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Phylum Arthropoda*

ZHI-QIANG ZHANG
New Zealand Arthropod Collection, Landcare Research, Private Bag 92170, Auckland, New Zealand; zhangz@landcareresearch.co.nz

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Abstract

The Arthropoda is here estimated to have 1,302,809 described species, including 45,769 fossil species (the diversity of fossil taxa is here underestimated for many taxa of the Arthropoda). The Insecta (1,070,781 species) is the most successful group, and it alone accounts for over 80% of all arthropods. The most successful insect order, Coleoptera (392,415 species), represents over one-third of all species in 39 insect orders. Another major group in Arthropoda is the class Arachnida (114,275 species), which is dominated by the Acari (55,214 mite and tick species) and Araneae (44,863 spider species). Other diverse arthropod groups include Crustacea (73,141 species), Trilobitomorpha (20,906 species) and Myriapoda (12,010 species).

Key words: Classification, diversity, Arthropoda

Introduction

The Arthropoda, with over 1.5 million described species, is the largest animal phylum, and it alone accounts for about 80% of the total number of species in the animal kingdom (Zhang 2011a). In the last volume on animal higher-level classification and survey of taxonomic richness, 28 chapters by numerous teams of specialists were published on various taxa of the Arthropoda, but there were many gaps to be filled (Zhang 2011b). Also after the publication of the volume, we received comments on errors and proposal for new contributions on some taxa. In this volume, two new chapters were added (Order Hymenoptera by Aguiar *et al.* 2013 and Order Odonata by Dijkstra *et al.* 2013) and four chapters in Zhang (2011b) were updated with new diversity estimates (Order Opiliones by Kury 2013, Order Pseudoscorpiones by Harvey 2013, Order Thysanoptera by Mound 2013, Order Blattodea by Beccaloni & Eggleton 2013). For arthropod taxa without new chapters or updates in this volume, diversity estimates in Zhang (2011c) were updated using recent papers, books and also databases, especially the *Metrics* function at http://www.organismnames.com/ where the option “Graphs of new taxa over time” was used to check new species-level taxa described in recent years (ie. 2012, and 2013 if any); it should be noted that the 2013 data are incomplete and the count of new species includes subspecies (although the number of new subspecies described is very low compared to that of new species) and new names for described species.

Fossil taxon counts are not available for many taxa in the last volume (e.g. Crustacea by Ahyong *et al.* 2011). Here, for chapters without fossil data, I used PaleoBiology Database to obtain estimates for these fossil taxa (search http://paleodb.org/ using “Taxon Count” option, date of search provided as reference); these counts for fossil taxa may not be complete and should be viewed as underestimates in most cases.

Classification

Phylum **Arthropoda** [1] (1,302,809 species, including †45,769 species)[2]

Subphylum 1 †**Trilobitomorpha** (20,906 species, including †20,906 species)[3]

Subphylum 2 **Chelicerata** (1,15,992 species, including †2,219 species)[4]

Class 1 **Pycnogonida** (1,346 species, including †11 species)[5]

Class 2 †**Aglaspidida** (11 species, including †11 species)[6]

Class 3.1 †**Xiphosura** (103 species, including †103 species)[7]

Class 3.2.1 †**Eurypterida** (249 species, including †249 species)[8]

Class 3.2.2 †**Chasmataspidida** (8 species, including †8 species)[9]

Class 3.3 **Arachnida** (114,275, including †1,833 species)[10]

Order 1.1 **Opiliones** (6,571 species, including †37 species)[11]

Order 1.2 **Scorpiones** (2,109 species, including †121 species)[12]

Order 2.1 **Solifugae** (1,116 species, including †3 species)[13]

Order 2.2 **Pseudoscorpiones** (3,574 species, including †41 species)[14]

Order 3 **Palpigradi** (88 species, including †1 species)[15]

Order 4 †**Phalangiotarbida** (†31 species, including †31 species)[16]

Order 5 **Ricinulei** (77 species, including †16 species)[17]

Order 6.1 **Opilioacarida** Zakhvatkin, 1952 (37 species, including †2 species)[18]

Order 6.2 **Holothyrida** (27 species; including †0 species)[19]

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1. Updated from that in Zhang (2011c), whose classification at the subphylum level generally reflects the high level relationship summarized by Giribet & Edgecombe (2012: Fig. 5), with modification and updates as indicated. †Marellomorpha was not included in the phylogentic relationships focused on Recent taxa in Giribet & Edgecombe (2012). Grimaldi & Engel (2005) listed three genera.
2. Total number of described species (extant and fossil) is presented for each taxon; synonyms are excluded. Diversity of fossil taxa is greatly underestimated (counts of fossil species with prefix †).
3. Adrain (2011) estimated a total 20,859 species, which was mistakenly printed as 19,606 species in Zhang (2011c). The current estimate is updated using *Zoological Record.*
4. Grimaldi & Engel (2005) listed three poorly known fossil arthropod taxa (†Sidneyiida, †Emeraldellida Størmer, 1944 and †Sanctacarida); their placement is uncertain in the current system. Total fossil species count includes 4 unplaced species in Dunlop *et al.* (2013).
5. Bamber (2011) estimated 1330 species, including †8 species. Takahashi *et al.* (2012a, b) added three species; Cano & López-González (2003) two species, Arango & Brenneis (2013) two species, Wang *et al*. (2013) two species, Kuehl *et al. (*2013) one species, Rudkin *et al.* (2013) one species, and Bamber (2013) five species. Dunlop *et al.* (2013) listed †11 species.
6. Data from Zhang (2011c), which was based on J. Ortega-Hernandez (personal communication, 2011).
7. Data from Dunlop *et al.* (2013).
8. Data from Dunlop *et al.* (2013).
9. Data from Dunlop *et al.* (2013).
10. Arachnid classification reflects mostly the phylogenetic hypothesis by Shultz (2007), but his Acaromorpha is now disputed (see Dunlop 2010).
11. Kury (2011) estimated 6,519 species, including †35 species. The current estimate is based on Kury (2013). It should be noted that Dunlop *et al.* (2013) listed 34 valid species of fossil harvestman.
12. Prendini (2011a) estimated 2,068 species, including †121 species. The current estimate is updated with *Zoological Record.* It should be noted that Dunlop *et al.* (2013) listed 117 valid species of fossil Scorpiones.
13. Prendini (2011b) estimated 1,116 species, including †3 species. It should be noted that Dunlop *et al.* (2013) listed 5 valid species of fossil Scorpiones.
14. Harvey (2011) estimated 3,494 species, including †40 species. The current estimate is from Harvey (2013).
15. Prendini (2011c) estimated 83 species, including †1 species. The current estimate is updated with *Zoological Record.*
16. Data from Dunlop *et al.* (2013).
17. Prendini (2011d) estimated 73 species, including †15 species. Three new species living species were added (Pinto-da-Rocha1 & Andrade 2012; Valdez-Mondragón & Francke 2013). Dunlop *et al.* (2013) listed 16 valid species of fossil Scorpiones.
18. See Beaulieu *et al.* (2011), with a list of families and diversity estimates for each family within the mite superorder Parasitiformes, including Opilioacarida, Holothyrida, Ixodida and Mesostigmata.

Order 6.3 **Ixodida** (897 species, including †5 species) [20]
Order 6.4 **Mesostigmata** (>11,424 species, including †5 species)[21]
Order 7.1 **Trombidiformes** (>25,821 species, including †55 species)[22]
Order 7.2 **Scarcoptiformes** (>16,412 species, including †239 species)[23]
Order 8.1 †**Trigonotarbida** (†65 species, including †65 species)[24]
Order 8.2.1.1 †**Uraraneida** (†2 species, including †2 species)[25]
Order 8.2.1.2 **Araneae** (44,863 species, including †1,185 species)[26]
Order 8.2.2.1 †**Haptopoda** Pocock, 1911 (†1 species, including †1 species)[27]
Order 8.2.2.2.1 **Amblypygi** (172 species, including †9 species)[28]
Order 8.2.2.2.2.1 **Thelyphonida** (119 species, including †9 species)[29]
Order 8.2.2.2.2.2 **Schizomida** (273 species, including †6 species)[30]
Subphylum 2.1 **Myriapoda** (12,010 species, including †11 species)[31]
Class 1 **Chilopoda** (3,118 species, including †6 species)[32]
Class 2.1 **Symphyla** (204 species, including †0 species)[33]
Class 2.2.1 **Pauropoda** (846 species, including †0 species)[34]
Class 2.2.2 **Diplopoda** (7,842 species, including †5 species)[35]
Subphylum 2.2.1 **Crustacea** (73,141 species, including †5,406 species)[36]
Subphylum 2.2.2 **Hexapoda** (1,080,760 species, including †17,227 species)[37]
Class 1.1 **Collembola** (8,187 species, including †24 species)[38]
Class 1.2.1 **Protura** (816 species, including †0 species)[39]
Class 1.2.2 **Diplura** (976 species, including †1 species)[40]

19. No new species added after Beaulieu *et al.* (2011) survey.
20. Guglielmone *et al.* (2010) estimated 896 species, including †5 species; Nava *et al.* (2013) described a new species.
21. Beaulieu *et al.* (2011) estimated 11,424 species and more new species described later (which were counted in the total for Acari in this update). Dunlop *et al.* (2013) listed 4 fossil species
22. Acariformes = Trombidiformes + Sarcoptiformes. Zhang *et al.* (2011) estimated >25,821 species, including †24 species for Trombidiformes and more new species described later (which were counted in the total for Acari in this update). Dunlop *et al.* (2013) listed 55 fossil species of Trombidiformes.
23. This order includes two suborders: Oribatida and Endeostigmata. Schatz *et al.* (2011) estimated 16,197 species of Recent Oribatida (including Astigmata) and 108 species fossil; Walter *et al.* (2011) estimated 108 species for Endeostigmata, including 5 species are based on fossil Dunlop *et al.* (2013) listed 239 fossil species of for this order.
Total number of Acari (six orders) is updated here with 55,214 species using *Zoological Record.*
24. Dunlop *et al.* (2013).
25. Dunlop *et al.* (2013).
26. Dunlop & Penney (2011) estimated 43,579 species, including †1,106 species. Platnick & Raven (2013) counted 43,678 extant species. Dunlop *et al.* (2013) counted 1,185 fossil species.
27. Dunlop *et al.* (2013).
28. Prendini (2011e) estimated 170 species, including †9 species. Three new species were recently described and one synonymized (Giupponi & Miranda 2012; Giupponi & Kury 2013).
29. Prendini (2011f) estimated 119 species, including †9 species. It should be noted that Dunlop *et al.* (2013) listed 7 valid species of fossil Thelyphonida.
30. Prendini (2011g) estimated 264 species, including †4 species. Dunlop *et al.* (2013) listed 6 valid species of fossil Schizomida. Updated with *Zoological Record* here.
31. Recent species only; many fossil species were described but the number of described species were not yet estimated, so the total number of species should be considered incomplete.
32. Shear (2011) estimated Recent 3,100 species. Updated with *Zoological Recrod* here. Fossils are represented in 6 species (Data from Paleobiology Database on 26 August, 2013 using "Taxon Count" search).
33. Minelli (2011) estimated 197 Recent species Symphyla. and also 835 for Pauropoda and 7,753 Diplopoda. Updated here with *Zoological Record.*
34. Minelli (2011) estimated 835 Recent species of Pauropoda. Updated here with *Zoological Record.*
35. Minelli (2011) estimated 7,753 Recent species of Diplopoda. Updated here with *Zoological Record.* Fossils are represented in 5 species (Data from Paleobiology Database on 26 August, 2013 using "Taxon Count" search).

Class 2 **Insecta** (1,070,781 species, including †17,203 species)[41]
Order 1 **Archaeognatha** (514 species, including †8 species)[42]
Order 2.1 **Zygentoma** (574 species, including †20 species)[43]
Order 2.2.1.1 **Ephemeroptera** (3,281 species, including †157 species)[44]
Order 2.2.1.2.1.1 †**Geroptera** (2 species, including †2 species)[45]
Order 2.2.1.2.1.2.1 †**Protodonata** (57 species, including †57 species)[46]
Order 2.2.1.2.1.2.2 **Odonata** (6,650 species, including †608 species)[47]
Order 2.2.1.2.2.1.1 †**Palaeodictyoptera** (233 species, including †233 species)[48]
Order 2.2.1.2.2.2.2.1 †**Mischopterida** (100 species, including †100 species)[49]
Order 2.2.1.2.2.2.2.2 †**Diaphanopterodea** (74 species, including †74 species)[50]
Order 2.2.2.1 †**Paoliida** (14 species, including †14 species)[51]
Order 2.2.2.2.1 †**Caloneurodea** (40 species, including †40 species)[52]
Order 2.2.2.2.2 †**Titanoptera** (46 species, including †46 species)[53]

36. Ahyong *et al.* (2011) provided a classification of all families and an estimate of 1,003 families, 9,522 genera and 66,914 species for Recent Crustacea. Crustacea is paraphyletic according to Giribet & Edgecombe (2012). The traditional consensus classification presented in Ahyong *et al.* (2011) is here followed. Updated here with *Zoological Record* (821 species in 2012–2013). Fossil taxa are represented in 3508 genera and 5,406 species (Data from Paleobiology Database on 26 August, 2013 using "Taxon Count" search); it should be noted that 1703 genera do not include species with taxonomic classification data—the species count is thus an underestimate.
37. Classification reflects consensus phylogenetic relationship in Trautwein *et al.* (2012); inclusion of fossil orders follows Grimaldi & Engel (2005).
38. Janssens & Christiansen (2011) estimated 8,130 species. Fossils are represented in 24 species (Data from Paleobiology Database on 26 August, 2013 using "Taxon Count" search).
39. Zhang (2011c) estimated 804 species based on Szeptycki (2007) with updates to 2011 using Zoological Record.Updated here with *Zoological Record.*
40. 800 species cited in Zhang (2011c) was also cited by Chapman (2009). New estimate from Koch (2009). Fossil 1 species (Data from Paleobiology Database on 26 August, 2013 using "Taxon Count" search).
41. Diversity estimates for fossil insects are not available for many orders and thus total diversity is underestimated.
42. Zhang (2011c) estimated 513 species based on Foottit & Adler (2009) and updated here using *Zoological Record*.
43. Alternative name Thysanura; Zhang (2011c) listed 561 species, including †1 species. Fossil taxa are represented in 2 families, 12 genera and 20 species (Data from Paleobiology Database on 26 August, 2013 using "Taxon Count" search).
44. Zhang (2011c) estimated 3,240 species based on Foottit & Adler (2009) and updated using *Zoological Record.* Here updated again using *Zoological Record*. Fossil taxa are represented in 32 families, 103 genera and 157 species (Data from Paleobiology Database on 26 August, 2013 using "Taxon Count" search).
45. Fossil taxa are represented in 1 family, 2 genera and 2 species (Data from Paleobiology Database on 26 August, 2013 using "Taxon Count" search)—note that these data may be incomplete; Grimaldi & Engel (2005) mentioned "a few species" for this order.
46. Fossil taxa are represented in 5 families, 30 genera and 57 species (Data from Paleobiology Database on 26 August, 2013 using "Taxon Count" search term Meganisoptera, which is synonym of Protodonata).
47. Zhang (2011c) estimated 5,899 species based on Foottit & Adler (2009) and updated using Zoological Record. Trueman (2007) mentioned "around 6,000 species" for Odonata. Dijkstra *et al.* (2013, this volume) estimated 5952 extant species by the end of 2010, plus 90 species added in 2011 and 2012. Fossil taxa are represented in 94 families, 94 genera and 393 species (Data from Paleobiology Database on 26 August, 2013 using "Taxon Count" search).
48. Fossil taxa are represented in 32 families, 152 genera and 233 species (Data from Paleobiology Database on 26 August, 2013 using "Taxon Count" search)—note that these data are incomplete as 6 genera do not include species with taxonomic classification data.
49. Zhang (2011c) estimated 100 species following Rasnitsyn & Quicke (2002). This order includes two orders listed in Grimaldi & Engel (2005): †Dipliptera (=Archodonata) and †Megasecoptera. It should be noted that the former is represented in 3 species and the latter in 75 species based on data from Paleobiology Database on 26 August, 2013 using "Taxon Count" search.
50. Zhang (2011c) estimated 50 species following Rasnitsyn & Quicke (2002). New estimate is 13 families, 37 genera and 74 species (Data from Paleobiology Database on 26 August, 2013 using "Taxon Count" search)
51. Zhang (2011c) estimated 12 species following Prokop & Nel (2007). Prokop *et al.* (2012) added two new species.
52. Fossil taxa are represented in 7 families, 31 genera and 40 species (Data from Paleobiology Database on 26 August, 2013 using "Taxon Count" search).

Order 2.2.2.2.3 **Orthoptera** (24,481 species, including †651 species)[54]
Order 2.2.2.3.1 **Phasmida** (3,100 species, including †54 species)[55]
Order 2.2.2.3.2 **Embioptera** (464 species[56], including †7 species)
Order 2.2.2.4.1 **Grylloblattodea** (542 species, including †510 species)[57]
Order 2.2.2.4.2 **Mantophasmatodea** (23 species, including †6 species)[58]
Order 2.2.2.5.1 **Plecoptera** (3,833 species[59], including †120 species[60])
Order 2.2.2.5.2 **Dermaptera** (1,982 species, including †49 species)[61]
Order 2.2.2.6.1 **Zoraptera** (45 species, including †9 species)[62]
Order 2.2.2.6.2.1 **Mantodea** (2,447 species, including †22 species)[63]
Order 2.2.2.6.2.2 **Blattodea** (8,643 species, including †1073 species)[64]
Order 2.2.3.1 †**Miomoptera** (89 species, including †89 species)[65]
Order 2.2.3.2.1 **Psocoptera** (5,732 species, including †121 species)[66]
Order 2.2.3.2.2 **Phthiraptera** (5,136 species, including †1 species)[67]
Order 2.2.3.3.1 **Thysanoptera** (6,091 species, including †153 species)[68]
Order 2.2.3.3.2 **Hemiptera** (104,165, including †1,982 species)[69]

53. Zhang (2011c) reported 15 species citing Shcherbakov (2011). Current estimates of fossil taxa are 5 families, 32 genera and 46 species (Data from Paleobiology Database on 26 August, 2013 using "Taxon Count" search).
54. Ingrisch (2011) estimated 24,276 species, including †421 species. Here updated using *Zoological Record*. Fossil taxa are represented in 64 families, 408 genera and 651 species (Data from Paleobiology Database on 26 August, 2013 using "Taxon Count" search)
55. Brock and Marshall (2011) estimated 3,029 species for Recent taxa only. Here updated using *Zoological Record*. Fossil taxa are represented in 10 families, 40 genera and 54 species (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search)—note that these data are incomplete as 9 genera do not include species with taxonomic classification data.
56. Zhang (2011c) estimated 464 species based on Foottit & Adler (2009) and updated using *Zoological Record*. Fossil taxa are represented in 6 families, 7 genera and 7 species (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search; search term is Embiodea).
57. Zhang (2011c) estimated 34 species based on Grimaldi & Engel (2005) updated using *Zoological Record.* However, Bai et al. (2010) indicated 29 Recent species and Schoville (2012) added 3 more species. Fossil taxa are represented in 49 families, 268 genera and 510 (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search)—note that these data are incomplete,as 7 genera do not include species with taxonomic classification data.
58. Zhang (2011c) estimated 21 species, including †6 species based on Arillo & Engel (2006) and Eberhard *et al.* (2011). Wipfler *et al.* (2012) added 2 new species.
59. Zhang (2011c) estimated 3,788 Recent species based on Foottit & Adler (2009) and updated using *Zoological Record*. Here again updated using *Zoological Record.*
60. Fossil taxa are represented in 21 families, 63 genera and 120 (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search)—note that these data are incomplete as 1 genus do not include species with taxonomic classification data.
61. Zhang (2011c) 1,978 species estimated based on Foottit & Adler (2009) and updated using *Zoological Record.* Updated here again using *Zoological Record.* Fossil taxa are represented in 9 families, 40 genera and 49 (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search)—note that these data are incomplete, as 5 genera do not include species with taxonomic classification data.
62. Zhang (2011c) 37 species based on Foottit & Adler (2009) and updated using *Zoological Record.* Updated here with Terry & Whiting (2012). Fossil taxa are represented in 1 family, 2 genera and 9 species (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search). Thus, the species count of Terry & Whiting (2012) agrees with that from Paleobiology Database.
63. Data from Otte *et al.* (2013).
64. Beccaloni & Eggleton (2011) estimated 7,314 without fossils; including 2,692 species of termites (no longer an order). Beccaloni & Eggleton (2013) updated this to 7570 species (including 2929 species of termites). Fossil taxa are represented in (1) 35 families, 292 genera and 919 species of cockroaches and (2) 11 families, 80 genera and 154 species of termites (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search).
65. Fossil taxa are represented in 5 families, 27 genera and 89 species (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search).
66. Zhang (2011c) estimated 5,720 species based on Foottit & Adler (2009) and updated using *Zoological Record*. Fossil taxa are represented in 36 families, 95 genera and 121 species (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search).

Order 2.2.4 †**Glosselytrodea** (30 species, including †30 species)[70]
Order 2.2.5.1 **Hymenoptera** [71] (155,517 species, including †2,429 species)[72]
Order 2.2.5.2.1.1.1 **Strepsiptera** (624 species, including †11 species)[73]
Order 2.2.5.2.1.1.2 **Coleoptera** (392,415 species, including †2,928 species)[74]
Order 2.2.5.2.1.2.1 **Neuroptera** (5,937 species, including †469 species)[75]
Order 2.2.5.2.1.2.2.1 **Megaloptera** (380 species, including †21 species)[76]
Order 2.2.5.2.1.2.2.2 **Raphidioptera** (271 species, including †87 species)[77]
Order 2.2.5.2.2.1.1 **Trichoptera** (15,233 species, including †685 species)[78]
Order 2.2.5.2.2.1.2 **Lepidoptera** (158,570 species, including †147 species)[79]
Order 2.2.5.2.2.2.1 **Diptera** (160,591 species, including †3,817 species)[80]
Order 2.2.5.2.2.2.2.1 **Siphonaptera** (2,086 species, including †4 species)[81]
Order 2.2.5.2.2.2.2.2 **Mecoptera** (769 species, including †369 species)[82]

67. Zhang (2011c) estimated 5,102 species based on Foottit & Adler (2009) and updated using *Zoological Record*. Fossil taxa are represented in 1 family, 1 genus and 1 species (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search).
68. Mound *et al.* (2011) estimated 6,019 species, including †155 species—updated to 6,091 species, including †153 species by Mound (2013)
69. Zhang (2011c) estimated 103,590 based on Foottit & Adler (2009) and updated using *Zoological Record*. Fossil taxa are represented in 195 families, 1,192 genera and 1,982 species (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search)—note that these data are incomplete, as 117 genera do not include species with taxonomic classification data.
70. Based on Hong (2007) with updates.
71. Holometabola for 11 orders from Hymenoptera to Mecoptera.
72. Zhang (2011c) listed 116,861 species based on Hymenoptera Online http://hol.osu.edu/ (accessed 15 Dec. 2011). Foottit & Adler (2009), citing Huber in that volume, mentioned 144,695 species. Current estimate based on Aguiar *et al.* (2013)
73. Zhang (2011c) estimated 609 species based on Foottit & Adler (2009) and updated using *Zoological Record*. Fossil taxa are represented in 6 families, 10 genera and 11 species (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search). Kathirithamby (2013)'s database listed 620 species, including 7 fossil species.
74. Slipinski *et al.* (2011) estimated 387,100 species, including †600 species. Here updated using *Zoological Record*. Fossil taxa are represented in 165 families, 1,758 genera and 2,928 species (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search)—note that these data are incomplete,as 72 genera do not include species with taxonomic classification data.
75. Zhang (2011c) estimated 5,868 species based on Foottit & Adler (2009) and updated using *Zoological Record*. Here updated using *Zoological Record*. Fossil taxa are represented in 37 families, 315 genera and 469 species (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search)—note that these data are incomplete, as 29 genera do not include species with taxonomic classification data.
76. Zhang (2011c) estimated 354 species based on Foottit & Adler (2009) and updated using *Zoological Record*. Here updated using *Zoological Record*. Fossil taxa are represented in 6 families, 18 genera and 21 species (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search).
77. Zhang (2011c) estimated 254 species based on Foottit & Adler (2009) and updated using *Zoological Record*. Here updated using *Zoological Record*. Fossil taxa are represented in 6 families, 42 genera and 87 species (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search)—note that these data are incomplete, as 7 genera do not include species with taxonomic classification data.
78. Holzenthal *et al.* (2011) estimated 14,999 species, including †608 species. Updated here using John Morse's Trichoptera World Checklist at http://www.clemson.edu/cafls/departments/esps/database/trichopt/ (assessed on 26 Aug. 2013).
79. Nieukerken *et al*. (2011) estimated 157,424 species, including †86 species. Here updated using *Zoological Record*. Fossil taxa are represented in 40 families, 176 genera and 147 species (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search)—note that these data are incomplete,as 33 genera do not include species with taxonomic classification data.
80. Pape *et al.* (2011) estimated 159,294 species, including †3,817 species (5,969 dubious species not included in total count). Here the total is updated using *Zoological Record*; the number fossil species is underestimated.
81. Zhang (2011c) estimated 2,075 species based on Foottit & Adler (2009) and updated using *Zoological Record*. Here updated using *Zoological Record*. Fossil taxa are represented in 2 families, 3 genera and 4 species (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search).
82. Zhang (2011c) estimated 757 species based on Foottit & Adler (2009) and updated using *Zoological Record*. Here updated using *Zoological Record*. Fossil taxa are represented in 40 families, 143 genera and 369 species (Data from Paleobiology Database on 26 August 2013 using "Taxon Count" search)—note that these data are incomplete, as1 genus do not include species with taxonomic classification data.

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