



The number of known plants species in the world and its annual increase

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Abstract

We have counted the currently known, described and accepted number of plant species as ca 374,000, of which approximately 308,312 are vascular plants, with 295,383 flowering plants (angiosperms; monocots: 74,273; eudicots: 210,008). Global numbers of smaller plant groups are as follows: algae ca 44,000, liverworts ca 9,000, hornworts ca 225, mosses 12,700, lycophytes 1,290, ferns 10,560 and gymnosperms 1,079. *Phytotaxa* is currently contributing more than a quarter of the ca 2000 species that are described every year, showing that it has become a major contributor to the dissemination of new species discovery. However, the rate of discovery is slowing down, due to reduction in financial and scientific support for fundamental natural history studies.

When working on the classification of vascular plants at a global scale, we often receive questions about the numbers of currently described and accepted species in a particular lineage. Additionally, in *Phytotaxa* and other taxonomical journals, it is general practice to cite numbers of genera and species in a family or genus, when the organism of study is introduced (e.g. Chen *et al.* 2015, Christenhusz 2015, Fernandez-Júnior & Esteves 2016, Ortiz *et al.* 2016, Otto & Verloove 2016, Sofiyanti *et al.* 2016, and many more). The numbers of species of given families fluctuates though, because systematic research is not static with new species and genera continually being described, whilst others are being synonymised. As soon as a number is published, the number is outdated. There are also disagreements in taxonomy with differing opinions on species circumscriptions in some groups, whilst reliable accounts are difficult to find or are only rough estimates in others rather than actual counts. This is particularly the case in large species rich groups. Nevertheless, there is a demand for a reliable estimate of species numbers, and in light of the recently published APG IV (2016), we thought it useful to compile a list of genera and species and calculate the annual increase.

Below we provide a list of all vascular plant families (Table 1; lycophytes and ferns based on Christenhusz & Chase 2014; gymnosperms based on Christenhusz *et al.* 2011; angiosperms based on APG IV 2016), with estimated numbers of described and accepted genera and species. This should not be confused with the total hypothesised number of species (i.e. described and undescribed) which is subject to increases (new discovery) and declines (new synonyms) as new evidence comes available. Species numbers for families that have been treated in the *Kew Checklist of Selected Plant Families* (WCSP 2016) are generally followed here and adapted where new evidence has emerged but was not yet absorbed into this checklist or proven contradictory by the taxonomic community. If families were not treated then the most recent monographs, revisions and flora treatments were consulted. These numbers were originally compiled for our comprehensive plant family books (Byng 2014, 2015, in press, Christenhusz, Fay & Chase, in press) and rather than cite per family an exhaustive list of sources, substantial references can be found therein. Admittedly, this list is also already out of date, as several new species will have been published in the period it took for this paper to come to press, but it at least gives an informed estimate of there currently being **308,312** described, accepted, vascular plant species of which **295,383** are angiosperms (monocots: 74,273, eudicots: 210,008), gymnosperms: 1,079, ferns: 10,560, lycophytes 1,290 (Table 1). We have not estimated numbers of mosses and algae, as our expertise does not lie in these plant groups, but existing estimates of 9,000 species of liverworts (Marchantiophyta; Crandall-Stotler & Stotler 2000), 200–250 hornworts (Anthocerotophyta; Villarreal *et al.* 2010), 12,700 mosses (Bryophyta; Crosby *et al.* 1999; Cox *et al.* 2014), ca 44,000 algae (Guiry 2012; although number is likely to be much higher), amounts to a total of **ca 374,000** (~374,262) **plant species worldwide**. These numbers differ from earlier estimates by Chapman (2009), which has substantially lower estimates, with 310,129 as the total number of plants species of which 281,621 are vascular plants.

A higher estimate is by Pimm & Joppa (2015) which states that there are an estimated 450,000 species. We stress that our counts are more accurate and reliable as they are actual counts of accepted, published species in each linear, based on counts taken from monographic studies (removing synonymy bias), rather than informed estimates from group specialists (which includes taxonomical bias for groups not covered by such specialists) or hypothetical numbers of possible species (described and yet not discovered) calculated by using statistical models (e.g. Joppa *et al.* 2011a, Pimm & Joppa 2015). Useful as these calculated estimates may be, it does not tell us the numbers of known species at this present day, and predictions for the future are often unreliable.

TABLE 1. Estimated numbers of genera and species in a linear sequence of vascular plants (based on Christenhusz *et al.* 2011, Christenhusz & Chase 2014 and APG IV 2016), with numbers of taxa taken or adapted from Byng (2014, 2015, in press), Christenhusz, Fay & Chase (in press) and WCSP (2016). For sources see references cited in Byng (2015).

Order	Family	Approximate no of genera	Approximate no of species
Lycopodiales	Lycopodiaceae	3	400
Isoëtiales	Isoëtaceae	1	140
Selaginellales	Selaginellaceae	1	750
Total lycopods	3	5	1,290
Equisetales	Equisetaceae	1	20
Ophioglossales	Ophioglossaceae	4	80
Psilotales	Psilotaceae	2	12
Marattiales	Marattiaceae	6	135
Osmundales	Osmundaceae	4	25
Hymenophyllales	Hymenophyllaceae	2	650
Gleicheniales	Gleicheniaceae	6	165
Gleicheniales	Dipteridaceae	2	9
Gleicheniales	Matoniaceae	2	4
Schizaeales	Schizaeaceae	4	190
Salviniales	Marsileaceae	3	65
Salviniales	Salviniaceae	2	20
Cyatheaales	Cyatheaceae	12	700
Polypodiales	Lonchitidaceae	1	2
Polypodiales	Saccolomataceae	2	12
Polypodiales	Cystodiaceae	1	1
Polypodiales	Lindsaeaceae	6	220
Polypodiales	Dennstaedtiaceae	10	240
Polypodiales	Pteridaceae	45	1,150
Polypodiales	Aspleniaceae	24	2,780
Polypodiales	Polypodiaceae	76	4,080
Total ferns	21	215	10,560
Cycadales	Cycadaceae	1	107
Cycadales	Zamiaceae	9	230
Ginkgoales	Ginkgoaceae	1	1
Welwitschiales	Welwitschiaceae	1	1

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TABLE 1. (Continued)

Order	Family	Approximate no of genera	Approximate no of species
Gnetales	Gnetaceae	1	43
Ephedrales	Ephedraceae	1	68
Pinales	Pinaceae	11	228
Araucariales	Araucariaceae	3	37
Araucariales	Podocarpaceae	19	187
Cupressales	Sciadopityaceae	1	1
Cupressales	Cupressaceae	29	149
Cupressales	Taxaceae	6	27
Total gymnosperms	12	83	1,079
Amborellales	Amborellaceae	1	1
Nymphaeales	Hydatellaceae	1	12
Nymphaeales	Cabombaceae	2	6
Nymphaeales	Nymphaeaceae	5	70
Austrobaileyales	Austrobaileyaceae	1	1
Austrobaileyales	Trimeniaceae	1	8
Austrobaileyales	Schisandraceae	3	85
Canellales	Canellaceae	5	23
Canellales	Winteraceae	5	65
Piperales	Saururaceae	4	6
Piperales	Piperaceae	5	3,700
Piperales	Aristolochiaceae	7	500
Magnoliales	Myristicaceae	21	520
Magnoliales	Magnoliaceae	2	294
Magnoliales	Degeneriaceae	1	2
Magnoliales	Himantandraceae	1	2
Magnoliales	Eupomatiaceae	1	3
Magnoliales	Annonaceae	105	2,500
Lurales	Calycanthaceae	3	10
Lurales	Siparunaceae	2	75
Lurales	Gomortegaceae	1	1
Lurales	Atherospermataceae	6	16
Lurales	Hernandiaceae	5	58
Lurales	Monimiaceae	24	217
Lurales	Lauraceae	45	2,850
Chloranthales	Chloranthaceae	4	77
Acorales	Acoraceae	1	2
Alismatales	Araceae	114	3,750
Alismatales	Tofieldiaceae	4	28

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TABLE 1. (Continued)

Order	Family	Approximate no of genera	Approximate no of species
Alismatales	Alismataceae	17	115
Alismatales	Butomaceae	1	1
Alismatales	Hydrocharitaceae	16	135
Alismatales	Scheuchzeriaceae	1	1
Alismatales	Aponogetonaceae	1	56
Alismatales	Juncaginaceae	3	34
Alismatales	Maundiaceae	1	1
Alismatales	Zosteraceae	2	22
Alismatales	Potamogetonaceae	6	110
Alismatales	Posidoniaceae	1	9
Alismatales	Ruppiaceae	1	8
Alismatales	Cymodoceaceae	5	17
Petrosaviales	Petrosaviaceae	2	4
Dioscoreales	Nartheciaceae	5	35
Dioscoreales	Burmanniaceae	8	99
Dioscoreales	Dioscoreaceae	9	715
Pandanales	Triuridaceae	9	55
Pandanales	Velloziaceae	5	306
Pandanales	Stemonaceae	4	37
Pandanales	Cyclanthaceae	12	230
Pandanales	Pandanaceae	5	982
Liliales	Campynemataceae	2	4
Liliales	Corsiaceae	3	27
Liliales	Melanthiaceae	17	173
Liliales	Petermanniaceae	1	1
Liliales	Alstroemeriaceae	4	254
Liliales	Colchicaceae	15	285
Liliales	Philesiaceae	2	2
Liliales	Ripogonaceae	1	6
Liliales	Smilacaceae	1	255
Liliales	Liliaceae	15	705
Asparagales	Orchidaceae	736	28,000
Asparagales	Boryaceae	2	12
Asparagales	Blandfordiaceae	1	4
Asparagales	Asteliaceae	3	37
Asparagales	Lanariaceae	1	1
Asparagales	Hypoxidaceae	4	159
Asparagales	Doryanthaceae	1	2

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TABLE 1. (Continued)

Order	Family	Approximate no of genera	Approximate no of species
Asparagales	Ixioliriaceae	1	4
Asparagales	Tecophilaeaceae	9	27
Asparagales	Iridaceae	66	2,244
Asparagales	Xeronemataceae	1	2
Asparagales	Asphodelaceae	39	900
Asparagales	Amaryllidaceae	75	1600
Asparagales	Asparagaceae	114	2900
Arecales	Dasypogonaceae	4	16
Arecales	Arecaceae	181	2,600
Commelinales	Hanguanaceae	1	12
Commelinales	Commelinaceae	41	731
Commelinales	Philydraceae	3	6
Commelinales	Pontederiaceae	6	34
Commelinales	Haemodoraceae	14	102
Zingiberales	Strelitziaceae	3	7
Zingiberales	Lowiaceae	1	18
Zingiberales	Heliconiaceae	1	194
Zingiberales	Musaceae	3	91
Zingiberales	Cannaceae	1	10
Zingiberales	Marantaceae	29	570
Zingiberales	Costaceae	7	143
Zingiberales	Zingiberaceae	50	1,600
Poales	Typhaceae	2	51
Poales	Bromeliaceae	51	3,475
Poales	Rapateaceae	16	94
Poales	Xyridaceae	5	399
Poales	Eriocaulaceae	7	1,207
Poales	Mayacaceae	1	6
Poales	Thurniaceae	2	4
Poales	Juncaceae	8	464
Poales	Cyperaceae	90	5,500
Poales	Restionaceae	51	572
Poales	Flagellariaceae	1	4
Poales	Joinvilleaceae	1	4
Poales	Ecdeiocoleaceae	2	3
Poales	Poaceae	780	12,000
Ceratophyllales	Ceratophyllaceae	1	4
Ranunculales	Eupteleaceae	1	2

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TABLE 1. (Continued)

Order	Family	Approximate no of genera	Approximate no of species
Ranunculales	Papaveraceae	42	775
Ranunculales	Circaeasteraceae	2	2
Ranunculales	Lardizabalaceae	7	40
Ranunculales	Menispermaceae	68	440
Ranunculales	Berberidaceae	14	700
Ranunculales	Ranunculaceae	43	2,346
Proteales	Sabiaceae	3	66
Proteales	Nelumbonaceae	1	3
Proteales	Platanaceae	1	8
Proteales	Proteaceae	83	1660
Trochodendrales	Trochodendraceae	2	2
Buxales	Buxaceae	6	123
Gunnerales	Myrothamnaceae	1	2
Gunnerales	Gunneraceae	1	63
Dilleniales	Dilleniaceae	11	430
Saxifragales	Peridiscaceae	4	12
Saxifragales	Paeoniaceae	1	33
Saxifragales	Altingiaceae	1	15
Saxifragales	Hamamelidaceae	26	86
Saxifragales	Cercidiphyllaceae	1	2
Saxifragales	Daphniphyllaceae	1	30
Saxifragales	Iteaceae	2	18
Saxifragales	Grossulariaceae	1	150
Saxifragales	Saxifragaceae	33	640
Saxifragales	Crassulaceae	35	1,400
Saxifragales	Aphanopetalaceae	1	2
Saxifragales	Tetracarpaeaceae	1	1
Saxifragales	Penthoraceae	1	2
Saxifragales	Haloragaceae	9	145
Saxifragales or Rosales	Cynomoriaceae	1	2
Vitales	Vitaceae	14	910
Zygophyllales	Krameriaceae	1	18
Zygophyllales	Zygophyllaceae	22	285
Fabales	Quillajaceae	1	3
Fabales	Fabaceae	751	19,500
Fabales	Surianaceae	5	8
Fabales	Polygalaceae	21	900
Rosales	Rosaceae	91	2,950

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TABLE 1. (Continued)

Order	Family	Approximate no of genera	Approximate no of species
Rosales	Barbeyaceae	1	1
Rosales	Dirachmaceae	1	2
Rosales	Elaeagnaceae	3	60
Rosales	Rhamnaceae	55	950
Rosales	Ulmaceae	7	45
Rosales	Cannabaceae	8	100
Rosales	Moraceae	38	1,180
Rosales	Urticaceae	53	2625
Fagales	Nothofagaceae	1	43
Fagales	Fagaceae	8	927
Fagales	Myricaceae	3	57
Fagales	Juglandaceae	9	50
Fagales	Casuarinaceae	4	91
Fagales	Ticodendraceae	1	1
Fagales	Betulaceae	6	167
Cucurbitales	Apodanthaceae	2	10
Cucurbitales	Anisophylleaceae	4	71
Cucurbitales	Corynocarpaceae	1	5
Cucurbitales	Coriariaceae	1	14
Cucurbitales	Cucurbitaceae	95	965
Cucurbitales	Tetramelaceae	2	2
Cucurbitales	Datisceae	1	3
Cucurbitales	Begoniaceae	2	1,825
Celastrales	Lepidobotryaceae	2	2
Celastrales	Celastraceae	96	1,350
Oxalidales	Huaceae	2	4
Oxalidales	Connaraceae	12	180
Oxalidales	Oxalidaceae	5	570
Oxalidales	Cunoniaceae	27	330
Oxalidales	Elaeocarpaceae	12	615
Oxalidales	Cephalotaceae	1	1
Oxalidales	Brunelliaceae	1	60
Malpighiales	Pandaceae	3	17
Malpighiales	Irvingiaceae	3	13
Malpighiales	Ctenolophonaceae	1	2
Malpighiales	Rhizophoraceae	15	147
Malpighiales	Erythroxylaceae	4	242
Malpighiales	Ochnaceae	32	550

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TABLE 1. (Continued)

Order	Family	Approximate no of genera	Approximate no of species
Malpighiales	Bonnetiaceae	3	35
Malpighiales	Clusiaceae	13	750
Malpighiales	Calophyllaceae	14	475
Malpighiales	Podostemaceae	46	300
Malpighiales	Hypericaceae	6	590
Malpighiales	Caryocaraceae	2	26
Malpighiales	Lophopyxidaceae	1	1
Malpighiales	Putranjivaceae	2	216
Malpighiales	Centroplacaceae	2	6
Malpighiales	Elatinaceae	2	35
Malpighiales	Malpighiaceae	73	1,315
Malpighiales	Balanopaceae	1	9
Malpighiales	Trigoniaceae	5	28
Malpighiales	Dichapetalaceae	3	170
Malpighiales	Euphroniaceae	1	3
Malpighiales	Chrysobalanaceae	18	533
Malpighiales	Humiriaceae	8	56
Malpighiales	Achariaceae	32	155
Malpighiales	Violaceae	31	980
Malpighiales	Goupiaceae	1	2
Malpighiales	Passifloraceae	29	980
Malpighiales	Lacistemataceae	2	14
Malpighiales	Salicaceae	56	1,220
Malpighiales	Peraceae	5	127
Malpighiales	Rafflesiaceae	3	25
Malpighiales	Euphorbiaceae	209	6,252
Malpighiales	Linaceae	10	255
Malpighiales	Ixonanthaceae	3	17
Malpighiales	Picrodendraceae	25	96
Malpighiales	Phyllanthaceae	57	2,050
Geraniales	Geraniaceae	5	830
Geraniales	Francoaceae	8	37
Myrtales	Combretaceae	10	530
Myrtales	Lythraceae	27	620
Myrtales	Onagraceae	22	656
Myrtales	Vochysiaceae	7	217
Myrtales	Myrtaceae	132	5,950
Myrtales	Melastomataceae	165	5,115

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TABLE 1. (Continued)

Order	Family	Approximate no of genera	Approximate no of species
Myrtales	Crypteroniaceae	3	13
Myrtales	Alzateaceae	1	1
Myrtales	Penaeaceae	9	32
Crossosomatales	Aphloiaceae	1	1
Crossosomatales	Geissolomataceae	1	1
Crossosomatales	Strasburgeriaceae	2	2
Crossosomatales	Staphyleaceae	2	45
Crossosomatales	Guamatelaceae	1	1
Crossosomatales	Stachyuraceae	1	8
Crossosomatales	Crossosomataceae	4	10
Picramniales	Picramniaceae	3	49
Sapindales	Biebersteiniaceae	1	4
Sapindales	Nitrariaceae	3	19
Sapindales	Kirkiaceae	1	6
Sapindales	Burseraceae	19	615
Sapindales	Anacardiaceae	83	860
Sapindales	Sapindaceae	142	1,860
Sapindales	Rutaceae	148	2,070
Sapindales	Simaroubaceae	22	108
Sapindales	Meliaceae	53	600
Huerteales	Gerrardinaceae	1	2
Huerteales	Petenaeeae	1	1
Huerteales	Tapisciaceae	2	6
Huerteales	Dipentodontaceae	2	20
Malvales	Cytinaceae	2	10
Malvales	Muntingiaceae	3	3
Malvales	Neuradaceae	3	10
Malvales	Malvaceae	244	4,225
Malvales	Sphaerosepalaceae	2	18
Malvales	Thymelaeaceae	46	913
Malvales	Bixaceae	4	23
Malvales	Cistaceae	9	170
Malvales	Sarcolaenaceae	10	71
Malvales	Dipterocarpaceae	16	695
Brassicales	Akaniaceae	2	2
Brassicales	Tropaeolaceae	1	94
Brassicales	Moringaceae	1	13
Brassicales	Caricaceae	6	35

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TABLE 1. (Continued)

Order	Family	Approximate no of genera	Approximate no of species
Brassicales	Limnanthaceae	2	8
Brassicales	Setchellanthaceae	1	1
Brassicales	Koerberliniaceae	1	2
Brassicales	Bataceae	1	2
Brassicales	Salvadoraceae	3	11
Brassicales	Emblingiaceae	1	1
Brassicales	Tovariaceae	1	2
Brassicales	Pentadiplandraceae	1	1
Brassicales	Gyrostemonaceae	4	20
Brassicales	Resedaceae	12	107
Brassicales	Capparaceae	30	324
Brassicales	Cleomaceae	1	346
Brassicales	Brassicaceae	328	3,628
Berberidopsidales	Aextoxicaceae	1	1
Berberidopsidales	Berberidopsidaceae	2	3
Santalales	Olacaceae	29	180
Santalales	Opiliaceae	11	33
Santalales	Balanophoraceae	17	44
Santalales	Santalaceae	43	1,000
Santalales	Misodendraceae	1	8
Santalales	Schoepfiaceae	3	58
Santalales	Loranthaceae	76	1,050
Caryophyllales	Frankeniaceae	1	90
Caryophyllales	Tamaricaceae	4	78
Caryophyllales	Plumbaginaceae	30	725
Caryophyllales	Polygonaceae	48	1,200
Caryophyllales	Droseraceae	3	180
Caryophyllales	Nepenthaceae	1	150
Caryophyllales	Drosophyllaceae	1	1
Caryophyllales	Dioncophyllaceae	3	3
Caryophyllales	Ancistrocladaceae	1	21
Caryophyllales	Rhabdodendraceae	1	3
Caryophyllales	Simmondsiaceae	1	1
Caryophyllales	Physenaceae	1	2
Caryophyllales	Asteropeiaceae	1	8
Caryophyllales	Macarthuriaceae	1	10
Caryophyllales	Microteaceae	1	9
Caryophyllales	Caryophyllaceae	81	2,625

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TABLE 1. (Continued)

Order	Family	Approximate no of genera	Approximate no of species
Caryophyllales	Achatocarpaceae	2	11
Caryophyllales	Amaranthaceae	165	2,040
Caryophyllales	Stegnospermataceae	1	4
Caryophyllales	Limeaceae	1	21
Caryophyllales	Lophiocarpaceae	2	6
Caryophyllales	Kewaceae	1	8
Caryophyllales	Barbeuiaceae	1	1
Caryophyllales	Gisekiaceae	1	8
Caryophyllales	Aizoaceae	121	1,900
Caryophyllales	Phytolaccaceae	5	33
Caryophyllales	Petiveriaceae	9	20
Caryophyllales	Sarcobataceae	1	2
Caryophyllales	Nyctaginaceae	31	400
Caryophyllales	Molluginaceae	9	80
Caryophyllales	Montiaceae	14	230
Caryophyllales	Didiereaceae	7	22
Caryophyllales	Basellaceae	4	19
Caryophyllales	Halophytaceae	1	1
Caryophyllales	Talinaceae	2	28
Caryophyllales	Portulacaceae	1	115
Caryophyllales	Anacampserotaceae	3	36
Caryophyllales	Cactaceae	127	1750
Cornales	Nyssaceae	5	37
Cornales	Hydrostachyaceae	1	22
Cornales	Hydrangeaceae	9	223
Cornales	Loasaceae	20	308
Cornales	Curtisiaceae	1	1
Cornales	Grubbiaceae	1	3
Cornales	Cornaceae	2	85
Ericales	Balsaminaceae	2	1,000
Ericales	Marcgraviaceae	7	120
Ericales	Tetrameristaceae	3	5
Ericales	Fouquieriaceae	1	11
Ericales	Polemoniaceae	26	350
Ericales	Lecythidaceae	25	355
Ericales	Sladeniaceae	2	3
Ericales	Pentaphragmaceae	12	330
Ericales	Sapotaceae	54	1,273

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TABLE 1. (Continued)

Order	Family	Approximate no of genera	Approximate no of species
Ericales	Ebenaceae	4	800
Ericales	Primulaceae	53	2,790
Ericales	Theaceae	9	240
Ericales	Symplocaceae	2	260
Ericales	Diapensiaceae	5	12
Ericales	Styracaceae	11	160
Ericales	Sarraceniaceae	3	34
Ericales	Roridulaceae	1	2
Ericales	Actinidiaceae	3	360
Ericales	Clethraceae	2	75
Ericales	Cyrillaceae	2	2
Ericales	Ericaceae	124	4,250
Ericales	Mitrastemonaceae	1	2
Icacinales	Oncothecaceae	1	2
Icacinales	Icacinaceae	25	165
Metteniusales	Metteniusaceae	11	50
Garryales	Eucommiaceae	1	1
Garryales	Garryaceae	2	25
Gentianales	Rubiaceae	590	13,620
Gentianales	Gentianaceae	102	1735
Gentianales	Loganiaceae	15	390
Gentianales	Gelsemiaceae	3	11
Gentianales	Apocynaceae	366	5,100
Gentianales	Boraginaceae	135	2,535
Vahliales	Vahliaceae	1	8
Solanales	Convolvulaceae	53	1,660
Solanales	Solanaceae	100	2,600
Solanales	Montiniaceae	3	5
Solanales	Sphenocleaceae	1	2
Solanales	Hydroleaceae	1	12
Lamiales	Plocospermataceae	1	1
Lamiales	Carlemanniaceae	2	5
Lamiales	Oleaceae	26	790
Lamiales	Tetrachondraceae	2	3
Lamiales	Calceolariaceae	2	271
Lamiales	Gesneriaceae	152	3,540
Lamiales	Plantaginaceae	94	1,900
Lamiales	Scrophulariaceae	62	1,830

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TABLE 1. (Continued)

Order	Family	Approximate no of genera	Approximate no of species
Lamiales	Stilbaceae	8	40
Lamiales	Linderniaceae	23	220
Lamiales	Byblidaceae	1	7
Lamiales	Martyniaceae	5	16
Lamiales	Pedaliaceae	13	75
Lamiales	Acanthaceae	210	4,000
Lamiales	Bignoniaceae	82	870
Lamiales	Lentibulariaceae	3	316
Lamiales	Schlegeliaceae	4	37
Lamiales	Thomandersiaceae	1	6
Lamiales	Verbenaceae	32	1,000
Lamiales	Lamiaceae	241	7530
Lamiales	Mazaceae	3	33
Lamiales	Phrymaceae	13	186
Lamiales	Paulowniaceae	3	8
Lamiales	Orobanchaceae	98	1,960
Aquifoliales	Stemonuraceae	12	90
Aquifoliales	Cardiopteridaceae	5	43
Aquifoliales	Phyllonomaceae	1	4
Aquifoliales	Helwingiaceae	1	4
Aquifoliales	Aquifoliaceae	1	500
Asterales	Rousseaceae	4	6
Asterales	Campanulaceae	81	2,300
Asterales	Pentaphragmataceae	1	30
Asterales	Stylidiaceae	6	245
Asterales	Alseuosmiaceae	5	13
Asterales	Phellinaceae	1	12
Asterales	Argophyllaceae	2	21
Asterales	Menyanthaceae	6	60
Asterales	Goodeniaceae	12	440
Asterales	Calyceraceae	4	60
Asterales	Asteraceae	1,623	24,700
Escalloniales	Escalloniaceae	7	103
Bruniales	Columelliaceae	2	8
Bruniales	Bruniaceae	6	81
Paracryphiales	Paracryphiaceae	3	36
Dipsacales	Adoxaceae	5	225
Dipsacales	Caprifoliaceae	28	825

... Continued on next page

TABLE 1. (Continued)

Order	Family	Approximate no of genera	Approximate no of species
Apiales	Pennantiaceae	1	4
Apiales	Toricelliaceae	3	10
Apiales	Griselinaceae	1	7
Apiales	Pittosporaceae	7	245
Apiales	Araliaceae	43	1,650
Apiales	Myodocarpaceae	2	15
Apiales	Apiaceae	442	3,575
Total angiosperms	416	13,164	295,383
Total vascular plants	452	13,467	308,312

The largest vascular plant families are Orchidaceae (ca 736 genera, ca 28,000 species; Chase *et al.* 2015) and Asteraceae (ca 1,623 genera, ca 24,700 species; e.g. Funk *et al.* 2009), the difference showing that the generic taxonomy of Asteraceae appears to need further revision as the rate of species per genus is higher in Orchidaceae than in Asteraceae, which has fewer species but more than twice the number of genera, which seems highly inflated.

Since Linnaeus (1753) over 250,000 plant species have been described (Payne 2016) and the number of species is increasing every day, particularly in large families like Orchidaceae, Asteraceae and Fabaceae. However, the rate of new species discovery and publication has not always been the same. During ages of exploration in the 18th and 19th Centuries, spikes in numbers of published new species names can be observed. Peaks in species description are particularly noticeable in the periods between 1830–1850 and 1890–1920, when per decade over 35,000 species names were proposed (Lindon *et al.* 2015; note that this data includes new species, new names and new combinations). These corresponded with major taxonomic works (e.g. Candolle 1824–1873, Steudel 1840–1841, Bentham & Hooker 1862–1883, Kuntze 1891–1898) or major regional floristic studies of newly explored areas (e.g. Siebold & Zuccarini 1837–1870, Martius 1840–1906, Boissier 1843–1859, Miquel 1855–1859), when species delimitation became more closely scrutinised. Currently the numbers of new species published per decade (excluding new combinations) has stabilised around 20,000 per decade (Lindon *et al.* 2015). An average of ca 2,000 new species are now published annually, although the last years there seems to be a slight decline and we can only hope that this is not a continuing trend (Fig. 1). It should be noted that *Phytotaxa* contributed over a quarter of the total number of species published in 2015 (Fig 1), a major increase in the input of this journal to plant taxonomy, making it currently the largest journal in systematic botany in the world (Zhang *et al.* 2014). The main countries that yield the greatest numbers of new species are Australia, Brazil, China and New Guinea, although many smaller African, American, Pacific and Central and tropical Asian countries also contribute substantial numbers, which is reflected in the increase in new species published by scientists from biodiverse BRIC countries, which have invested in their taxonomic capacity, shifting away from European and North American taxonomists as main descriptors of taxonomic novelties (Zhang *et al.* 2014). A recent study has shown that most new species are probably to be found in the world's biodiversity hotspots (Joppa *et al.* 2011b). Large parts of the world are still in need of further biological exploration, particularly these designated biodiversity hotspots, but large areas not designated as such, particularly in the tropics and subtropics are still greatly in need of field study as well. The specific dynamics of species exploration, description, extinction rates (estimated to be 1000 to 10,000 times the background rate) and numbers of scientists involved in this work is detailed by the exploratory analyses of Pimm & Joppa (2015).

The age of large general botanical explorations appears to be over, even though many new species are still to be discovered. It seems that most new species are now discovered among existing collections in herbaria (Bebber *et al.* 2010), but as taxonomy is increasingly under financial pressure, resulting in a reduced number of taxonomists in big natural history institutions being paid by core funding to carry out descriptive, fundamental sciences. Fundamental research, needed to build upon applied studies which are generally well-funded, are not receiving the recognition among funding bodies that is required to complete the task of documenting and describing the natural diversity of our planet, plants in particular. It seems that discovery of extinct animals (particularly dinosaurs) receive more attention by the media and leading scientific journals than a new species of plant or animal that is still living among us. Do we really need species to become extinct before we value their fundamental description and associated traits?

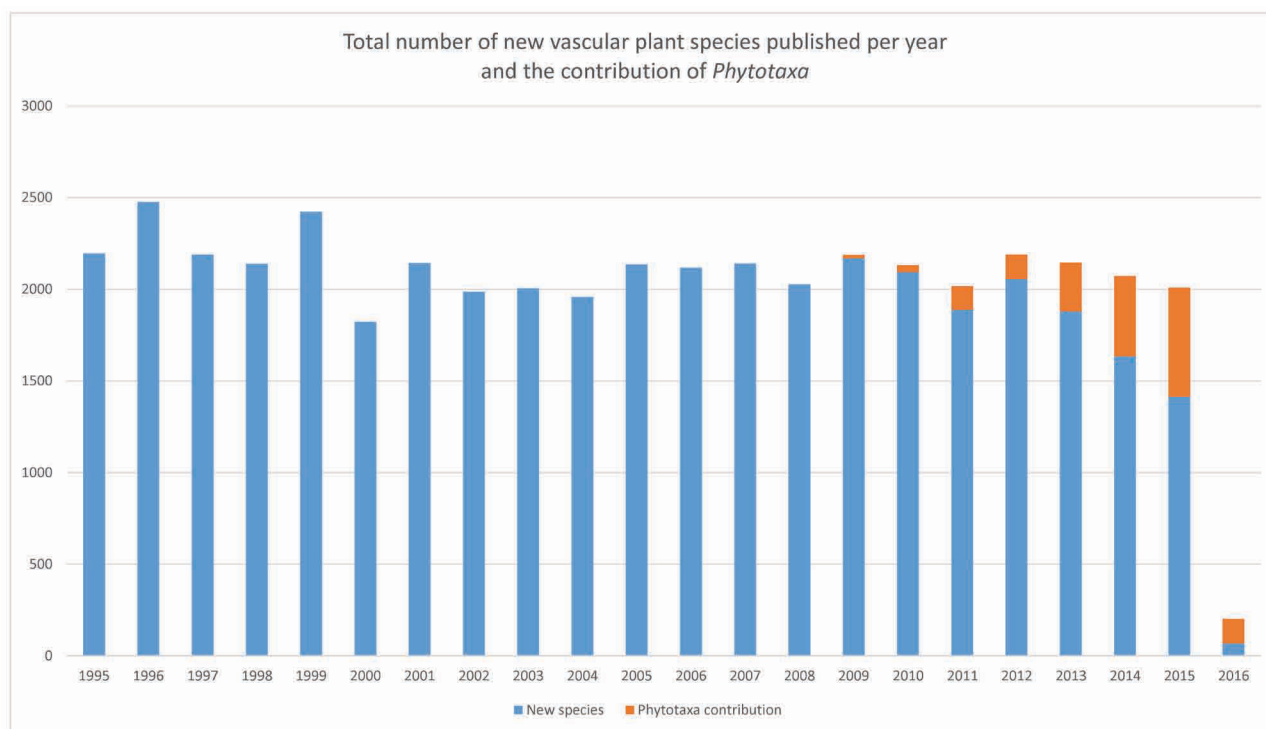


FIGURE 1. Increase in numbers of new vascular plant species published during the last two decades, based on data from the International Plant Name Index (IPNI 2016; www.ipni.org, accessed 6 March 2016). The actual numbers may possibly be somewhat higher as these numbers exclude hybrid taxa (which may be considered species in some cases) and taxa known at subspecific ranks that were elevated to species. On the other hand it includes species that were published but are now no longer accepted, which may even the numbers out. The years 2015 and 2016 were not yet completely indexed at this time and hence their final numbers will be higher.

It is important to estimate the numbers of known species, as we are dealing with an unprecedented rate of extinction. Since Linnaeus aimed to document all species of plants in 1753, the starting date of nomenclatural taxonomy of vascular plants, 139 described plant species are now known to have become extinct or only occur in cultivation (categories EX and EW of IUCN 2015), although many may have disappeared without ever having been discovered or further categorised as such (see Pimm & Joppa 2015 for further information on the current extinction rate of plant species). Taxonomy still has a massive task to undertake to describe and classify new species and *Phytotaxa* has played a major role in accelerating the publication of this species discovery, with the publication of 1750 new species since its foundation in 2009 (Christenhusz *et al.* 2009, Christenhusz *et al.* 2011, Zhang *et al.* 2014).

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