



## Papers and New Species of Minor Insect Orders Published in *Zootaxa*, 2001–2020

ERNEST C. BERNARD<sup>1</sup> & ANDREW E. WHITTINGTON<sup>2</sup>

<sup>1</sup>*Entomology & Plant Pathology, University of Tennessee, Knoxville, TN, USA 37996-4560.*

✉ [ebernard@utk.edu](mailto:ebernard@utk.edu); <https://orcid.org/0000-0003-3359-1516>

<sup>2</sup>*FlyEvidence, Conway House, 27 Stoke Gabriel Road, Galmpton, TQ5 0NQ, UK.*

✉ [awhittington@flyevidence.co.uk](mailto:awhittington@flyevidence.co.uk); <https://orcid.org/0000-0002-0465-1172>

A summary is presented of papers published on minor insect orders (MIO) in *Zootaxa*'s first 20 years, as well as the number of new species described therein. The MIO orders currently covered by the editors and summarized here include Archaeognatha (Microcoryphia), Dermaptera, Embioptera, Siphonaptera, Zoraptera and Zygentoma, as well as the hexapod classes Protura and Diplura. Both fossil and extant taxa of these groups are included in the MIO purview. The MIO editors also have frequently served as interim editors for groups temporarily without a subject-matter editor, such as Carabidae, Blattodea and Mantodea; as a backup editor for Mecoptera; and as ad-hoc editors for papers written by the editors of a different taxonomic group or for papers without a single-taxon focus. In the period 2001–2020, descriptions of 130 new species were published, compared with 816 species in all other journals. The greatest number of species were for Protura (49), while Zoraptera had the highest proportion of papers compared to all publications (50%).

**Key words:** Archaeognatha, Dermaptera, Diplura, Embioptera, Microcoryphia, new species, Protura, Siphonaptera, taxonomy, Zoraptera, Zygentoma

### Introduction

The founding of *Zootaxa* provided a major resource for the publication of taxonomy-oriented research papers. The editors associated with *Zootaxa* are experts in the orders or families they oversee, and thus have a deep interest in the science they practice. This involvement generally results in papers of high quality. However, not all classes, orders or families are large enough to warrant a separate editor. In the current arrangement, the following hexapod taxa are covered by the minor insect order (MIO) editors, with the approximate number of extant species in 2011, compiled by Zhang (2011): insect orders Dermaptera (1,978), Embioptera (464), Microcoryphia (=Archaeognatha) (513), Siphonaptera (2,075), Zoraptera (37), Zygentoma (561); and hexapod classes Diplura (800) and Protura (804). These orders and classes are included in the summary tables in this paper. Several other insect taxa previously included in the MIO editorial responsibilities (Blattodea, Mantodea, Mecoptera) have since been assigned to their own editors and are not included in the tallies. Also not included are papers for which MIO editors served on an interim basis for groups temporarily without a subject-matter editor, such as Carabidae, Blattodea and Mantodea, or as ad-hoc editors for papers written by the editors of a different taxonomic group. A small number of papers on distributions, hosts and methodology also are not included in this report. It should be noted that although recent molecular analyses have combined Isoptera with Blattodea (Inward *et al.* 2007) and Siphonaptera with Mecoptera (Tihelka *et al.* 2020), *Zootaxa* retains the longstanding names for convenience and ease of editing.

### Material and methods

Each higher-level taxon was searched in Web of Science by the terms (taxon × new spe\*). Numbers were cross-checked and corrected by examining individual years for each taxon where results did not match an earlier tally. Each possibly relevant abstract was checked for new taxa, and in the case of ambiguous publications without abstracts the paper was located online and searched. Tables of Contents for the first four years of *Zootaxa* were searched for papers that might have escaped earlier cataloging. New subspecies were not counted. Recent and fossil species numbers were combined. All of the eight MIOs, except Protura, have described fossil species, especially Archaeognatha, Dermaptera, Embioptera and Zoraptera. Author opinions as to the placement of stem taxa (e.g., “giant Mesozoic fleas”) in an MIO were uncritically accepted.

**TABLE 1.** Comparison of numbers of papers and new species (fossil and recent) described in MIO<sup>a</sup> *Zootaxa* papers and in MIO papers in all other journals (2005–2020).

Year	<i>Zootaxa</i>		Other journals	
	Papers with new species	Number of new species	Papers with new species	Number of new species
2020	3	4	24	52
2019	3	7	20	30
2018	4	7	22	45
2017	2	7	12	24
2016	10	19	20	43
2015	1	2	19	33
2014	4	8	20	52
2013	3	15	17	22
2012	3	7	26	34
2011	3	5	19	27
2010	7	28	21	34
2009	7	8	21	28
2008	3	3	16	18
2007	5	6	8	23
2006	1	2	18	47
2005	1	1	17	19
2004			20	45
2003	1	1	19	99
2002			26	58
2001			26	83
Totals	61	130	391	816

***Zootaxa* species number as percentage of 946: 14%**

<sup>a</sup> MIO = minor insect orders. Comparisons are for the same higher-level MIO taxa as assigned currently (2021) by *Zootaxa*.

### Editorial history and discussion

Although *Zootaxa* was established in 2001, no MIO papers were published in the journal until a 2003 Protura paper by Andrzej Szeptycki and Jose Camilo Bedano (Szeptycki & Bedano 2003). The first editor for minor orders was Andrew Whittington, followed by Shaun Winterton and Peter Kerr. Ernest Bernard became the MIO editor in 2009 and Andrew Whittington rejoined the *Zootaxa* editorial team in 2020. The mix of taxa assigned to the MIO orders has changed somewhat through the years, with submissions for several orders reaching critical mass and being spun off with their own editors. However, the eight core taxa listed in the tables have always been part of the MIO editorial responsibility.

Over the 2001–2020 span *Zootaxa* published 14% of all species descriptions in these eight higher-level taxa (Table 1). This percentage is skewed by the enormous output of Embioptera species by E.S. Ross from 2001 to 2007 (e.g., Ross 2003). Without those species included, *Zootaxa* published about 20% of new species descriptions from 2005 through 2020. While the number of species described per year has fluctuated significantly through the years, *Zootaxa* has been an especially important outlet for Diplura, Embioptera, Protura and Zoraptera taxonomists (Table 2). Siphonaptera is underrepresented in *Zootaxa* at 4% of the total but comprises about 8% of the fossil taxa described since 2001. The majority of Zoraptera species described in *Zootaxa* are fossil species. In addition to papers with new taxa, *Zootaxa* has also published about 30 MIO papers in this time span on revisions, reviews, methodology and checklists that do not contain new species-level taxa.

An examination of Tables 1 and 2 suggests that there was a “discovery lag” in the first few years of *Zootaxa*’s existence, where many taxonomists may not have been aware of its presence on the scene or were still comfortable with their more traditional outlets. It was not until 2009 that new species papers for three MIOs were published in the same year. New species of five orders were published in 2012 and new species of six in 2016. The opportunity to publish for free in *Zootaxa* while still receiving expert editorial and scientific review is undoubtedly an attractive feature; 3.8% of papers were published with open-access (publication fee paid), while 96.2% were published behind the paywall.

**TABLE 2.** Summary of new species numbers in each minor hexapod order or class, 2001–2020, for *Zootaxa* and other journals.

	New Archaeognatha		New Dermaptera		New Diplura		New Embioptera	
	<i>Zootaxa</i>	Other	<i>Zootaxa</i>	Other	<i>Zootaxa</i>	Other	<i>Zootaxa</i>	Other
2020	2	15	1	7		10	1	3
2019	2	10		2	1	1		
2018	1	15		13		3	1	
2017		11		3	1	2	3	3
2016		1	7	4	6	1	1	2
2015		5	1	3		1		2
2014		1	1	10			5	
2013		1		2				
2012		3		5	1			1
2011		6		6			3	2
2010		14		1	3	2		
2009		3		3		2	2	2
2008				2			1	1
2007		1	1			1		14
2006		1		7	1	5		23
2005		1		3		3		
2004				4		5		
2003				2		4		74
2002		2		9		10		1
2001		8				8		41
<b>Column Totals</b>	<b>5</b>	<b>98</b>	<b>11</b>	<b>86</b>	<b>13</b>	<b>58</b>	<b>17</b>	<b>169</b>
	<b>Archaeognatha: 103 spp., <i>Zootaxa</i>: 5%</b>		<b>Dermaptera: 97 spp. <i>Zootaxa</i>: 11%</b>		<b>Diplura: 71 spp. <i>Zootaxa</i>: 18%</b>		<b>Embioptera: 186 spp. <i>Zootaxa</i>: 10%</b>	

**TABLE 2.** (Continued)

	New Protura		New Siphonaptera		New Zoraptera		New Zygentoma	
	<i>Zootaxa</i>	Other	<i>Zootaxa</i>	Other	<i>Zootaxa</i>	Other	<i>Zootaxa</i>	Other
2020				15				2
2019		3	2	5	2	1		8
2018	1			5	2	4	2	5
2017	1	1		4	2			
2016	1	2		15	1		3	18
2015				14	1			8
2014		5	2	24				12
2013	3	4		9	3		9	6
2012	3	8	1	9	1		1	8
2011	2	2		5				6
2010	25	3		10				4
2009	4	1	2	11				6
2008	2	9		1		2		3
2007	5	3		3				1
2006	1	1		6		1		3
2005		1	1	7				4
2004		8		16				12
2003	1	1		16				2
2002		1		7		4		24

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TABLE 2. (Continued)

	New Protura		New Siphonaptera		New Zoraptera		New Zygentoma	
	Zootaxa	Other	Zootaxa	Other	Zootaxa	Other	Zootaxa	Other
2001		6		13				7
<b>Column Totals</b>	<b>49</b>	<b>59</b>	<b>8</b>	<b>195</b>	<b>12</b>	<b>12</b>	<b>15</b>	<b>139</b>
	<b>Protura: 108 spp.</b>		<b>Siphonaptera: 203 spp.</b>		<b>Zoraptera: 24 spp.</b>		<b>Zygentoma: 154 spp.</b>	
	<i>Zootaxa: 45%</i>		<i>Zootaxa: 4%</i>		<i>Zootaxa: 50%</i>		<i>Zootaxa: 10%</i>	

It is not reasonable to expect that any editor will be wholly expert on such a disparate range of hexapod taxa, and therefore the minor insect order editors have had somewhat different challenges than those of many other taxa. With the exception of Siphonaptera and Dermaptera, there are few specialists worldwide on whom to call for reviews (Table 3). Retirement or death can create a practical problem in finding knowledgeable reviewers. For instance, two experts on Diplura passed away in the past seven years, nearly halving the world's number of diplurologists. The continuing challenge is to maintain a high level of scholarship with a limited pool of reviewers. Fortunately, most reviewers have been willing or even eager to receive future manuscripts, for which the MIO editors are most humbly grateful.

TABLE 3. Subjective estimate of current numbers of specialists working actively on minor hexapod orders and classes.

Hexapod higher taxon	Specialists
Protura	5
Diplura	3
Zygentoma	5
Archaeognatha	3
Dermaptera	>8
Embioptera	4
Zoraptera	3
Siphonaptera	>10

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### Literature Cited

- Inward, D., Beccaloni, G. & Eggleton, P. (2007) Death of an order: a comprehensive molecular phylogenetic study confirms that termites are eusocial cockroaches. *Biology Letters*, 3, 331–335.  
<https://doi.org/10.1098/rsbl.2007.0102>
- Ross, E.S. (2003) EMBIA. Contributions to the biosystematics of the insect order Embiidina. Part 5. A review of the family Anisembiidae with descriptions of new taxa. *Occasional Papers, California Academy of Sciences*, 154, 1–123.
- Tihelka, E., Giacomelli, M., Huang, D.-Y., Pisani, D., Donoghue, P.C.J. & Cai, C.-Y. (2020) Fleas are parasitic scorpionflies. *Palaeoentomology*, 003 (6), 641–653.  
<https://doi.org/10.11646/palaeoentomology.3.6.16>
- Szeptycki, A. & Bedano, J.C. (2003) *Brasilidia auleta* sp. n., a new species from Argentina (Protura: Acerentomidae s.l.). *Zootaxa*, 336, 1–10.  
<https://doi.org/10.11646/zootaxa.336.1.1>
- Zhang, Z.-Q. (Ed.) (2011) Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness. *Zootaxa*, 3148, 1–237.  
<https://doi.org/10.11646/zootaxa.3148.1>