CAUP)	-32.7	E	1884
<i>D. cutis-bufonis</i> Luer & R. Escobar	L. Posada 151 (HUA)	-33.3	E	2200
<i>D. diana</i> Luer & R. Escobar	P. Silverstone-Sopkin, <i>et al.</i> 11149 (CUVC)	-28.9	E	1783
<i>D. houtteana</i> (Rchb.f.) Luer	M. Rincón 374 ((TOLI)/Dendrology sec.)	-33.8	E	2580
<i>D. inaequalis</i> (Rchb.f.) Luer & R. Escobar	J. F. Restrepo 459 (CAUP)	-26.2	E	1884
<i>D. platycrater</i> (Rchb.f.) Luer	A. Cogollo & J. G. Ramírez 3230 (JAUM)	-33.5	E	880
<i>D. venefica</i> Luer & R. Escobar	J. F. Restrepo 597 (CAUP)	-29.6	E	1884
<i>D. vinacea</i> Luer & R. Escobar	J. F. Restrepo 484 (CAUP)	-28.5	E	1884
<i>D. xenos</i> Luer & R. Escobar	J. F. Restrepo 596 (CAUP)	-30.4	E	1884
<b><i>Dryadella</i> Luer (53; 0/1 = 0%)</b>				
<i>D. simula</i> (Rchb.f.) Luer	S. Hoyos, <i>et al.</i> 1699 (JAUM)	-28.5	E	2022
<b><i>Fronitaria</i> Luer (1; 0/1 = 0%)</b>				
<i>F. caulescens</i> (Lindl.) Luer	S. Sarria, <i>et al.</i> 1119 (CUVC)	-27.5	E	3180
<b><i>Kraenzlinella</i> Kuntze (9; 0/1 = 0%)</b>				
<i>K. anfracta</i> (Luer) Luer (= <i>Pleurothallis anfracta</i> Luer)	J. F. Restrepo 471 (CAUP)	-32.1	E	1884
<b><i>Lepanthes</i> Sw. (1092; 0/36 = 0%)</b>				
<i>L. aduncata</i> Luer & R. Escobar	C. Berrío, <i>et al.</i> 58 (HUQ)	-29.9	E	2800
<i>L. agglutinata</i> Luer	N. L. Vela 272 (FMB)	-32.7	E	3503
<i>L. arbuscula</i> Luer & R. Escobar	M. J. Rodríguez & M. E. Pantoja 22 (CAUP)	-33.8	E	3327
<i>L. auriculata</i> Luer	P. Silverstone-Sopkin, <i>et al.</i> 3786 (CUVC)	-31.4	T	2250
<i>L. carunculigera</i> Rchb.f.	Y. Rueda-Valoyes & J. García-Arias 8 (CHOCO)	-30.1	E	86.9
<i>L. caudatiseipala</i> C. Schweinf.	M. J. Rodríguez & M. E. Pantoja 12 (CAUP)	-33.5	E	3327
<i>L. caudatiseipala</i> C. Schweinf. (= <i>L. profusa</i> Luer & Hirtz)	M. Rincón 165 (TOLI)	-28.1	E	3300
<i>L. cornualis</i> Luer & R. Escobar	P. Silverstone, <i>et al.</i> 6541 (CUVC)	-30.1	E	3450
<i>L. dunstervilleorum</i> Foldats	M. Rincón 183 (TOLI)	-20.6	E	3300
<i>L. dunstervilleorum</i> Foldats	C. Luer, <i>et al.</i> 7503 (JAUM)	-30.1	E	2930
<i>L. effusa</i> Schltr.	R. Callejas, <i>et al.</i> 7795 (HUA)	-26.1	E	3120
<i>L. elata</i> Rchb.f.	O. Pérez & E. Parra 1129 (CUVC)	-34.9	E	1800
<i>L. elata</i> Rchb.f.	C. Luer, <i>et al.</i> 7674 (JAUM)	-31.1	E	2300
<i>L. elephantina</i> Luer & R. Escobar	M. L. Delgado & A. Quenguan 76 (FMB)	-32.7	E	3428
<i>L. escifera</i> Luer & R. Escobar	R. Callejas, <i>et al.</i> 10051 (HUA)	-34.9	E	2080
<i>L. felis</i> Luer & R. Escobar	P. A. Silverstone, <i>et al.</i> 2949 (CUVC)	-29.5	E	2260
<i>L. cf. fonnegrae</i> Luer & R. Escobar	P. Stevenson & C. Prada 3192 (ANDES/P. stevenson Coll.)	-33.7	E	1900
<i>L. gargantua</i> Rchb.f.	J. L. Zarucchi & A. E. Brant 5326 (HUA)	-25.3	T	2970

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>L. cf. helgae</i> Luer & R. Escobar (= <i>*Epidendrum cf. helgae</i> )	N. F. Alzate 619 (FAUC)	-31.7	E	3745
<i>L. hirpex</i> Luer & R. Escobar	E. Domínguez & E. Durango 38 (JAUM)	-32.6	E	2500
<i>L. manabina</i> Dodson	C. Berrior, <i>et al.</i> 5 (HUQ)	-29.5	E	3020
<i>L. marthae</i> Luer & R. Escobar	C. Berrior, <i>et al.</i> 26 (HUQ)	-26.4	E	3300
<i>L. medusa</i> Luer & R. Escobar	M. Rincón 370 ((TOLI)/Dendrology sec.)	-37.4	E	2580
<i>L. monoptera</i> Lindl. (= <i>L. dolichopus</i> Schltr.)	M. J. Rodríguez & M. E. Pantoja 63 (CAUP)	-32.7	E	3206
<i>L. nummularia</i> Rchb.f. [= <i>Neoreophilus nummularius</i> (Rchb.f.) Archila]	E. Domínguez, <i>et al.</i> 39 (JAUM)	-28.7	E	3001
<i>L. ollaris</i> Luer & R. Escobar	J. S. García-Revelo & A. D. García-Ramírez 14 (CUVC)	-32.1	E	2169
<i>L. papyrophylla</i> Rchb.f.	B. R. Ramírez & K. Ocampo 21313 (CAUP)	-32.5	E	3360
<i>L. pastoensis</i> Schltr.	A. H. Gentry, <i>et al.</i> 53974 (CUVC)	-29.4	E	2300
<i>L. pendens</i> Garay [= <i>Neoreophilus pendens</i> (Garay) Archila]	C. Luer, <i>et al.</i> 7541 (JAUM)	-30.2	E	2500
<i>L. pilosella</i> Rchb.f.	C. Berrior, <i>et al.</i> 11 (HUQ)	-27.7	E	3020
<i>L. platysepala</i> Luer & R. Escobar [= <i>Brachycladium platysepalum</i> (Luer & R. Escobar) Luer]	J. Farfán, <i>et al.</i> 1179 (FMB)	-27.7	E	2688
<i>L. cf. platysepala</i> Luer & R. Escobar [= <i>Neoreophilus cf. platysepalus</i> (Luer & R. Escobar) Archila]	J. Betancur, <i>et al.</i> 980 (HUA)	-25.8	E	2380
<i>L. scalaris</i> Luer	S. M. Pasmíño & M. R. Posso 26 (CAUP)	-26.8	E	3240
<i>L. setifera</i> Luer & R. Escobar	J. S. García-Revelo & A. D. García-Ramírez 5 (CUVC)	-29.6	E	2107
<i>L. smaragdina</i> Luer & R. Escobar	L. Rodríguez & C. Rincón-Useche 52 (VALLE)	-30.8	E	1900
<i>L. tibouchinicola</i> Luer & R. Escobar	A. Idárraga, <i>et al.</i> 4083 (HUA)	-31.9	E	3147
<i>L. tricuspis</i> Schltr.	J. Cuatrecasas 18867 (VALLE)	-29.4	E	3325
<i>L. wagneri</i> Rchb.	J. E. Calle, <i>et al.</i> 165 (HUA)	-29.7	E	2325
<i>L. sp.</i>	M. Rincón 128 ((TOLI)/Dendrology sec.)	-31.8	E	100
<b>Lepanthopsis Ames (42; 0/2 = 0%)</b>				
<i>L. acuminata</i> Ames	R. Callejas & R. Fonnegra 10746 (HUA)	-31.7	E	1600
<i>L. floripecten</i> Ames	P. Viveros, <i>et al.</i> 752 (HUQ)	-27.4	E	1730
<b>Masdevallia Ruiz &amp; Pav. (586; 0/42 = 0%)</b>				
<i>M. aenigma</i> Luer & R. Escobar	C. Luer, <i>et al.</i> 7571A (JAUM)	-30.2	E	2500
<i>M. amanda</i> Rchb.f. & Warsz.	R. Callejas, <i>et al.</i> 6404 (HUA)	-29.3	E	3000
<i>M. angulata</i> Rchb.f.	M. Tsubota 12 (FAUC)	-28.5	E	1500
<i>M. arangoi</i> Luer & R. Escobar	R. Escobar & L. Agudelo <i>s.n.</i> (JAUM)	-23.3	E	1850
<i>M. assurgens</i> Luer & R. Escobar	C. Barbosa 9565 (275) (FMB)	-27.4	T	3000
<i>M. bicolor</i> Poepp. & Endl.	J. Home, <i>et al.</i> 118 (CUVC)	-33.2	E	1807
<i>M. bulbophyllopsis</i> Kraenzl.	M. Tsubota 9 (FAUC) Ecuador	-25.9	E	2650
<i>M. caudivolvula</i> Kraenzl.	R. Escobar, <i>et al.</i> <i>s.n.</i> (JAUM)	-24.9	E	2400
<i>M. chaetostoma</i> Luer	D. Portillo, <i>et al.</i> <i>s.n.</i> (JAUM) Ecuador	-29.2	E	2450
<i>M. civilis</i> Rchb.f. & Warsz. [= <i>Byrsella fragrans</i> (Woolward) Luer]	C. Luer, <i>et al.</i> 7644 (JAUM)	-30.2	E	3150
<i>M. coccinea</i> Linden ex Lindl.	C. Luer, <i>et al.</i> 7804 (JAUM)	-30.6	T	2500
<i>M. coriacea</i> Lindl.	C. Luer, <i>et al.</i> 7985 (JAUM)	-24.8	T	3550

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>M. corniculata</i> Rchb.f.	P. Viveros, <i>et al.</i> 230 (HUQ)	-31.7	T	3297
<i>M. cucullata</i> Lindl.	A. Cogollo, <i>et al.</i> 11565 (JAUM)	-30.1	E	2650
<i>M. falcago</i> Rchb.f.	C. Luer, <i>et al.</i> 7733 (JAUM)	-29.2	E	2400
<i>M. fasciata</i> Rchb.f.	W. Buitrago, <i>et al.</i> 226 (JAUM)	-32.5	T	2480
<i>M. filaria</i> Luer & R.Escobar	C. Alexandra, <i>et al.</i> 235 (VALLE)	-36.2	E	1800
<i>M. guttulata</i> Rchb.f.	R. Escobar 1386 (JAUM) Ecuador	-27.8	E	1600
<i>M. herraduræ</i> F.Lehm. & Kraenzl.	J. F. Restrepo 393 (CAUP)	-27.4	E	1884
<i>M. hians</i> Linden & Rchb.f.	C. Luer & R. Escobar 7869 (JAUM)	-29.9	E	2850
<i>M. ignea</i> Rchb.f.	C. Luer, <i>et al.</i> 7672 (JAUM)	-30.7	T	2750
<i>M. impostor</i> Luer & R.Escobar	E. Domínguez & D. Vargas 42 (JAUM)	-32.5	E	2300
<i>M. laevis</i> Lindl.	A. Prieto, <i>et al.</i> 1141 (FMB)	-32.2	E	3020
<i>M. laevis</i> Lindl. (= <i>M. lepida</i> Rchb.f.)	C. Luer & R. Escobar 7799 (JAUM)	-28.5	E	2600
<i>M. laevis</i> Lindl. (= <i>M. pantherina</i> F.Lehm. & Kraenzl.)	C. Luer & R. Escobar 8481 (JAUM)	-28.4	E	3380
<i>M. laevis</i> Lindl. (= <i>M. pantherina</i> F.Lehm. & Kraenzl.)	J. Cuatrecasas 20214 (VALLE)	-23.6	T	3500
<i>M. macroglossa</i> Rchb.f.	C. Luer, <i>et al.</i> 7608 (JAUM)	-28.2	E	3150
<i>M. mandarina</i> (Luer & R.Escobar) Luer	E. Domínguez & N. Urán 7 (JAUM)	-32.1	E	2600
<i>M. mastodon</i> Rchb.f.	C. Luer, <i>et al.</i> 7763 (JAUM)	-28.4	E	2750
<i>M. nidifica</i> Rchb.f.	Anon. <i>s.n.</i> (JAUM)	-28.5	E	1355
<i>M. pardina</i> Rchb.f.	W. Devia, <i>et al.</i> 8542 (JAUM)	-28.4	E	2850
<i>M. peristeria</i> Rchb.f.	C. Luer, <i>et al.</i> 8863 (JAUM)	-29.2	E	2150
<i>M. picturata</i> Rchb.f.	P. A. Morales, <i>et al.</i> 642 (HUA)	-27.6	T	2562
<i>M. pteroglossa</i> Schltr.	J. F. Restrepo 329 (CAUP)	-28.2	E	1884
<i>M. pteroglossa</i> Schltr.	E. Domínguez, <i>et al.</i> 69 (JAUM)	-31.8	E	2000
<i>M. racemosa</i> Lindl.	C. Luer & R. Escobar 8416 (JAUM)	-25.9	T	2850
<i>M. sceptrum</i> Rchb.f.	A. Hernández & S. Medina 63 (FMB)	-26.8	E	2700
<i>M. strumifera</i> Rchb.f.	D. Hartman 721 (CUVC)	-29.6	E	2800
<i>M. towarensis</i> Rchb.f.	J. F. Restrepo 607 (CAUP)	-28.1	E	1884
<i>M. trochilus</i> Linden & André	M. Tsubota 14 (FAUC)	-26.6	E	2000
<i>M. tubulosa</i> Lindl.	C. Luer & R. Escobar 7797 (JAUM)	-29.9	E	2500
<i>M. uncifera</i> Rchb.f.	C. Luer & R. Escobar 8337 (JAUM)	-27.5	E	3000
<i>M. urceolaris</i> Kraenzl.	C. Luer, <i>et al.</i> 7657 (JAUM)	-29.1	E	2570
<i>M. ventricularia</i> Rchb.f.	MOH 759 (JAUM)	-27.6	E	2098
<i>M. wendlandiana</i> Rchb.f.	J. F. Restrepo 325 (CAUP)	-26.9	E	1884
<i>M. xanthina</i> Rchb.f.	C. Luer & R. Escobar 7856 (JAUM)	-27.8	E	2850
<b>Myoxanthus Poepp. &amp; Endl. (46; 0/5 = 0%)</b>				
<i>M. chloroleuca</i> *	M. S. González & B. R. Ramírez 1598 (CAUP)	-32.8	E	750
<i>M. exasperatus</i> (Lindl.) Luer	B. R. Ramírez 5039 (CAUP)	-29.9	T	1650
<i>M. melittanthus</i> (Schltr.) Luer	M. S. González, <i>et al.</i> 1908 (CAUP)	-27.5	E	2800
<i>M. reymondii</i> (H.Karst.) Luer	B. R. Ramírez 14587 (CAUP)	-27.4	E	1850
<i>M. sp.</i>	M. Ospina 81 (JAUM)	-25.0	T	1900
<b>Octomeria R.Br. (151; 0/3 = 0%)</b>				
<i>O. erosilabia</i> C.Schweinf.	M. V. Arbeláez, <i>et al.</i> 679 (COAH)	-22.7	E	112
<i>O. grandiflora</i> Lindl. (= <i>O. surinamensis</i> H.Focke)	G. M. Urreta 82 (JAUM)	-28.0	E	50
<i>O. scirpoidea</i> Rchb.f.	D. Cárdenas, <i>et al.</i> 43754 (COAH)	-28.8	E	290
<b>Pabstiella Brieger &amp; Senghas (29; 1/1 = 100%)</b>				
<i>P. aryter</i> (Luer) F.Barros (= <i>Pleurothallis aryter</i> Luer)	G. Reina 1337 (CUVC)	-14.7	E	1076
<b>Phloeophila Hoehne &amp; Schltr. (11; 0/2 = 0%)</b>				
<i>P. pleurothallopsis</i> (Kraenzl.) Pridgeon & M.W.Chase (= <i>Ophidion pleurothallopsis</i> (Kraenzl.) Luer)	G. M. Urreta 66c (HPUJ)	-29.0	E	75

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>P. cf. pleurothallopsis</i> (Kraenzl.) Pridgeon & M.W.Chase (= <i>Ophidion cf. pleurothallopsis</i> (Kraenzl.) Luer)	R. Fonnegra, <i>et al.</i> 3768 (HUA)	-29.6	E	3000
<b><i>Platystele</i> Schltr. (95; 0/10 = 0%)</b>				
<i>P. cf. alucitae</i> Luer	MOH 630 (JAUM)	-29.7	E	2328
<i>P. compacta</i> Ames	R. Escobar & R. Moran 3110 (JAUM) Costa Rica	-28.5	E	1950
<i>P. consobrina</i> Luer	A. Juncosa & G. Misas 1012 (JAUM)	-31.2	E	2560
<i>P. intronsa</i> *	J. F. Restrepo 296 (CAUP)	-27.8	E	1884
<i>P. misera</i> (Lindl.) Garay	J. L. Zarucchi, <i>et al.</i> 7009 (HUA)	-30.6	E	2110
<i>P. orectoglossa</i> P.Ortiz	J. Betancur, <i>et al.</i> 977 (HUA)	-28.7	E	2380
<i>P. cf. oxyglossa</i> (Schltr.) Garay	P. A. Morales, <i>et al.</i> 662 (HUA)	-27.7	E	2573
<i>P. stenostachya</i> (Rchb.f.) Garay	G. M. Urreta 88 (HUA)	-31.0	E	75
<i>P. stonyx</i> Luer	M. S. González, <i>et al.</i> 2840 (CAUP)	-27.2	E	2800
<i>P. sp.</i>	P. Stevenson & C. Prada 3239 (ANDES/P. stevenson Coll.)	-35.7	E	1900
<b><i>Pleurothallis</i> R.Br. (557; 1/78 = 1.3%)</b>				
<i>P. alvaroi</i> Luer & R.Escobar	N. F. Alzate 644 (FAUC)	-24.7	E	2203
<i>P. amphigya</i> Luer & R.Escobar	P. A. Silverstone, <i>et al.</i> 2747 (CUVC)	-31.6	E	2425
<i>P. antennifera</i> Lindl.	O. Duque 2242 (JAUM)	-28.2	E	800
<i>P. antennifera</i> Lindl. (= <i>P. cyclochila</i> Lindl.)	A. Fernández-Pérez, <i>et al.</i> 30145 (FMB)	-28.3	E	3247
<i>P. cf. anthrax</i> Luer & R.Escobar	P. Stevenson & C. Prada 3081 (ANDES/P. stevenson Coll.)	-34.0	E	1900
<i>P. aff. baudoensis</i> Luer & R.Escobar	M. Rincón 392 ((TOLI)/Dendrology sec.)	-32.2	E	140
<i>P. bicochlearis</i> Luer	P. A. Silverstone, <i>et al.</i> 1628 (CUVC)	-29.8	E	1929
<i>P. bicornis</i> Lindl.	J. M. Duque J 1180 (FAUC)	-24.1		
<i>P. bivalvis</i> Lindl. (= <i>Acronia bivalvis</i> (Lindl.) Luer)	A. Campuzano & C. Sánchez 50 (HUA)	-31.3	E	2300
<i>P. bivalvis</i> Lindl. (= <i>P. cardium</i> Rchb.f.)	J. Cuatrecasas 19148 (VALLE)	-26.1	E	2750
<i>P. brachiata</i> Luer	O. Pérez & V. Bub 1075 (CUVC)	-27.2	E	1800
<i>P. calolalax</i> Luer & R.Escobar [= <i>Acronia calolalax</i> (Luer & R.Escobar) Luer]	K. Quintero & P.A. Villa 43 (HUQ)	-29.9	E	1700
<i>P. canaliculata</i> Rchb.f.	E. R. Echeverry 3216 (HUA)	-25.5		2000
<i>P. canaligera</i> Rchb.f.	V. H. Grande, <i>et al.</i> 111 (HUQ)	-33.1	E	2600
<i>P. cardiostola</i> Rchb.f. [= <i>Acronia cardiostola</i> (Rchb.f.) Luer]	A. Juncosa 2037 (CUVC)	-30.5	E	580
<i>P. cernua</i> Luer	P. A. Silverstone, <i>et al.</i> 1678 (CUVC)	-33.2	T	1970
<i>P. chloroleuca</i> Lindl. (= <i>P. wendlandiana</i> Rchb.f.)	M. I. Valencia 4 (FAUC)	-31.0	E	2250
<i>P. circinata</i> Luer	J. L. Luteyn, <i>et al.</i> 12361 (CUVC)	-32.8	E	2100
<i>P. colossus</i> Kerch.	P. A. Silverstone, <i>et al.</i> 2797 (CUVC)	-31.2	E	2413
<i>P. cordata</i> Lindl.	B. Villanueva, <i>et al.</i> 1224 (TOLI)	-28.4	T	1801
<i>P. cordata</i> Lindl. (= <i>P. cardiophylla</i> Schltr.)	P. Silverstone-Sopkin, <i>et al.</i> 3843 (CUVC)	-27.0	T	2070
<i>P. cordifolia</i> Rchb.f. & Wagener [= <i>Acronia cordifolia</i> (Rchb.f. & Wagener) Luer]	M. Ospina 128 (JAUM)	-27.4	T	2700
<i>P. coriacardia</i> Rchb.f.	J. L. Zarucchi & F. J. Roldán 6859 (HUA)	-28.5	T	3020
<i>P. crocodiliceps</i> Rchb.f. [= <i>Ancipitia crocodiliceps</i> (Rchb.f.) Luer]	F. Silverstone-Sopkin, <i>et al.</i> 11319 (CUVC)	-32.2	E	1980
<i>P. crocodiliceps</i> Rchb.f.	J. Home 166 (CUVC)	-32.3	E	1450
<i>P. cunabularis</i> Luer	J. S. García-Revelo & A. D. García-Ramírez 15 (CUVC)	-30.4	T	2205
<i>P. cf. diabolica</i> Luer & R.Escobar [= <i>Acronia diabolica</i> (Luer & R.Escobar) Luer]	C. Luer, <i>et al.</i> 6693 (JAUM)	-25.1	E	2775

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>P. divaricans</i> Schltr.	P. A. Morales, <i>et al.</i> 667 (JAUM)	-28.2	T	2454
<i>P. dorotheae</i> Luer	Anon. <i>s.n.</i> (JAUM)	-26.8		
<i>P. dunstervillei</i> Foldats [= <i>Ancipitia dunstervillei</i> (Foldats) Luer]	J. Ramos, <i>et al.</i> 6348 (CUVC) Ecuador	-29.2	E	2098
<i>P. elegans</i> (Kunth) Lindl.	C. Berrío & G. Gómez 39 (HUQ)	-26.2	T	3040
<i>P. garayana</i> (Ospina) Luer (= <i>Colombiana garayana</i> Ospina)	M. Ospina 905 (JAUM)	-31.2	E	1700
<i>P. giraldoi</i> Luer [= <i>Acronia giraldoi</i> (Luer) Luer]	F. Silverstone-Sopkin, <i>et al.</i> 2122 (CUVC)	-32.9	E	2068
<i>P. glossopogon</i> Rchb.f.	C. Luer, <i>et al.</i> 7603 (JAUM)	-26.4	E	3200
<i>P. glossopogon</i> Rchb.f. (= <i>P. biserrula</i> Rchb.f.)	P. Silverstone & J. Giraldo 6383 (CUVC)	-24.1	E	2300
<i>P. gracilipedunculata</i> Foldats	C. Luer, <i>et al.</i> 7581 (JAUM)	-29.1	E	2800
<i>P. grandiflora</i> Lindl. [= <i>Acronia grandiflora</i> (Lindl.) Luer]	J. Ramos, <i>et al.</i> 6132 (CUVC) Ecuador	-30.2	E	2772
<i>P. guttulata</i> Cogn.	V. H. Grande, <i>et al.</i> 99 (HUQ)	-32.6	E	2900
<i>P. homalantha</i> Schltr.	S. Arango 54 (FAUC)	-27.3	E	2150
<i>P. imbaburae</i> Luer & Hirtz	P. A. Silverstone, <i>et al.</i> 1606 (CUVC)	-33.0	E	1905
<i>P. imber-florum</i> Luer & R. Escobar	P. A. Silverstone, <i>et al.</i> 2906 (CUVC)	-32.2	E	2280
<i>P. lacera</i> Luer [= <i>Acronia lacera</i> (Luer) Luer]	J. Ramos, <i>et al.</i> 6872 (CUVC) Ecuador	-29.5	E	2600
<i>P. lamellaris</i> Lindl.	J. S. García-Revelo & A. D. García-Ramírez 43 (CUVC)	-28.0	E	2085
<i>P. lilijae</i> Foldats	W. Devia, <i>et al.</i> 7841 (JAUM)	-30.3	E	2940
<i>P. lindenii</i> Lindl.	F. Giraldo, <i>et al.</i> 1641 (JAUM)	-28.7	E	2365
<i>P. lindenii</i> Lindl. (= <i>P. andrei</i> Luer & R. Escobar)	D. Hartman 615 (CUVC)	-25.8	E	2900
<i>P. litotes</i> Luer	M. J. Rodríguez & M. E. Pantoja 43 (CAUP)	-24.9	E	3350
<i>P. loranthophylla</i> Rchb.f.	J. F. Restrepo & N. Erazo 241 (CAUP)	-28.8	E	1750
<i>P. lunatus*</i> Kunth	P. Silverstone, <i>et al.</i> 1605 (TULV)	-31.3	E	1905
<i>P. macra</i> Lindl. [= <i>Acronia macra</i> (Lindl.) Luer]	J. Ramos, <i>et al.</i> 5817 (CUVC) Ecuador	-25.4	E	2614
<i>P. manicosa</i> Luer & R. Escobar	P. A. Silverstone, <i>et al.</i> 2918 (CUVC)	-31.5	T	2280
<i>P. marthae</i> Luer & R. Escobar	N. H. Ospina-Calderón 313 (CUVC)	-28.7	T	1431
<i>P. matudana</i> C. Schweinf.	D. A. García-Ramírez 62 (CUVC)	-32.8	E	2114
<i>P. medusa</i> Luer	M. Rincón 274 (TOLI)	-24.9	E	2600
<i>P. microcardia</i> Rchb.f.	C. Berrío & G. Gómez 32 (HUQ)	-27.1	T	2800
<i>P. mundula</i> Luer & R. Escobar	C. Berrío, <i>et al.</i> 14 (HUQ)	-27.6	E	3020
<i>P. notabilis</i> Luer & R. Escobar	P. A. Silverstone, <i>et al.</i> 2870 (CUVC)	-28.6	E	2400
<i>P. octavioi</i> Luer & R. Escobar	J. F. Restrepo 217 (CAUP)	-31.3	E	1000
<i>P. odobeniceps</i> Luer [= <i>Ancipitia odobeniceps</i> (Luer) Luer]	C. Luer & R. Escobar 6604 (JAUM)	-28.3	E	2840
<i>P. penduliflora</i> Kraenzl.	MOH 750 (JAUM)	-30.5	T	2599
<i>P. perijaensis</i> Dunst. [= <i>Acronia perijaensis</i> (Dunst.) Luer]	C. Luer, <i>et al.</i> 7778 (JAUM)	-24.1	T	2050
<i>P. aff. perryi</i> Luer	O. Pérez & M. Kolanowska 1054 (VALLE)	-29.9	E	1500
<i>P. cf. phalangifera</i> Rchb.f.	B. Villanueva, <i>et al.</i> 1220 (TOLI)	-30.8	T	1801
<i>P. phratría</i> Luer & Hirtz	D. Hartman 115 (CUVC)	-26.9	E	1500
<i>P. pileata</i> Luer & R. Escobar	F. A. Silverstone-Sopkin, <i>et al.</i> 2917 (CUVC)	-31.4	E	2280
<i>P. platysepala</i> Schltr.	O. Pérez, <i>et al.</i> 211 (VALLE)	-31.8	E	2000
<i>P. possoae</i> Luer	B. R. Ramírez 11567 (CAUP)	-27.9	T	3350
<i>P. cf. pulvinaris</i> Luer & R. Escobar	O. Marulanda, <i>et al.</i> 124 (CHOCO)	-28.3	T	2330
<i>P. ramificans</i> Luer	D. Hartman 314 (CUVC)	-25.0	E	3000
<i>P. ruberrima</i> Lindl.	O. de Benavides 8915 (CAUP)	-26.3	E	1800



Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>P. ruscifolia</i> (Jacq.) R.Br. in W.T.Aiton	G. M. Urreta 277 (HUA)	-26.5	E	50
<i>P. scabrilunguis</i> Lindl. in Hook [= <i>Acronia scabrilunguis</i> (Lindl.) Luer]	J. L. Zarucchi & J. Betancur 6373 (HUA)	-25.5	E	2705
<i>P. secunda</i> Poepp. & Endl.	W. Rodríguez, <i>et al.</i> 7145 (HUA)	-31.7	E	2502
<i>P. silverstonei</i> Luer (= <i>Colombiana silverstonei</i> Luer)	P. Silverstone-Sopkin, <i>et al.</i> 3949 (CUVC)	-29.1	E	2399
<i>P. somnolenta</i> Luer	P. A. Silverstone, <i>et al.</i> 4389 (CUVC)	-31.1	E	2525
<i>P. cf. strobilifera</i> F.Lehm. & Kraenzl.	J. M. MacDougal, <i>et al.</i> 4378 (HUA)	-28.5	T	3435
<i>P. aff. suspensa</i> Luer	O. Pérez, <i>et al.</i> 404 (VALLE)	-22.4	E	3800
<i>P. talpinaria</i> Rchb.f.	J. Farfán, <i>et al.</i> 1051 (FMB)	-26.3	E	2450
<i>P. aff. testifolia</i> (Sw.) Lindl.	D. Bonilla 46 (TOLI)	-17.8	E	3300
<i>P. tetragona</i> Luer & R.Escobar	C. Berrío, <i>et al.</i> 59 (HUQ)	-29.2	E	2800
<i>P. tetroxys</i> Luer	B. R. Ramírez, <i>et al.</i> 9341 (CAUP)	-28.3	E	1100
<i>P. titan</i> Luer [= <i>Acronia titan</i> (Luer) Luer]	N. Paz, <i>et al.</i> 643 (CUVC)	-28.5	E	1200
<i>P. torrana</i> Luer	P. A. Silverstone, <i>et al.</i> 1605 (CUVC)	-31.6	E	1905
<i>P. variabilis</i> Luer [= <i>Acronia variabilis</i> (Luer) Luer]	M. S. González, <i>et al.</i> 2993 (CAUP)	-29.7	E	3000
<i>P. velaticaulis</i> Rchb.f.	D. Stancik, <i>et al.</i> 988 (FMB)	-25.3	L	2200
<b><i>Pleurothallopsis</i> Porto &amp; Brade (18; 0/3 = 0%)</b>				
<i>P. microptera</i> (Schltr.) Pridgeon & M.W.Chase [= <i>Restrepiopsis microptera</i> (Schltr.) Luer]	N. H. Ospina-Calderón 318 (CUVC)	-28.6	E	1431
<i>P. striata</i> (Luer & R.Escobar) Pridgeon & M.W.Chase (= <i>Restrepiopsis striata</i> Luer & R.Escobar)	N. F. Alzate 751 (FAUC)	-24.1	E	2530
<i>P. tubulosa</i> (Lindl.) Pridgeon & M.W.Chase [= <i>Pleurothallis viridula</i> (Lindl.) Kuntze]	M. I. Valencia 5 (FAUC)	-30.5	E	2250
<i>P. tubulosa</i> (Lindl.) Pridgeon & M.W.Chase [= <i>Restrepiopsis tubulosa</i> (Lindl.) Luer]	MOH 25 (JAUM)	-25.1	T	2500
<b><i>Porroglossum</i> Schltr. (38; 0/2 = 0%)</b>				
<i>P. echidna</i> (Rchb.f.) Garay	C. Luer, <i>et al.</i> 7607 (JAUM)	-26.7	E	3200
<i>P. eduardi</i> (Rchb.f.) H.R.Sweet	P. A. Silverstone, <i>et al.</i> 4613 (CUVC)	-29.1	T	2750
<b><i>Restrepia</i> Kunth (52; 0/9 = 0%)</b>				
<i>R. antennifera</i> Kunth	C. Luer 8349 (JAUM)	-27.5	E	1800
<i>R. aristulifera</i> Garay & Dunst.	C. Luer, <i>et al.</i> 7966 (JAUM)	-27.9	E	2440
<i>R. brachypus</i> Rchb.f.	A. E. Brant & J. Betancur 1625 (HUA)	-25.2	E	2060
<i>R. contorta</i> (Ruiz & Pav.) Luer (= <i>R. maculata</i> Lindl.)	J. Cuatrecasas 22288 (VALLE)	-28.0	E	2000
<i>R. elegans</i> H.Karst. (= <i>R. erythroantha</i> Rchb.f.)	J. F. Restrepo 312 (CAUP)	-24.1	E	1884
<i>R. cf. elegans</i> H.Karst.	N. F. Alzate 762 (FAUC)	-32.5	E	2530
<i>R. fritillina</i> Luer & V.N.M.Rao	O. Pérez 1074 (CUVC)	-28.6	E	1800
<i>R. trichoglossa</i> Sander	J. F. Restrepo 313 (CAUP)	-27.2	E	1884
<i>R. sp.</i>	D. Bonilla 55 (TOLI)	-26.2	E	3100
<b><i>Restrepiella</i> Garay &amp; Dunst. (2; 0/1 = 0%)</b>				
<i>R. sp.</i>	J. Castro, E. L. Velásquez 452 (JAUM)	-31.0	E	2303
<b><i>Scaphosepalum</i> Pfitzer (45; 0/9 = 0%)</b>				
<i>S. antenniferum</i> Rolfe	C. Luer, <i>et al.</i> 8861 (JAUM)	-24.4	T	2400
<i>S. gibberosum</i> Rolfe	MOH 702 (JAUM)	-27.0	E	1940
<i>S. grande</i> Kraenzl.	J. Pipoly, <i>et al.</i> 16930 (JAUM)	-31.4	E	1330
<i>S. lima</i> Schltr.	E. Domínguez 377 ((TOLI)/Den-drology sec.)	-27.6	E	2580
<i>S. odontochilum</i> Kraenzl.	O. Pérez, <i>et al.</i> 204 (VALLE)	-32.8	T	2000
<i>S. odontochilum</i> Kraenzl.	Anon. s.n. (CUVC)	-34.1		

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>S. panduratum</i> Luer & R.Escobar	J. F. Restrepo 392 (CAUP)	-25.3	E	1884
<i>S. swertiifolium</i> Rolfe	C. Luer, <i>et al.</i> 8995 (JAUM)	-31.9	E	2050
<i>S. verrucosum</i> Pfitzer	C. Luer, <i>et al.</i> 7717 (JAUM)	-26.7	E	2400
<i>S. sp.</i>	H. Mendoza 1318 (FMB)	-27.1	T	2500
<b><i>Specklinia</i> Lindl. (135; 0/9 = 0%)</b>				
<i>S. brighamii</i> (S.Watson) Pridgeon & M.W.Chase (= <i>Pleurothallis brighamii</i> S.Watson)	R. Escobar & M. A. Pérez 3128 (JAUM) Costa Rica	-32.1	E	1470
<i>S. corniculata</i> (Sw.) Mutel [= <i>Pleurothallis corniculata</i> (Sw.) Lindl.]	E. R. Echeverry 3216 (FAUC)	-24.1	T	2000
<i>S. costaricensis</i> (Rolfe) Pridgeon & M.W.Chase (= <i>Pleurothallis costaricensis</i> Rolfe)	F. Ramírez 3 (HUQ)	-28.2	E	1780
<i>S. grobyi</i> (Bateman ex Lindl.) F.Barros	J. F. Restrepo 297 (CAUP)	-27.6	E	1700
<i>S. grobyi</i> (Bateman ex Lindl.) F.Barros (= <i>Pleurothallis grobyi</i> Bateman ex Lindl.)	M. Hill GP-32 (HUA)	-28.6		5
<i>S. macroblepharis</i> (Rchb.f.) Pridgeon & W.Chase (= <i>Pleurothallis macroblepharis</i> Rchb.f.)	M. C. Iglesias 245 (CUVC)	-26.1	E	3575
<i>S. cf. picta</i> (Lindl.) Pridgeon & M.W.Chase (= <i>Pleurothallis cf. picta</i> Lindl.)	G. Reina, <i>et al.</i> 1165 (CUVC)	-33.8	E	1166
<i>S. uniflora</i> (Lindl.) Pridgeon & M.W.Chase (= <i>Pleurothallis leontoglossa</i> Rchb.f.)	J. Cuatrecasas 19260 (VALLE)	-28.1	E	3050
<i>S. zephyrina</i> (Rchb.f.) Luer	P. Stevenson & C. Prada 3193 (ANDES/P. stevenson Coll.)	-34.9	E	1900
<i>S. sp.</i>	M. Rincón 195 ((TOLI)/Dendrology sec.)	-31.9		100
<b><i>Stelis</i> Sw. (878; 0/57 = 0%)</b>				
<i>S. cf. alba</i> Kunth	P. A. Morales, <i>et al.</i> 681 (HUA)	-29.5	T	2439
<i>S. angustifolia</i> Kunth	D. A. García-Ramírez 89 (CUVC)	-26.3	E	2304
<i>S. aprica</i> Lindl.	P. A. Silverstone, <i>et al.</i> 5675 (CUVC)	-25.4	E	950
<i>S. argentata</i> Lindl.	M. Rincón 280 (TOLI)	-28.8	E	2600
<i>S. atra</i> Lindl. in Lindely	D. Bonilla 32 (TOLI)	-30.0	E	3000
<i>S. attenuata</i> Lindl.	C. Berrío, <i>et al.</i> 9 (HUQ)	-27.2	E	3020
<i>S. cassidis</i> (Lindl.) Pridgeon & M.W.Chase	R. Echeverry 3214 (TOLI)	-27.8	T	2000
<i>S. cassidis</i> (Lindl.) Pridgeon & M.W.Chase [= <i>Crocodeilanthe cassidis</i> (Lindl.) Luer]	W. G. Vargas 4819 (HUA)	-25.7	T	3578
<i>S. cf. chamaestelis</i> (Rchb.f.) Garay & Dunst. in Dunst. & Garay	G. Andrade 20 (FMB)	-29.6	E	2250
<i>S. cochlearis</i> Garay	W. Johnson & F. A. Barkley 180804 (VALLE)	-23.5	E	2700
<i>S. aff. concinna</i> Lindl. (= <i>S. aff. flexuosa</i> Lindl.)	C. Rincón-Useche, <i>et al.</i> 10 (CUVC)	-30.4	E	1600
<i>S. decipiens</i> Schltr.	D. Bonilla 68 (TOLI)	-29.1	E	3000
<i>S. decipiens</i> Schltr.	M. Hernández-Schmidt 1293 (FMB)	-24.9	E	2900
<i>S. deregularis</i> Barb.Rodr. [= <i>Pleurothallis deregularis</i> (Barb.Rodr.) Luer]	C. Luer 6716 (JAUM)	-27.5	E	2258
<i>S. eugenii</i> Schltr.	B. R. Ramírez, <i>et al.</i> 22913 (CAUP)	-30.1	E	3320
<i>S. exigua</i> Luer & Hirtz	M. J. Rodríguez & M. E. Pantoja 17 (CAUP)	-33.3	E	3327
<i>S. fendleri</i> Lindl.	R. Fonnegra, <i>et al.</i> 1219 (HUA)	-29.5	E	301
<i>S. foetida</i> O.Duque	D. A. García-Ramírez 81 (CUVC)	-33.2	E	2115
<i>S. frontinensis</i> O.Duque	D. A. García-Ramírez & J. S. García-Revelo 50 (CUVC)	-26.6	E	2245
<i>S. furfuracea</i> F.Lehm. & Kraenzl.	M. J. Rodríguez & M. E. Pantoja 38 (CAUP)	-26.6	E	3206
<i>S. galeata</i> (Lindl.) Pridgeon & M.W.Chase [= <i>Crocodeilanthe galeata</i> (Lindl.) Luer]	M. I. Gaurin 77-A (VALLE)	-28.0	E	1600

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>S. galeata</i> (Lindl.) Pridgeon & M.W.Chase (= <i>Pleurothallis trianae</i> Schltr.)	R. Londoño, <i>et al.</i> 735 (FAUC)	-27.4	T	3460
<i>S. galerasensis</i> (Luer) Pridgeon & M.W.Chase (= <i>Pleurothallis galerasensis</i> Luer)	S. M. Pasmíño & M. R. Posso 14 (CAUP)	-28.1	E	3240
<i>S. gelida</i> (Lindl.) Pridgeon & M.W.Chase [= <i>Specklinia gelida</i> (Lindl.) Luer]	J. Cuatrecasas 18794 (VALLE)	-29.6	E	3325
<i>S. cf. gelida</i> (Lindl.) Pridgeon & M.W.Chase (= <i>Pleurothallis cf. gelida</i> Lindl.)	E. Méndez 652 (HUQ)	-31.0	E	2550
<i>S. cf. glossula</i> Rchb.f.	C. Duque <i>s.n.</i> (FAUC)	-27.3	E	3120
<i>S. gracilis</i> Ames	N. F. Alzate 569 (FAUC)	-28.9	E	2608
<i>S. humboldtina</i> Luer & Hirtz	C. López 78 (TULV)	-28.9	T	3400
<i>S. cf. lanceolata</i> Willd.	O. Pérez 296 (CUVC)	-31.0	E	1600
<i>S. lankesteri</i> Ames	L. Uribe-Urbe 6472 (FAUC)	-25.0	E	2150
<i>S. lentiginosa</i> Lindl.	L. Uribe-Urbe 6742 (FAUC)	-28.9	E	2900
<i>S. ligulata</i> (Lindl.) Pridgeon & M.W.Chase (= <i>Pleurothallis hopfiana</i> Schltr.)	N de F & Álvarez & Gallego 224 (FAUC)	-27.5	E	2250
<i>S. lindenii</i> Lindl.	O. E. Meneses 6 (CUVC)	-28.9	E	1683
<i>S. aff. lumbricosa</i> O.Duque	M. Rincón 296 (TOLI)	-29.6	E	3400
<i>S. maderoi</i> Schltr.	A. M. Benavides, <i>et al.</i> 4047 (HUA)	-33.1	E	2503
<i>S. cf. minax</i> *	A. F. Bohórquez, <i>et al.</i> 140 (FAUC)	-30.0	E	3212
<i>S. morgani</i> Dodson & Garay	D. A. García-Ramírez 113 (CUVC)	-29.0	E	2072
<i>S. nanegalensis</i> Lindl. (= <i>S. vulcanica</i> Schltr.)	N. H. Ospina-Calderón 339b (CUVC)	-28.9	E	1543
<i>S. oblongifolia</i> Lindl. (= <i>S. superposita</i> Schltr.)	F. González, <i>et al.</i> 2157 (TOLI)	-30.7	E	2800
<i>S. papilio</i> O.Duque	D. A. García-Ramírez & J. S. García-Revelo 57 (CUVC)	-30.8	E	2121
<i>S. pardipes</i> Rchb.f.	M. I. Guarín 93 (VALLE)	-27.1	E	2690
<i>S. preclara</i> Luer & Hirtz	P. Silverstone-Sopkin, <i>et al.</i> 7977 (CUVC)	-30.3	T	2110
<i>S. aff. pulchella</i> Kunth (= <i>Pleurothallis aff. pulchella</i> (Kunth) Lindl. in Hook.)	H. Bernal 1448 (FMB)	-30.0	E	3160
<i>S. purpurea</i> Willd.	C. Berrío, <i>et al.</i> 22 (HUQ)	-29.2	E	3500
<i>S. pusilla</i> Kunth	D. L. Echeverry & J. Pineda 57 (HUA)	-28.3	E	3000
<i>S. reptans</i> Pridgeon & M.W.Chase [= <i>Crocodeilanthe scansor</i> (Luer) Luer]	M. J. Rodríguez & M. E. Pantoja 5 (CAUP)	-28.8	T	3549
<i>S. rhodantha</i> (Rchb.f.) Pridgeon & M.W.Chase (= <i>Pleurothallis potamophila</i> Schltr.)	J. Cuatrecasas 19264 (VALLE)	-28.9	E	3050
<i>S. spathulata</i> Poepp. & Endl.	P. Silverstone & N. Paz 7536 (CUVC)	-29.3	E	1500
<i>S. strobilacea</i> Luer	B. R. Ramírez & D. M. Munar 17684 (CAUP)	-32.5	T	3000
<i>S. superbiens</i> Lindl.	J. E. Ramos 1007 (CUVC)	-30.9	E	1000
<i>S. tenuilabris</i> Lindl. (= <i>S. alata</i> Lindl.)	J. M. Valencia & J. C. Ospina 28 (HUQ)	-29.8	E	3360
<i>S. tridactylon</i> Luer	P. A. Silverstone, <i>et al.</i> 10357 (CUVC)	-32.1	E	1960
<i>S. velaticaulis</i> (Rchb.f.) Pridgeon & M.W.Chase (= <i>Crocodeilanthe velaticaulis</i> (Rchb.f.) Luer)	K. von Sneidern 4706 (VALLE)	-24.4	E	1700
<i>S. aff. velutina</i> Lindl.	G. M. Rodríguez, <i>et al.</i> 1253 (FMB)	-24.9	E	2675
<i>S. vulcani</i> Rchb.f.	P. Viveros, <i>et al.</i> 797 (HUQ)	-27.0	E	1840
<i>S. sp1.</i>	M. Rincón 139 ((TOLI)/Dendrology sec.)	-32.4	E	100
<i>S. sp2.</i>	M. Rincón 401 ((TOLI)/Dendrology sec.)	-32.7	E	0
<i>S. sp3.</i>	P. Stevenson 3407 (ANDES/P. Stevenson Coll.)	-33.1	E	1900

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>S. sp4.</i>	M. Rincón 204 ((TOLI)/Dendrology sec.)	-28.2		2800
<i>S. sp5.</i>	P. Stevenson & C. Prada 3246 (ANDES/P. stevenson Coll.)	-31.5	E	1900
<b><i>Trichosalpinx</i> Luer (109; 0/8 = 0%)</b>				
<i>T. berlineri</i> (Luer) Luer	J. F. Restrepo 292 (CAUP)	-24.9	E	1884
<i>T. chamaelepanthes</i> (Rchb.f.) Luer	J. Betancur 1794 (HUA)	-29.3	E	2100
<i>T. dependens</i> (Luer) Luer	P. Silverstone-Sopkin, <i>et al.</i> 8796 (CUVC)	-25.9	E	1110
<i>T. intricata</i> (Lindl.) Luer	P. A. Silverstone, <i>et al.</i> 4148 (CUVC)	-30.4	E	1935
<i>T. orbicularis</i> (Lindl.) Luer	D. Cárdenas, <i>et al.</i> 6715 (COAH)	-30.7	E	200
<i>T. pergrata</i> (Ames) Luer	J. M. MacDouga, <i>et al.</i> 4370 (HUA)	-29.1	E	3435
<i>T. pseudolepanthes</i> Luer & R. Escobar	J. E. Ramos, <i>et al.</i> 1306 (CHOCO)	-32.9	E	1900
<i>T. spathulata</i> Luer	P. A. Silverstone, <i>et al.</i> 4830 (CUVC)	-33.1	E	2200
<b><i>Trisetella</i> Luer (23; 0/1 = 0%)</b>				
<i>T. sp.</i>	J. Espina, <i>et al.</i> 2648 (CHOCO)	-30.9	E	80
<b><i>Zootrophion</i> Luer (21; 0/1 = 0%)</b>				
<i>Z. dayanum</i> (Rchb.f.) Luer	J. F. Restrepo 380 (CAUP)	-31.2	E	1650
<b>Subtribe Ponerinae</b>				
<b><i>Isochilus</i> R.Br. (12; 0/1 = 0%)</b>				
<i>I. linearis</i> (Jacq.) R.Br.	J. F. Restrepo 346 (CAUP)	-26.6	E	1884
<b><i>Ponera</i> Lindl. (8; 0/1 = 0%)</b>				
<i>P. striata</i> Lindl.	D. Bonilla 39 (TOLI)	-23.7	E	1596
<b>Tribe Malaxideae</b>				
<b>Subtribe Dendrobiinae Lindl. ex Endl.</b>				
<b><i>Bulbophyllum</i> Thouars (1924; 1/2 = 50%)</b>				
<i>B. setigerum</i> Lindl.	J. Betancur & J. González 13378 (COAH)	-17.9	E	120
<i>B. sp.</i>	A. Idárraga & M. Da Silva 1715 (JAUM)	-29.4	E	250
<b>Subtribe Malaxidinae</b>				
<b><i>Liparis</i> Rich. (431; 0/2 = 0%)</b>				
<i>L. cf. caulescens</i> Frapp. ex Cordem.	A. J. Negret 371 (CAUP)	-30.0	T	2000
<i>L. nervosa</i> (Thunb.) Lindl.	M. Hernández, <i>et al.</i> 3098 (COAH)	-33.5	T	830
<b><i>Malaxis</i> Sol. ex Sw. (176; 0/3 = 0%)</b>				
<i>M. andicola</i> Kuntze	J. Becoche 40 (CAUP)	-35.7	T	1685
<i>M. fastigiata</i> Kuntze	M. de Fraume & Álvarez y Gallego 166 (FAUC)	-35.3	T	2250
<i>M. parthoni</i> C. Morren	C. Berrío, <i>et al.</i> 20 (HUQ)	-33.2	T	3500
<b>Tribe Neottieae</b>				
<b><i>Epipactis</i> Zinn (91; 0/1 = 0%)</b>				
<i>E. sp.</i>	K. Rosas 64 (CAUP)	-31.8	T	67
<b><i>Palmorchis</i> Barb. Rodr. (22; 0/3 = 0%)</b>				
<i>P. puber</i> (Cogn.) Garay	MOH 616 (JAUM)	-32.7	T	104
<i>P. sp1.</i>	W. Devia, <i>et al.</i> 10801 (TULV)	-34.1	T	1840
<i>P. sp2.</i>	C. Barbosa 1966 (FMB)	-34.9	T	80
<b>Tribe Sobralieae</b>				
<b><i>Elleanthus</i> C. Presl (112; 1/35 = 2.9%)</b>				
<i>E. ampliflorus</i> Schltr.	J. S. García-Revelo & A. D. García-Ramírez 17 (CUVC)	-27.6	E	2246
<i>E. cf. arpophyllostachys</i> Rchb.f.	O. Pérez & E. Parra 531 (VALLE)	-32.7	E	1860
<i>E. aurantiacus</i> Rchb.f.	P. Stevenson & C. Prada 3262 (ANDES/P. stevenson Coll.)	-30.7	T	1900
<i>E. aureus</i> Rchb.f.	O. Pérez & E. Parra 1154 (CUVC)	-31.9	E	1800

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>E. capitatus</i> Rchb.f. (= <i>Evelyna capitata</i> Poepp. & Endl.)	J. Cuatrecasas 20932 (VALLE)	-26.9	E	2200
<i>E. capitatus</i> Rchb.f.	C. Barbosa 2635 (FMB)	-27.3	E	2609
<i>E. columnaris</i> Rchb.f.	P. Franco, et al. 4700 (HUA)	-33.1	E	1325
<i>E. discolor</i> Rchb.f.	N. Paz, et al. 529 (CUVC)	-28.2	T	2300
<i>E. ensatus</i> Rchb.f.	A. Cavalier 41 (FMB)	-24.2	T	3200
<i>E. flavescens</i> Rchb.f.	L. A. de Escobar, et al. 2749 (HUA)	-33.3	T	1550
<i>E. fractiflexus</i> Schltr.	P. A. Silverstone, et al. 1570 (CUVC)	-29.5	E	1880
<i>E. glaucophyllus</i> Schltr.	P. A. Morales, et al. 611 (JAUM)	-29.0	T	2420
<i>E. gracilis</i> Rchb.f.	M. I. Guarín 111 (VALLE)	-27.4	E	1985
<i>E. graminifolius</i> (Barb.Rodr.) Løjtnant	L. A. de Escobar, et al. 2271 (HUA)	-31.1	E	1829
<i>E. hirtzii</i> Dodson	A. Cogollo & J. G. Ramírez 3171 (JAUM)	-27.4	E	1280
<i>E. hymenophorus</i> Rchb.f.	D. Cardona 1 (HUQ)	-29.2	T	3000
<i>E. jimenezii</i> (Schltr.) C.Schweinf. (= <i>Epilyna jimenezii</i> Schltr.)	Y. Rueda-Valoyes & J. García-Arias 7 (CHOCO)	-18.0	E	86.9
<i>E. kermesinus</i> Rchb.f.	C. Barbosa 2569 (FMB)	-28.3	T	3345
<i>E. lancifolius</i> C.Presl	O. Pérez, et al. 1077 (CUVC)	-28.8	E	1800
<i>E. lancifolius</i> C.Presl	P. Acevedo, et al. 1272 (HUA)	-30.2	E	1780
<i>E. longibracteatus</i> (Lindl. ex Griseb.) Fawc. (= <i>E. xanthocomus</i> Rchb.f.)	R. Moreno & F. Buitrago 27 (HUA)	-28.2	L	3000
<i>E. longibracteatus</i> (Lindl. Ex Griseb.) Fawc. (= <i>E. xanthocomus</i> Rchb.f.)	N. de P & Álvarez & Gallego 408 (JAUM)	-27.1	T	2250
<i>E. maculatus</i> Rchb.f. (= <i>E. lupulinus</i> Rchb.f.)	E. Segura, et al. 125 (FMB)	-31.2	E	3100
<i>E. maculatus</i> Rchb.f.	A. León 444 (FMB)	-27.6	E	3400
<i>E. maculatus</i> Rchb.f.	A. Idárraga, et al. 4034 (HUA)	-24.9	E	3153
<i>E. magnicallosus</i> Garay	M. S. González, et al. 2985 (CAUP)	-29.4	E	3000
<i>E. cf. myrosomatis</i> Rchb.f.	J. Cuatrecasas 15089 (VALLE)	-30.9	T	1040
<i>E. cf. oliganthus</i> Rchb.f.	V. Vargas, et al. 99 (COAH)	-34.6	E	450
<i>E. purpureus</i> Rchb.f.	M. Córdoba, et al. 3241 (FMB)	-27.5	T	2620
<i>E. rhodolepis</i> Rchb.f.	B. E. Salgado-Negret 75 (CAUP)	-26.9	T	2500
<i>E. cf. robustus</i> Rchb.f.	D. Gamba 53 (CUVC)	-26.9	E	2700
<i>E. smithii</i> Schltr.	P. Ortiz-Valdivieso 4011 (HPUJ)	-24.4	T	2050
<i>E. sodiroi</i> Schltr.	G. M. Urreta 8 (HPUJ)	-29.2	E	21
<i>E. sphaerocephalus</i> Schltr.	P. Viveros, et al. 465 (HUQ)	-32.4	E	1480
<i>E. strobilifer</i> Rchb.f.	A. Cogollo, et al. 3018 (JAUM)	-32.0	T	800
<i>E. vinosus</i> Schltr.	J. Cuatrecasas 18904 (VALLE)	-24.7	E	3325
<i>E. virgatus</i> (Rchb.f.) C.Schweinf.	S. Restrepo 188 (HPUJ)	-26.4	T	2050
<i>E. wagneri</i> Rchb.f.	B. R. Ramírez 14192 (CAUP)	-27.9	T	1850
<i>E. cf. wagneri</i> Rchb.f.	W. Rodríguez 6 (HPUJ)	-23.9	T	2750
<i>E. sp.</i> (= <i>Adeneleuterophora</i> Barb.Rodr.)	E. Escobar 91 (VALLE)	-27.6	E	1625
<b>Sertifera Lindl. ex Rchb.f. (8; 0/3 = 0%)</b>				
<i>S. colombiana</i> Schltr.	J. S. García-Revelo & A. D. García-Ramírez 24 (CUVC)	-26.7	E	2182
<i>S. lehmanniana</i> (Kraenzl.) Garay	E. Forero, et al. 2079 (CHOCO)	-26.5	T	2075
<i>S. major</i> Schltr.	J. L. Luteyn, et al. 12276 (CUVC)	-27.6	T	1900
<b>Sobralia Ruiz &amp; Pav. (140; 0/31 = 0%)</b>				
<i>S. atropubescens</i> Ames & C.Schweinf.	G. M. Urreta 14 (HUA)	-31.7	E	96
<i>S. bimaculata</i> Garay	J. Giraldo-Gensini & L. O. Agredo 673 (CUVC)	-27.7	E	1900
<i>S. bletiae</i> Rchb.f. (= <i>S. suaveolens</i> Rchb.f.)	G. M. Urreta 276a (HPUJ)	-26.2	E	50
<i>S. candida</i> Rchb.f.	T. A. Medina 1425 (TOLI)	-27.3	T	1799
<i>S. cattleya</i> Rchb.f.	J. C. Ordóñez 20 (HPUJ)	-24.8	T	1580
<i>S. ciliata</i> C.Schweinf. ex Foldats	J. Farfán 870 (FMB)	-25.8	T	2400



Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>S. crocea</i> Rchb.f.	P. Ortiz-Valdivieso 1088 (HPUJ)	-28.6	E	1550
<i>S. decora</i> Bateman	M. I. Guarín 51 (VALLE)	-27.6	E	1653
<i>S. decora</i> Bateman (= <i>S. sessilis</i> Lindl.)	M. Gamboa & F. Pedreros 175 (CUVC)	-33.4	E	400
<i>S. densifoliata</i> Schltr.	M. I. Guarín 101 (VALLE)	-24.8	E	1535
<i>S. dichotoma</i> Ruiz & Pav.	S. A. Barclay, <i>et al.</i> 3499 (FMB)	-24.2	T	1450
<i>S. fragrans</i> Lindl.	G. M. Urreta 10a (HPUJ)	-28.4	E	222
<i>S. gloriosa</i> Rchb.f.	A. Castaño & W. Devia 201 (TULV)	-26.4	T	1800
<i>S. granitica</i> G.A.Romero & Carnevali	A. Rudas, <i>et al.</i> 7336 (COAH)	-26.6	E	300
<i>S. hoppii</i> Schltr.	E. Méndez-Vargas 6609 (CUVC)	-25.6	T	1878
<i>S. klotzscheana</i> Rchb.f.	S. Espinal 1927 (CUVC)	-25.2	T	1250
<i>S. liliastrum</i> Lindl.	N. Hernández, <i>et al.</i> 69 (COAH)	-30.0	T	231
<i>S. luerorum</i> Dodson	P. Stevenson, <i>et al.</i> 2631 (ANDES/P. stevenson Coll.)	-29.3	T	1600
<i>S. macrantha</i> Lindl.	K. Rosas 11 (CAUP)	-27.9	T	33
<i>S. macrophylla</i> Rchb.f.	G. M. Urreta 11b (HPUJ)	-28.3	E	222
<i>S. cf. macrophylla</i> Rchb.f.	G. Lozano & O. Rangel 5238 (FMB)	-29.4	E	40
<i>S. mucronata</i> Ames & C.Schweinf.	G. M. Urreta 12a (HPUJ)	-27.0	E	200
<i>S. mutisii</i> P.Ortiz	P. A. Sarmiento 7 (HPUJ)	-26.7	T	1650
<i>S. pulcherrima</i> Garay	A. H. Gentry & E. Rentería 24348 (HUA)	-27.4	T	100
<i>S. roezlii</i> Rchb.f.	P. Ortiz-Valdivieso 4447 (HPUJ)	-22.6	T	1781
<i>S. roezlii</i> Rchb.f.	J. Farfán 876 (FMB)	-27.2	T	1741
<i>S. rosea</i> Poepp. & Endl.	C. Acevedo, <i>et al.</i> 83888 (FMB)	-25.7	T	2585
<i>S. semperflorens</i> Kraenzl.	P. Ortiz-Valdivieso 4034 (HPUJ)	-25.9	T	1500
<i>S. sobralioides</i> (Kraenzl.) Garay	P. Ortiz-Valdivieso 911 (HPUJ)	-24.7	T	1250
<i>S. valida</i> Rolfe	G. M. Urreta 284d (HPUJ)	-24.0	E	750
<i>S. violacea</i> Linden ex Lindl.	J. Vargas & Y. Guiza 19 (LLANOS)	-28.1	E	687
<i>S. virginalis</i> Peeters & Cogn. in Cogn. & Gooss.	G. M. Urreta 232a (HPUJ)	-33.5	E	50
<i>S. xantholeuca</i> hort. ex Williams	S. Espinal, <i>et al.</i> 3714 (CUVC)	-24.4	T	2100
<b>Tribe Triphoreae</b>				
<b>Subtribe Triphorinae</b>				
<b><i>Psilochilus</i> Barb.Rodr. (7; 0/1 = 0%)</b>				
<i>P. cf. macrophyllus</i> Ames	P. Stevenson, <i>et al.</i> 2961 (ANDES/P. stevenson Coll.)	-33.1	T	1900
<b>Tribe Tropidieae</b>				
<b><i>Corymborkis</i> Thouars (6; 0/2= 0%)</b>				
<i>C. flava</i> Kuntze	D. Sanín, <i>et al.</i> 3095 (HUQ)	-32.7	T	1980
<i>C. forcipigera</i> (Rchb.f.) L.O.Williams	A. M. Hernández, <i>et al.</i> 2359 (COAH)	-31.4	T	1241
<b>Tribe Vandeeae</b>				
<b>Subtribe Angraecinae</b>				
<b><i>Campylocentrum</i> Benth. (64; 3/3 = 100%)</b>				
<i>C. brenesii</i> Schltr. (= <i>C. longicalcaratum</i> Ames & C.Schweinf.)	P. A. Viveros 72 (HUQ)	-15.2	E	1800
<i>C. micranthum</i> (Lindl.) Rolfe	O. Pérez & E. Parra 165 (CUVC)	-14.1	E	1600
<i>C. panamense</i> Ames	D. Cárdenas 1133 (JAUM)	-14.9	E	15
<b>Subtribe Polystachyinae</b>				
<b><i>Polystachya</i> Hook. (239; 0/3 = 0%)</b>				
<i>P. concreta</i> (Jacq.) Garay & H.R.Sweet	J. G. Vélez, J. Correa & F. Villa 5577 (FMB)	-25.2	E	1420
<i>P. foliosa</i> (Hook.) Rchb.f. in Walp.	J. G. Ramírez & D. Cárdenas 1245 (HUA)	-24.2	E	735
<i>P. stenophylla</i> Schltr.	D. Macías & B. R. Ramírez 5012 (CUVC)	-31.9	E	300

Table 1. Continued

Taxon	Accession/Voucher details‡	$\delta^{13}\text{C}$ (‰)	G	Elevation (m)
<b>SUBFAMILY ORCHIDOIDEAE</b>				
<b>Tribe Cranichideae</b>				
<b>Subtribe Cranichidinae</b>				
<b><i>Aa</i> Rchb.f. (27; 0/3 = 0%)</b>				
<i>A. colombiana</i> Schltr.	J. Farfán, <i>et al.</i> 1102 (FMB)	-30.2	E	3250
<i>A. hartwegii</i> Garay	B. César 9474 (FMB)	-28.4	T	2532
<i>A. paleacea</i> (Kunth) Rchb.f.	L. M. Ospina 38 (FMB)	-29.8	T	2960
<b><i>Altensteinia</i> Kunth (7; 0/1 = 0%)</b>				
<b><i>Baskervilla</i> Lindl. (10; 0/1 = 0%)</b>				
<i>B. colombiana</i> Garay	B. R. Ramírez & D. Macías P 14700 (CAUP)	-34.1	T	2890
<b><i>Cranichis</i> Sw. (54; 0/5 = 0%)</b>				
<i>C. cf. antioquiensis</i> Schltr.	O. Pérez & V. Bub 1071 (CUVC)	-33.1	T	1800
<i>C. cf. ciliata</i> Kunth	P. Stevenson, <i>et al.</i> 3276 (ANDES/P. stevenson Coll.)	-36.3	T	1900
<i>C. diphylla</i> Sw.	M. Córdoba, <i>et al.</i> 3006 (FMB)	-33.4	T	3000
<i>C. lehmanniana</i> (Kraenzl.) L.O. Williams	S. L. Díaz-Ibarra 252 (CAUP)	-30.7	T	2880
<i>C. muscosa</i> Sw.	P. Ortiz-Valdivieso 4247 (HPUJ)	-34.6	T	1600
<b><i>Gomphichis</i> Lindl. (24; 0/8 = 0%)</b>				
<i>G. altissima</i> Renz	P. Silverstone-Sopkin, <i>et al.</i> 3848 (CUVC)	-31.9	T	2424
<i>G. caucana</i> Schltr.	C. Barbosa 9449 (159) (FMB)	-29.6	T	2532
<i>G. cundinamarcae</i> Renz	G. M. Rodríguez, <i>et al.</i> 1160 (FMB)	-29.9	T	3047
<i>G. hetaeroides</i> Schltr.	MOH 213 (JAUM)	-25.9	T	2500
<i>G. scaposa</i> Schltr.	MOH 115 (JAUM)	-29.7	T	3000
<i>G. traceyae</i> Rolfe	R. Fonnegra, <i>et al.</i> 5670 (HUA)	-27.2	T	2680
<i>G. viscosa</i> Schltr.	C. Berrío & G. Gómez 33 (HUQ)	-31.6	T	2800
<i>G. sp.</i>	P. Stevenson, <i>et al.</i> 3212 (ANDES/P. stevenson Coll.)	-30.9	E	1900
<b><i>Ponthieva</i> R.Br. (63; 0/3 = 0%)</b>				
<i>P. diptera</i> Linden & Rchb.f.	MOH 640 (JAUM)	-28.4	T	2595
<i>P. microglossa</i> Schltr.	J. Cuatrecasas 20698 (VALLE)	-32.6	T	2704
<i>P. racemosa</i> (Walter) C. Mohr	P. Silverstone 931 (TULV)	-29.5	T	2000
<b><i>Prescottia</i> Lindl. (26; 0/3 = 0%)</b>				
<i>P. petiolaris</i> Lindl.	M. Giraldo <i>s.n.</i> (CUVC)	-32.9	T	1871
<i>P. stachyodes</i> (Sw.) Lindl.	M. de Fraume & Álvarez y Gallego 177 (FAUC)	-29.9	T	2250
<i>P. stachyodes</i> (Sw.) Lindl.	J. Betancur & S. Churchill 2518 (HUA)	-31.4	T	2300
<i>P. stachyodes</i> (Sw.) Lindl. (= <i>P. longifolia</i> Schltr.)	A. M. Benavides, <i>et al.</i> 4014 (HUA)	-34.8	T	2495
<i>P. sp.</i>	J. Farfán, <i>et al.</i> 1134 (FMB)	-32.1	T	2600
<b><i>Pseudocentrum</i> Lindl. (7; 0/2 = 0%)</b>				
<i>P. bursarium</i> Rchb.f.	B. R. Ramírez 10525 (CAUP)	-29.4	T	3180
<i>P. macrostachyum</i> Lindl.	P. Silverstone-Sopkin, <i>et al.</i> 3894 (CUVC)	-31.9	E	2430
<b><i>Pterichis</i> Lindl. (20; 0/1 = 0%)</b>				
<i>P. galeata</i> Lindl.	B. R. Ramírez, <i>et al.</i> 22784 (CAUP)	-30.3	T	3205
<b>Subtribe Goodyerinae</b>				
<i>A. fimbriata</i> Kunth	P. Ortiz-Valdivieso 493 (HPUJ)	-27.1	T	2800
<b><i>Aspidogyne</i> Garay (45; 0/2 = 0%)</b>				
<i>A. boliviensis</i> (Cogn.) Garay	P. Silverstone-Sopkin, <i>et al.</i> 4695 (CUVC)	-33.6	T	2460
<i>A. boliviensis</i> (Cogn.) Garay [= <i>Erythrodes boliviensis</i> (Cogn.) Dodson & M.W. Chase]	O. Pérez & E. Parra 784 (CUVC)	-31.9	E	1900

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<i>A. foliosa</i> (Poepp. & Endl.) Garay	J. G. Ramírez & D. Cárdenas 1362 (JAUM)	-35.0	T	550
<b><i>Erythrodes</i> Blume (26; 0/1 = 0%)</b>				
<i>E. sp.</i>	W. Devia, <i>et al.</i> 4472 (TULV)	-32.6	T	100
<b><i>Kreodanthus</i> Garay (12; 0/1 = 0%)</b>				
<i>K. ecuadorensis</i> Garay	D. Bonilla 53 (TOLI)	-34.0	T	3200
<b><i>Ligeophila</i> Garay (10; 0/3 = 0%)</b>				
<i>L. clavigera</i> (Rchb.f.) Garay	O. Pérez, <i>et al.</i> 602-2 (CUVC)	-36.2	T	1800
<i>L. stigmatoptera</i> (Rchb.f.) Garay	M. Rincón 395 ((TOLI)/Dendrology sec.)	-30.0	T	100
<i>L. sp.</i>	Ohba, <i>et al.</i> 1022 (FMB)	-37.1	T	1276
<b><i>Microchilus</i> C.Presl (137; 0/5 = 0%)</b>				
<i>M. madrinanii</i> Ormerod	S. Madriñan & C. E. Barbosa 168 (JBGp)	-35.6	T	916
<i>M. major</i> C.Presl (= <i>Erythrodes major</i> (C.Presl) Ames)	A. Juncosa 1763 (JAUM)	-35.1	T	450
<i>M. major</i> C.Presl	A. J. Negret 378 (CAUP)	-35.7	T	1800
<i>M. cf. nugax</i> Ormerod	O. Pérez, <i>et al.</i> 602-1 (VALLE)	-34.9	T	1800
<i>M. procerus</i> (Schltr.) Ormerod [= <i>Erythrodes procerus</i> (Schltr.) Ames]	D. Hartman 422 (CUVC)	-31.7	T	2200
<i>M. scrotiformis</i> (C.Schweinf.) Ormerod (= <i>Erythrodes scrotiformis</i> C.Schweinf.)	N. H. Ospina-Calderón 299 (CUVC)	-35.8	T	1528
<b><i>Platythelys</i> Garay (13; 0/1 = 0%)</b>				
<i>P. maculata</i> (Hook.) Garay	P. Viveros & J. Molina 142 (HUQ)	-37.1	T	1100
<b>Subtribe Spiranthiniae</b>				
<b><i>Coccineorchis</i> Schltr. (7; 0/1 = 0%)</b>				
<i>C. cernua</i> (Lindl.) Garay	P. Silverstone-Sopkin, <i>et al.</i> 2863 (CUVC)	-31.1	T	2300
<b><i>Cyclopogon</i> C.Presl (80; 0/1 = 0%)</b>				
<i>C. lindleyanus</i> Schltr.	A. Castaño 39 (TULV)	-35.8	E	1150
<i>C. cf. ovalifolius</i> C.Presl	T. Hinestroza & A. L. Montoya 456 (JAUM)	-33.8	E	2400
<b><i>Eurystyles</i> Wawra (20; 0/1 = 0%)</b>				
<i>E. cotyledon</i> Wawra	J. Castro, E. L. Velásquez 451 (JAUM)	-28.3	E	1500
<b><i>Pelexia</i> Poit. ex Lindl. (78; 0/1 = 0%)</b>				
<i>P. olivacea</i> Rolfe	S. Garzón 22 (CUVC)	-34.8	T	1680
<b><i>Sacoila</i> Raf. (7; 0/1 = 0%)</b>				
<i>S. lanceolata</i> (Aubl.) Garay [= <i>Stenorrhynchos lanceolatum</i> (Aubl.) Rich.]	J. M. MacDougal & M. P. Velásquez 4150 (HUA)	-24.3	T	790
<b><i>Stenorrhynchos</i> Spreng. (5; 0/1 = 0%)</b>				
<i>S. speciosum</i> (Jacq.) Rich. ex Spreng.	A. Giraldo & T. Gross 8062 (CUVC)	-35.9	T	2025
<b>Tribe Orchideae</b>				
<b>Subtribe Orchidinae</b>				
<b><i>Habenaria</i> Willd. (813; 0/5 = 0%)</b>				
<i>H. gollmeri</i> Schltr.	J. F. Restrepo & D. Salazar 495 (CAUP)	-28.6	T	2325
<i>H. monorrhiza</i> Cogn. (= <i>H. speciosa</i> Poepp. & Endl.)	P. Viveros, <i>et al.</i> 112 (HUQ)	-28.9	T	1100
<i>H. monorrhiza</i> Cogn.	A. Rojas 2155 (FMB)	-26.6	T	1695
<i>H. obtusa</i> Lindl.	R. Nascimento 472 (COAH) Brazil	-31.7	E	145
<i>H. repens</i> Nutt.	A. Castaño & W. Devia 318 (TULV)	-28.2	T	860
<i>H. sp.</i>	H. Mendoza 1469 (FMB)	-31.1	T	1900
<b>SUBFAMILY VANILLOIDEAE</b>				
<b>Tribe Pogonieae</b>				

Table 1. Continued

Taxon	Accession/Voucher details‡	δ <sup>13</sup> C (‰)	G	Elevation (m)
<b>Cleistes Rich. ex Lindl. (64; 0/1 = 0%)</b>				
<i>C. rosea</i> Lindl.	M. Ospina 603 (JAUM)	-27.9	T	1329
<b>Duckeella Porto &amp; Brade (3; 0/1 = 0%)</b>				
<i>D. pauciflora</i> Garay	P. A. Palacios & B. Plazas 1218 (COAH)	-29.8	T	229
<b>Tribe Vanilleae</b>				
<b>Epistephium Kunth</b>				
<i>E. duckei</i> Huber	M. I. Guarín 36 (VALLE)	-29.9	T	1600
<i>E. elatum</i> Kunth	N. Zúñiga & N. Macías 24 (VALLE)	-32.0	T	1500
<i>E. hernandii</i> Garay	D. Cárdenas, <i>et al.</i> 23420 (COAH)	-31.6	T	204
<i>E. parviflorum</i> Lindl.	M. Córdoba, <i>et al.</i> 527 (FMB)	-30.8	T	500
<i>E. subrepens</i> Hoehne	M. V. Arbeláez & F. Sueroque 546 (COAH)	-28.3	T	203
<b>Vanilla Mill. (103; 8/12 = 66.7%)</b>				
<i>V. bicolor</i> Lindl.	M. Rincón 136 ((TOLI)/Dendrology sec.)	-28.8	T	80
<i>V. columbiana</i> Rolfe	F. García & E. D. Agualimpia 325 (FMB)	-15.2	E	100
<i>V. cribbiana</i> Soto Arenas	R. T. González <i>s.n.</i> (Pers. Coll. Univer. del Pacífico)	-18.2	T	30
<i>V. dressleri</i> Soto Arenas	R. T. González <i>s.n.</i> (Pers. Coll. Univer. del Pacífico)	-16.4	T	1000
<i>V. odorata</i> C.Presl	R. T. González <i>s.n.</i> (Pers. Coll. Univer. del Pacífico)	-16.9	T	1030
<i>V. oroana</i> Dodson	R. T. González <i>s.n.</i> (Pers. Coll. Univer. del Pacífico)	-29.2	T	60
<i>V. palmarum</i> Lindl.	I. M. Idrobo, <i>et al.</i> 41423 (COAH)	-26.9	T	180
<i>V. phaeantha</i> Rchb.f.	J. Cabezas, <i>et al.</i> 149 (TOLI)	-16.9	T	272
<i>V. planifolia</i> Andrews	L. F. Prado & H. Berrío 387 (FMB)	-14.2	T	200
<i>V. pompona</i> Schiede	N. Pinilla, F.L.N 46 (FMB)	-15.1	T	874
<i>V. rivasi</i> Molineros, R.T.González, Flanagan & J.T.Otero	R. T. González <i>s.n.</i> (Pers. Coll. Univer. del Pacífico)	-16.9	T	30
<i>V. trigonocarpa</i> Hoehne	R. T. González <i>s.n.</i> (Pers. Coll. Univer. del Pacífico)	-27.4	T	30

Species classification into subfamilies, tribes and subtribes of Orchidaceae was based on the latest classification by Chase *et al.* (2015) and Freudenstein & Chase (2015). Synonyms are indicated in parentheses only for those species in which the name was originally provided in the herbarium sheet. Abbreviations for authorities followed The International Plant Names Index (IPNI) (<https://www.ipni.org>), The Plant List (<http://www.theplantlist.org/>) or Tropicos (<http://www.tropicos.org/>). The total number of species for each genus was estimated using The Plant List. ‡Herbaria are denoted by their acronyms as in Thiers, B. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. <http://sweetgum.nybg.org/science/ih/>. The list of herbarium can be found in the Methods.

\*Species not listed in International Plant Names Index (IPNI), The Plant List or Tropicos.

values were less negative than -20‰ (Crayn *et al.*, 2015). Leaf carbon stable isotopic signature was determined for 1192 orchid specimens and 1079 species, representing *c.* 25% of the total number of orchid species in Colombia (4270 species). Our analysis provides values for 230 endemic species, including *Cattleya trianae* Linden & Rchb.f., an endangered species and the emblematic Colombian national flower, and *Masdevallia ignea* Rchb.f., categorized as critically endangered in the red book of Colombia Orchids (Calderón-Sáenz, 2006).

#### CLIMATIC DATA AND STATISTICAL ANALYSIS

Climatic data for each orchid species was compiled using their geographical coordinates from herbarium labels and the WorldClim-Global Climate Data Base (Hijmans *et al.*, 2005). In the case of herbaria specimens without coordinates, we georeferenced them using the available information about locality on the herbarium sheet. However, some specimens had incorrect locality information. This became apparent once mapped, and we could identify locality errors, which allowed us to either correct the information or remove it from further analyses.

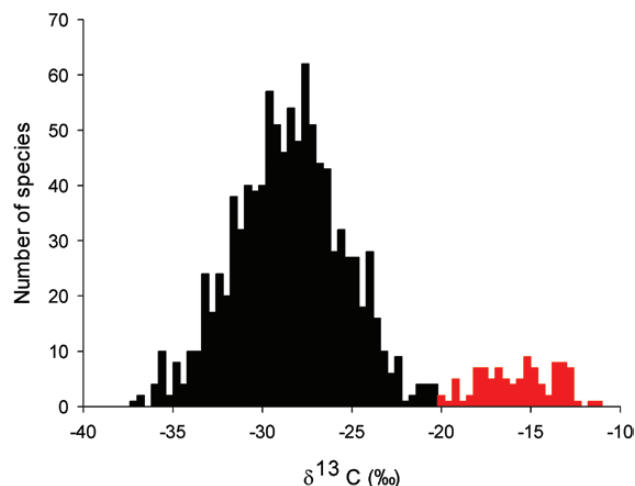
In addition, species without coordinates or locality information to georeference them were not included in the analyses. We downloaded a set of climate layers from WorldClim with a spatial resolution of *c.* 1 km<sup>2</sup> and used Qgis 2.12.3 software (QGIS Development Team, 2009) to extract the climatic data for each sampled orchid. We tested variables such as mean annual temperature (°C), annual precipitation (mm), precipitation of the wettest quarter (mm), precipitation of driest quarter (mm), the mean temperature of coldest quarter (°C) and mean temperature of warmest quarter (°C). In addition, we extracted cloud cover data using the layers from EarthEnv (Domisch, Amatulli & Jetz, 2015. [www.earthenv.org](http://www.earthenv.org)).

Redundant climate variables were eliminated using a principal component analysis (PCA). Parameters from which the initial three PCA axes and correlation coefficients were < 0.40 were eliminated. With the remaining explanatory variables, we then performed a generalized linear model analysis (GLM) using a Gaussian distribution family because of the continuous nature of the response variable,  $\delta^{13}\text{C}$ . All analyses were conducted in R (R Development Core Team, 2008). We used the Akaike information criterion to identify the best model of variables adjusted to the data to determine which series of variables better explained the distribution of photosynthetic pathways across the landscape. We used growth form as a dummy variable, where 1 represents epiphytes and 0 represents terrestrial species. Lithophytes were treated as epiphytes since both grow with no connection to the soil.

## RESULTS

Across the 1079 orchid species we studied,  $\delta^{13}\text{C}$  values ranged from  $-11.2\text{‰}$  (*Notylia albida* Klotzsch) to  $-37.4\text{‰}$  (*Lepanthes medusa* Luer & R.Escobar) (Table 1). The values showed a bimodal distribution; with a small peak between  $-11$  and  $-20\text{‰}$  typically associated with strong CAM and a larger peak between  $-20$  and  $-37.4\text{‰}$ , associated with  $\text{CO}_2$  uptake predominantly by the  $\text{C}_3$  pathway (Fig. 2). Specifically, 983 species (91.1%) belonged to the  $\text{C}_3$  cluster and 96 species (8.9%) showed  $\delta^{13}\text{C}$  values indicative of strong CAM (Table 1).

The distribution of orchids in our analysis spanned an elevation range from sea level to 3800 m (Fig. 1). Mean annual precipitation ranged from 439 to 9000 mm per year, with the mean annual temperature ranging from 6.2 to 28.4 °C (Table S1). From the total number of species with reliable growth form information, 805 were epiphytes, 260 were terrestrials and five were lithophytes.  $\text{C}_3$  photosynthesis was present in 729 epiphytes, 241 terrestrials and four lithophytes. Of the 96 species



**Figure 2.** Histogram of  $\delta^{13}\text{C}$  values from 1079 orchid species plotted in class intervals of  $0.4\text{‰}$ . Red bars denote species with  $\delta^{13}\text{C}$  values less negative than  $-20\text{‰}$ , indicating  $\text{CO}_2$  fixation predominantly by CAM. Black bars denote species with  $\delta^{13}\text{C}$  values more negative than  $-20\text{‰}$  indicating  $\text{CO}_2$  fixation predominantly by the  $\text{C}_3$  pathway.

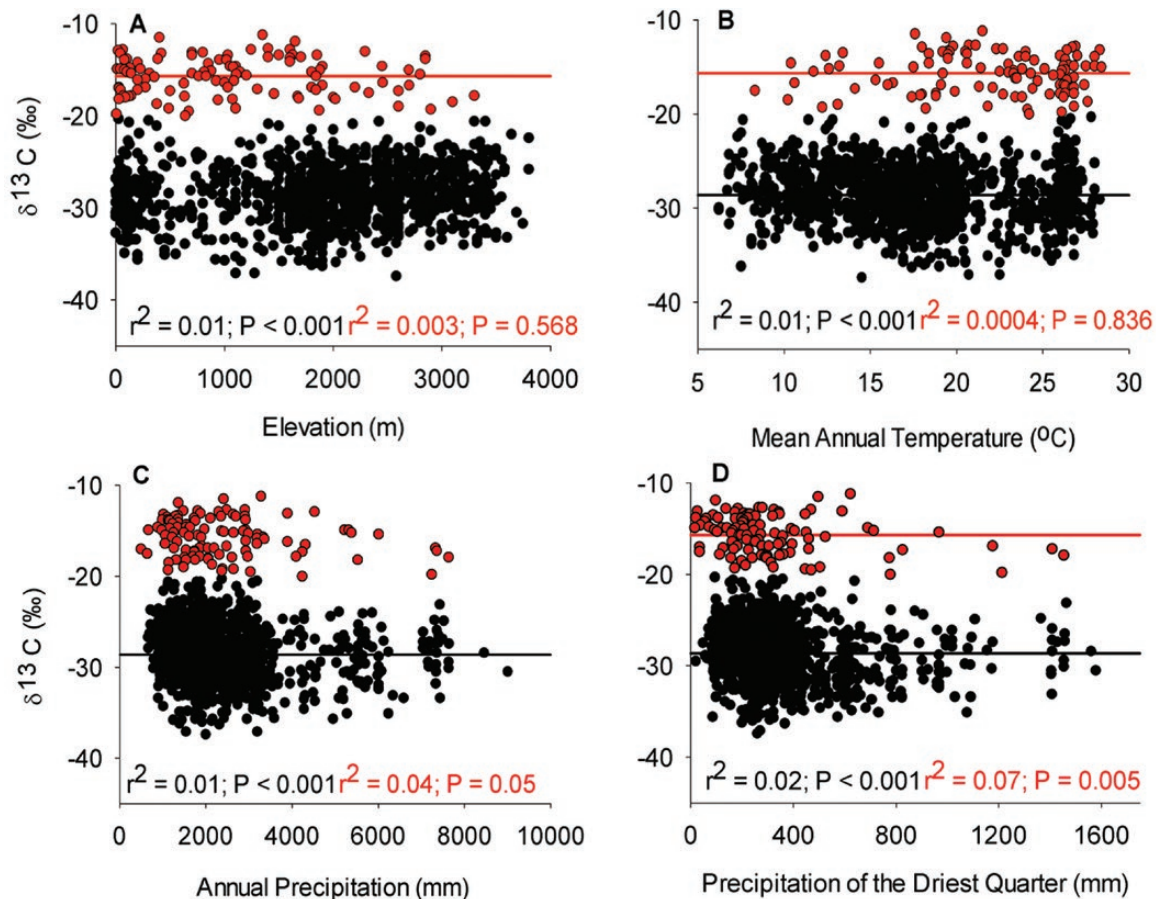
with strong CAM, 76 species (79.2%) were epiphytes, 19 species were terrestrials (19.8%) (Table 1) and one species was a lithophyte (1%).

After excluding redundant environmental variables, such as mean annual precipitation, precipitation of wettest month and cloud cover, we ran a series of GLMs with the remaining variables, with and without genera as a variable in the model. The best-fitted model included genera as the explanatory variable (AIC = 6391.2). In this model, the most significant variables that explained  $\delta^{13}\text{C}$  variability were orchid genera ( $P = 0.00024$ ), growth form ( $P = 0.049$ ), precipitation of driest quarter ( $P < 0.0001 = 5.08 \times 10^{-7}$ ) and mean annual temperature ( $P = 0.0068$ ).

Given that several environmental variables changed with elevation, we also explored the relationship between photosynthetic pathway and elevation, using information from samples with reliable collection locality and elevation (Fig. 3). For the  $\text{C}_3$  species ( $\delta^{13}\text{C}$  values of  $-20.0\text{‰}$  or more negative), we detected a small significant ( $P < 0.001$ ) effect of elevation on  $\delta^{13}\text{C}$  (Fig. 3A), with  $\delta^{13}\text{C}$  values becoming slightly less negative with increasing elevation. In contrast, there was no statistically significant trend with elevation in the CAM group of species ( $\delta^{13}\text{C}$  values less negative than  $-20.0\text{‰}$ ). A similar result was observed for mean annual temperature (Fig. 3B), which is correlated with elevation. Annual precipitation and precipitation of the driest quarter were significantly correlated with  $\delta^{13}\text{C}$  values for both the CAM and  $\text{C}_3$  species groups (Fig. 3C, D).

We found two main peaks of orchid diversity based on elevation range: one at mid-elevation (e.g. at 1500 m along





**Figure 3.** Relationship between: A,  $\delta^{13}\text{C}$  and elevation, B, mean annual temperature, C, annual precipitation and D, precipitation of driest quarter. Each point corresponds to one herbarium sample. Data were analysed by least-square regression in two groups: samples with  $\delta^{13}\text{C}$  values  $\leq -20$ ‰ indicates presence of CAM (red circles,  $N = 105$ ) and samples with  $\delta^{13}\text{C}$  values more negative than  $-20$ ‰ indicates  $\text{C}_3$  pathway (black circles, for elevation  $N = 1087$ ; other variables  $N = 1072$ ).

the belt of cloud forest) and another in the lowlands at  $< 500$  m (Fig. 4), including wet forests of the Pacific region of the Chocó/Darien biodiversity hotspot. The largest proportion of CAM species occurred in lowland sites, followed by mid-elevation sites. The proportion of CAM species markedly decreased above 2000 m, and we found no evidence of CAM above 3500 m (Fig. 4). Nonetheless, CAM-type isotope values were noted in 14 orchid species occurring between 2000 and 3400 m (Fig. 4, Table 2).

From 178 genera analysed, 28 genera (15.7%) had at least one species showing strong CAM (Table 1). The genera with the highest number of CAM species were *Epidendrum* L. (33/191 species sampled), *Rodriguezia* Ruiz & Pav. (3/3 species sampled), *Ornithocephalus* Hook. (5/5 species sampled), *Comparettia* Poepp & Endl. (3/3 species sampled), *Laelia* Lindl. (3/3 species sampled), *Notylia* Lindl. (3/3 species sampled), *Cattleya* Lindl. (6/7 species sampled), *Encyclia* Hook. (5/5 species sampled), *Campylocentrum* Benth. (3/3 species sampled), *Trichocentrum* Poepp. & Endl. (3/3 species sampled) and *Vanilla* Mill. (8/12 species sampled) (Table 1). We report

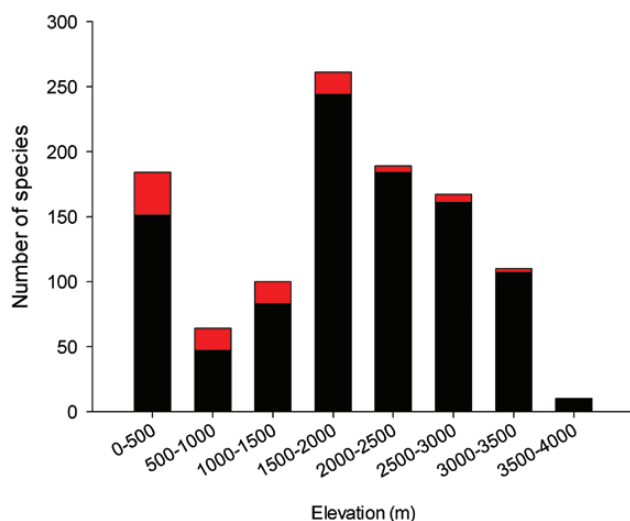
CAM for six genera previously not known to exhibit CAM, all in subfamily Epidendroideae, bringing the total number of orchid genera with CAM to 96 (following Silvera *et al.*, 2010). The genera where CAM is reported for the first time are: *Jacquinilla* Schltr. [one species; *Jacquinilla teretifolia* (Sw.) Britton], *Meiracyllium* (one species; *Meiracyllium trinasutum* Rchb.f), *Pabstiella* Brieger & Senghas [one species; *Pabstiella arytera* (Luer) F.Barros], *Psychopsis* Nutt. ex Greene for Raf. [one species; *Psychopsis papilio* (Lindl.) H.G.Jones], *Pterostemma* Kraenzl. (one species; *Pterostemma antioquiense* F.Lehm. & Kraenzl.) and *Solenidium* Lindl. (one species; *Solenidium racemosum* Lindl.) (Table 1).

## DISCUSSION

### TAXONOMY AND CAM

Our study represents the largest  $\delta^{13}\text{C}$  survey for South American orchid species to date and assists in providing a representative picture of photosynthetic

pathway distribution in the family and along a range of contrasting habitats. Our survey of 1079 species reveals that 8.9% exhibit CAM-type carbon isotopic signatures. This result is similar to that of a previous survey of 1002 orchid species from Panama and Costa Rica, which identified 9.6% as expressing CAM (Silvera *et al.*, 2010). These studies have 200 species in common and together provide information on isotopic values of 1881 Neotropical orchids corresponding to



**Figure 4.** Total number of orchid species by elevational range. Red bars denote samples with  $\delta^{13}\text{C}$  values less negative than  $-20\text{‰}$  indicative of CAM. Black bars denote samples with  $\delta^{13}\text{C}$  values more negative than  $-20\text{‰}$  indicative of  $\text{C}_3$ .

**Table 2.** Species with CAM-type isotopic signatures ( $\delta^{13}\text{C}$  values less negative than  $-20\text{‰}$ ) found above 2000 m above sea level.

Species	Growth form	Elevation (m)	$\delta^{13}\text{C}$ (‰)
<i>Acianthera boliviana</i> (Rchb.f.) Pridgeon & M.W.Chase	Epiphyte	2450	-14.6
<i>Comparettia ottonis</i> (Klotzsch) M.W.Chase & N.H.Williams	Epiphyte	2800	-15.5
<i>Epidendrum aura-usecheae</i> Hágsater, Rinc.-Useche & O.Pérez	Lithophytic	2600	-17.3
<i>Epidendrum jamiesonis</i> Rchb.f.	Epiphyte	2850	-13.8
<i>Epidendrum macrogastrium</i> Kraenzl.	Terrestrial	2900	-19.3
<i>Epidendrum secundum</i> Jacq.	Terrestrial	2000	-18.0
<i>Epidendrum secundum</i> Jacq.	Terrestrial	2695	-15.0
<i>Epidendrum cf. secundum</i> Jacq.	Epiphyte	2330	-17.5
<i>Epidendrum melinanthum</i> Schltr.	Terrestrial	2021	-18.2
<i>Epidendrum paternale</i> Hágsater, O.Pérez & E.Santiago*	Terrestrial	2600	-19.0
<i>Epidendrum ptoticum</i> Hágsater	Epiphyte	2295	-13.0
<i>Epidendrum schistochilum</i> Schltr.	Epiphyte	2700	-16.7
<i>Epidendrum tulcanense</i> Hágsater & Dodson	Terrestrial	3100	-18.5
<i>Ornithocephalus urceilabris</i> (P.Ortiz & R.Escobar) Toscano & Dressler	Epiphyte	2457	-16.4
<i>Pleurothallis aff. testifolia</i> (Sw.) Lindl.	Epiphyte	3300	-17.8
<i>Pterostemma antioquiense</i> F.Lehm. & Kraenzl.	Epiphyte	2200	-16.9

\*Species not listed in The Plant List.

6.2% of the global total. Consistent with previous observations, CAM species occurred in subfamilies Epidendroideae and Vanilloideae (Table 1), with no evidence of CAM in the subfamilies Cypripedioideae and Orchidoideae.

The large Neotropical genus *Epidendrum* with c. 1500 species worldwide was the most sampled taxon in this study (191 species); of these, 33 (17.3%) had  $\delta^{13}\text{C}$  values typical of strong CAM. A similar percentage of *Epidendrum* spp. from Panama and Costa Rica (16.8%) showed CAM (Silvera *et al.*, 2010). If the proportion of CAM in this genus is c. 17%, as both surveys suggest, we can predict CAM in a total of about 300 *Epidendrum* spp.

Genera with only CAM species were *Brassavola* R.Br., *Campylocentrum*, *Comparettia*, *Encyclia*, *Laelia*, *Meiracyllium*, *Notylia*, *Oeceoclades* Lindl., *Ornithocephalus*, *Pabstiella*, *Plectrophora*, *Psychopsis*, *Pterostemma*, *Rodriguezia*, *Trichocentrum* and *Trizeuxis* Lindl. Combining our information and that from the previous study by Silvera *et al.* (2010) accounts for 5.3% of the total number of *Comparettia* spp. worldwide, 6.3% of *Campylocentrum* spp., 8.9% of *Notylia* spp., 20.4% of *Ornithocephalus* spp., 8.3% of *Rodriguezia* spp., 5.5% of *Encyclia* spp., 17.4% of *Laelia* spp. and 13.9% of *Trichocentrum* spp., in addition to the sole species (100%) of *Trizeuxis*.

Seventy-nine orchid genera consistently showed no evidence of CAM, even though many species possess thick leaves (e.g. *Lepanthes* Sw., *Stelis* Sw., *Masdevallia* Ruiz & Pav. and *Maxillaria* Ruiz & Pav.). Together with Silvera *et al.* (2010), we covered 21.3% of the species for *Maxillaria*, 11.7% for *Stelis*, 5.8% for

*Lepanthes* and 10.6% for *Masdevallia*. *Bulbophyllum* Thouars had mostly C<sub>3</sub> species but included one CAM species (*Bulbophyllum setigerum* Lindl.).

#### BIMODALITY OF $\delta^{13}\text{C}$ VALUES

We found the typical bimodal distribution of  $\delta^{13}\text{C}$  values that has been reported in carbon isotopic surveys of other plant families containing CAM-exhibiting species (e.g. Medina *et al.*, 1977; Griffiths & Smith, 1983; Pierce, Winter & Griffiths, 2002; Winter & Holtum, 2002; Silvera *et al.*, 2005; Silvera *et al.*, 2010; Horn *et al.*, 2014; Crayn *et al.*, 2015). Few orchid species had intermediate  $\delta^{13}\text{C}$  values between  $-20.1$  and  $-22.0\text{‰}$ . The observation of two distinct groups of  $\delta^{13}\text{C}$  values, forming a large C<sub>3</sub> cluster and a smaller CAM cluster, indicates disruptive selection, favouring either CO<sub>2</sub> fixation predominantly in the light via C<sub>3</sub> photosynthesis, or CO<sub>2</sub> fixation predominantly in the dark via CAM photosynthesis. However, CAM surveys based on  $\delta^{13}\text{C}$  analysis alone, such as the one presented here, provide only conservative estimates of the occurrence of CAM. They do not identify species with weakly expressed constitutive and/or facultative CAM, in which CAM is present but C<sub>3</sub>-derived carbon is still the principal determinant of the carbon isotopic signature (Winter & Holtum, 2002; Silvera *et al.*, 2005; Winter & Holtum, 2007; Winter, García & Holtum, 2008). Species with weakly expressed CAM are typically hidden in the C<sub>3</sub> cluster, and physiological measurements on living plants (titratable acidity, CO<sub>2</sub> exchange) are necessary to detect the operation of the CAM cycle in such species. Indeed, a titratable acidity study by Silvera *et al.* (2005) of 173 orchid species from a living collection in Panama identified low-level CAM in one third of the 128 species in the C<sub>3</sub> cluster of isotopic signatures, suggesting that close to 50% of the total number of study species were capable of CAM. It is therefore likely that if species with weakly expressed CAM would also be considered, the proportion of CAM-exhibiting species among Colombian orchids would be much greater than the 8.9% of species with  $\delta^{13}\text{C}$  values less negative than  $-20.0\text{‰}$ . Further work is needed to explore the occurrence of weak CAM in orchid species and its role as an intermediate state between C<sub>3</sub> and strong CAM, or as an evolutionary reservoir for CAM adaptive radiations (Silvera & Lasso, 2016).

#### RELATIONSHIP BETWEEN $\delta^{13}\text{C}$ VALUE, CLIMATE AND OTHER VARIABLES

The most significant variables that explained the distribution of  $\delta^{13}\text{C}$  values on our survey were orchid genera, growth form, precipitation of driest quarter of the year and mean annual temperature. Orchid genera were important in explaining photosynthetic pathway distributions because the CAM trait is expected to

be phylogenetically conserved, leading to a stronger probability of strong CAM presence among closely related species (Givnish *et al.*, 2015).

The relationships between temperature and precipitation variables and photosynthetic metabolism were significant but weak, due to the marked variability in the climatic data and the isotopic signals in each photosynthetic pathway cluster. Similar results were found for orchids from Costa Rica and Panama (Silvera *et al.*, 2009). The use of climatic variables extracted from platforms such as WorldClim, although providing robust approximations for the climate at the collection sites, do not represent the subtleties of microclimate conditions of individual orchid habitats, especially for epiphytes (Silvera & Lasso, 2016). In our survey, the most important environmental variables to explain the distribution of CAM orchids in Colombia were precipitation of driest quarter of the year and mean annual temperature. There is a small tendency towards  $\delta^{13}\text{C}$  values becoming more negative with increasing precipitation of the driest quarter, suggesting that precipitation during the driest quarter is more important in determining the presence of CAM than the total amount of water received during the year.

For the C<sub>3</sub> group of orchid species ( $\delta^{13}\text{C}$  values of  $-20\text{‰}$  or more negative), there was a significant effect ( $P < 0.001$ ) of elevation on  $\delta^{13}\text{C}$  values, which increased by  $0.4\text{‰}$  per 1000 m. Similar, albeit much larger increases in  $\delta^{13}\text{C}$  value with increasing elevation were observed for C<sub>3</sub> bromeliads ( $1.47\text{‰}$  per 1000 m; Crayn *et al.*, 2015), species of Rapataceae ( $3.3\text{‰}$ ; Crayn, Smith & Winter, 2001) and a range of other species from different taxa around the globe ( $1.2\text{‰}$ ; Körner, Farquhar & Roksandic, 1988; Körner, Farquhar & Wong, 1991). Intraspecific changes of 1.6 and  $2.4\text{‰}$  per 1000 m have been found for conifers (Hultine & Marshall, 2000) and for *Metrosideros polymorpha* Gaudich. (Myrtaceae) (Cordell *et al.*, 1999). Less negative  $\delta^{13}\text{C}$  values with increasing elevation may be linked to lower ratio of intercellular to ambient CO<sub>2</sub> mole fractions ( $c_i/c_a$  ratios) during photosynthesis at higher elevations, resulting in increased carboxylation efficiency of rubisco at decreasing oxygen partial pressure (Farquhar & Wong, 1984; Cernusak *et al.*, 2013). As for CAM bromeliads (Crayn *et al.*, 2015), there was no statistically significant trend of  $\delta^{13}\text{C}$  with elevation in the CAM group of orchid species.

#### ELEVATION AND ORCHID DIVERSITY

Orchid species richness usually peaks at mid-elevation, where clouds are common and the temperature and moisture conditions allow orchids, especially epiphytes, to thrive (Whittaker & Niering, 1975; Silvera *et al.*, 2009). In Colombia, we found a corresponding diversity optimum between 1500 and 2000 m. Species diversity was also high



in the lowlands (< 500 m). High relative species richness in the lowlands is based on orchid species that mostly inhabit the tropical humid forest in the Amazonas region and the Chocó biogeographic region, one of the most diverse (Myers *et al.*, 2000) and wettest areas of the world (Eslava, 1994). Chocó and Amazonas are considered the second and third most diverse regions regarding general species richness in Colombia, after the Andean region (Rangel & Rivera, 2004), with orchids being one of the most representative plant families in the Chocó region (Rangel & Rivera, 2004). Below 500 m, we sampled 181 species; of which most (82.3%) were epiphytes and 18.2% showed CAM-type isotopic signatures.

The proportion of CAM species gradually decreased with increasing elevation and CAM species were absent above 3500 m. Similar elevational trends in the proportion of CAM species were previously observed in orchids from Papua New Guinea (Earnshaw *et al.*, 1987), Panama and Costa Rica (Silvera *et al.*, 2009), in Panamanian *Clusia* L. (Holtum *et al.*, 2004) and in a broad survey of bromeliads (Crayn *et al.*, 2015). Although CAM orchids were not found above 2600 m in Papua New Guinea, Panama or Costa Rica, our study revealed nine orchid species with  $\delta^{13}\text{C}$  values ranging from  $-19.3$  to  $-13.8\text{‰}$  between 2600 and 3300 m, in cloud forests, paramo or highland grasslands. Four, one and four of these species were epiphytic, lithophytic and terrestrial, respectively. Most of the highland species with  $\delta^{13}\text{C}$  values less negative than  $-20\text{‰}$  belonged to *Epidendrum*. In a recent stable isotope study of 46 orchid species from a single cloud forest site in Colombia, *Epidendrum secundum* Jacq. was the only species with a CAM-type carbon isotopic signature (Díaz-Álvarez, Felix & De la Barrera, 2019).

Physiological reasons for the decline of CAM species with increasing elevation were discussed by Earnshaw *et al.* (1987) and Crayn *et al.* (2015). Nonetheless, species exhibiting features of CAM do exist at high elevations, as demonstrated here for several species of Orchidaceae and previously for Andean species of Crassulaceae (Medina & Delgado, 1976), Cactaceae (Keeley & Keeley, 1989), Montiaceae (Arroyo, Medina & Ziegler, 1990) and Bromeliaceae (Crayn *et al.*, 2015). Although the studies of Medina & Delgado (1976) and Keeley & Keeley (1989) provide some information on microclimatic conditions and physiological performance, it is not yet possible to conclusively assess the adaptive significance of CAM in the high-elevation orchids studied here, particularly given the absence of microclimate data and *in situ* measurements of tissue temperatures, tissue acidity and  $\text{CO}_2$  exchange throughout the annual cycle.

#### EPIPHYTIC VERSUS TERRESTRIAL LIFE FORM

For many years, CAM was thought to be restricted to epiphytic orchids until Kluge *et al.* (1995) demonstrated

CAM in the terrestrial orchid genus *Lissochilus* R.Br. (now considered a synonym of *Eulophia* R.Br. or *Oeceoclades* Lindl. (subtribe Eulophiinae, subfamily Epidendroideae) from Madagascar. A comprehensive study of the Eulophiinae highlighted CAM evolution in four terrestrial lineages that colonized dry environments in Africa and Madagascar (Bone *et al.*, 2015). Early-diverging lineages comprise  $\text{C}_3$  and mostly epiphytic taxa, and the transition from epiphytic to terrestrial habit coincides with the transition from  $\text{C}_3$  to CAM. Our study included the terrestrial CAM orchid *Oeceoclades maculata* (Lindl.) Lindl. (the monk orchid; Eulophiinae) native to tropical Africa, which is now widespread in South and Central America. All other terrestrial strong CAM species from our survey (excluding *Vanilla* spp.) belong to *Epidendrum* and ranged from 700 to 3400 m. From 16 terrestrial *Epidendrum* spp., nine occur above 2000 m.

Although species such as *Epidendrum radicans* Pav. ex Lindl. and *Epidendrum xanthinum* Lindl. are found only on the ground over a wide elevational range, other mainly terrestrial species such as *Epidendrum secundum* and *Epidendrum ibaguense* Kunth can also grow epiphytically or lithophytically. *Epidendrum secundum* occurs from 180 m to almost 3000 m, and *E. ibaguense* has been recorded from 60 to 2420 m with no obvious shift in life form. The *Vanilla* spp. listed in Table 1 as terrestrial orchids may, strictly speaking, be considered nomadic vines (Zotz, 2013). Thus, whereas the evolution of CAM in Eulophiinae from Madagascar and Africa is tightly linked with the occupation of dry terrestrial habitats, the terrestrial and epiphytic life-forms are not mutually exclusive in some of the terrestrial *Epidendrum* spp. studied here. The preponderance of terrestrial forms of *Epidendrum* with CAM-type isotope ratios at high elevation deserves further investigation and may be partly related to a decrease of epiphytic opportunities because of the reduction of tall vegetation.

About 72% of all orchid species are epiphytes (Benzing, 1990; Gravendeel *et al.*, 2004). In our survey, 805 species (75.2%) were epiphytes, of which 76 species (9.4%) exhibited isotopic signatures indicative of strongly expressed CAM. This percentage of epiphytic CAM species is lower than in other, albeit much smaller orchid flora surveys. For example, in a survey of 87 epiphyte orchids species from Australia, 64% exhibited CAM-type isotopic signatures (Winter *et al.*, 1983), whereas in New Guinean forests 18.8% of 112 epiphytic orchid species were CAM (Earnshaw *et al.*, 1987). At a Panamanian lowland forest site, 40% of 50 epiphytic orchid species were CAM (Zotz & Ziegler, 1997) and in a Mexican dry forest all six epiphytic orchid species surveyed showed CAM (Mooney, Bullock & Ehleringer, 1989; Santiago *et al.*, 2017). Our survey was largely skewed towards samples from humid

forests where diversity tends to be high, with few samples from dry forest. Only *c.* 81 orchid species have been collected for areas with relatively low annual precipitation between 250 and 2000 mm (Holdridge, 1967; Murphy & Lugo, 1986), representing only 7200 km<sup>2</sup> (0.63%) of the total land area for Colombia (Pizano & García, 2014). Based on our results, 29 out of these 81 species showed CAM (Table S1).

## OUTLOOK

Our  $\delta^{13}\text{C}$  survey identified CAM as the major pathway of carbon acquisition in 8.9% of the mostly epiphytic species studied, a similar proportion to that of the orchid flora of Panama and Costa Rica. This percentage is substantially lower than that of another epiphytic species-rich family in the tropics, Bromeliaceae, in which 43% of species show CAM-type isotopic signatures. To further advance our understanding of CAM occurrence and CAM evolution in Orchidaceae, extensive sampling of understudied paleotropical orchids is required. In addition to  $\delta^{13}\text{C}$  analysis, future studies should also include physiological characterizations of the CAM cycle to identify species with weakly expressed CAM and thus to approach the true number of CAM-exhibiting orchids. Furthermore, detailed *in situ* measurements of microclimate and CAM physiology of orchids at high-elevation sites are needed to better understand the adaptive significance of CAM in these habitats.

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## SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

**Table S1.** Leaf carbon isotopic values (‰) reported in this study for 1177 specimens belonging to 1071 species including the elevation of collection, annual mean temperature, annual precipitation and precipitation of the driest quarter. Species and specimens without reliable georeferenced information are not listed in this table. Climatic variables were extracted from Bioclim grids from WorldClim with a resolution of 30 s (Hijmans *et al.*, 2005). Species are organized in alphabetic order.