

Opinion paper

Linnaeus builds a search engine

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Abstract. Botanists and zoologists in the 18th Century faced an explosion of species. What they needed was the equivalent of a search engine, and Carl Linnaeus rose to the challenge. He invented a cataloguing system that made it possible to find out whether a specimen belonged to a known species, and if it did, where more information could be found. His system was more powerful than an index, which requires knowing a name to begin with, while a user of his system could begin with an unnamed specimen. Linnaeus insisted that every group in his new ranks, order and class, must have a one-word name, which was a deliberate and powerful innovation. In his *Systema Naturae* those names were printed as running heads. This layout enabled a user to start with the higher categories and navigate downwards. Although he is often celebrated for his two-word format for the names of species, his attention to the names of groups above the rank of genus is often overlooked.

Keywords. Linnaeus, history of taxonomy, nomenclature, higher taxa, higher groups.

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Introduction

During my career as an historian of science, when I taught a survey course for undergraduates, I found it hard to explain the importance of Linnaeus. His belief in divine creation made him look like an enemy of evolution, stuck on the wrong side of history. Many writers portray him negatively, his only claim to fame seeming to be the invention of the two-word system we still use for naming species. Yet, Linnaeus was certainly a genius, an innovator of exactly the kind that was badly needed in an era when the enormous extent of the diversity of life was being discovered. His great contribution to biological science was the management of a large and increasing quantity of information (Müller-Wille 2017). His system enabled naturalists in different countries to keep track of one another's observations (Dietz 2012). Years ago, I tried to convey to my students how useful his *Systema Naturae* was by comparing it to a telephone book. If I were still teaching, I would ask my students, how could you find information online, if you had no search engine? This analogy is much more appropriate than my old one, for a phone book is useless unless you know the surname of the person you want to call. My computer's search engine can supply information about almost anything for which I have a name. Far more wonderful are the apps that can give me the name of a specimen just from an image. Linnaeus's system did that same impressive trick. Users of his *Systema Naturae* could begin with a plant or animal in front of them and

then, by working through his ranked groups, arrive at its name. Furthermore, his system could determine whether this species had ever been described, because if it wasn't in his latest edition, it must be new to science.

Linnaeus's genius: named ranks and named groups

Linnaeus's comprehensive catalogue of living things, *Systema Naturae*, issued over the years in ever-larger editions, contained the names of all known species. His techniques of information management included his invention of two categories ranked above genus, which he named order and class. The works of previous naturalists sometimes included higher groups, but often implicitly, as divisions in their classifications or chapters in their books; sometimes a group was labelled with a word like *class*, but a division might be marked with a number, a description, or no label at all. In contrast, Linnaeus used his named ranks consistently and always gave a name to each group. He explicitly declared that one-word names for every group were necessary and that choosing convenient words was important. Early in his career, he published *Fundamenta Botanica* (Linnaeus 1736), a list of the rules he said everyone should obey, ignoring the fact that no one had given him authority. There he said (Linnaeus 1736: 26) that the names given to orders and classes must consist of only a single word: "*Nomina Classium & ordinum unico (215) vocabulo constabunt.*" (The number 215 refers to another of his aphorisms, in which he stated that the name of a genus must be only one word.) Having devoted considerable attention to how the name of a genus should be chosen, he then declared that equal care must be given to the choice of name for orders and classes. "*Nomina classium (204) & ordinum cum genericis par est ratio.*" Stephen Freer (2003: 215) translated this as "The same argument that concerns generic names applies equally to those of classes and orders." *Par est ratio* could also be translated as simply "the rule is the same." In Linnaeus's later edition of those aphorisms, he added his reason for that rule: "*quum nomina sint onera artis inevitabilia / quum parata & prompta omni momento erint nomina*" (Linnaeus 1751: 200). Freer (2003: 216) translated this as "because names are the unavoidable burdens of technique / because names must be ready and prompt." The Latin word *artis* has numerous meanings, some of them like the several meanings of *art* in English, ranging from knowledge or science to skill or practice; "technique" is certainly a reasonable choice. Linnaeus used the same word when addressing the basic question of the meaning of groups: species and genera are the product of nature, while class and order are produced by a combination of nature and art.

Taxon names as running heads

In the two-volume 10th edition of *Systema Naturae*, we can see displayed on every page the effectiveness of Linnaeus's invention, but we must first set aside our fondness for words that have stood the test of time, like Mammalia and Hymenoptera, and our discomfort with words that were long ago discarded, like Vermes and Tetrandia. Both volumes begin with a list of taxa at the class level, each given a one-word name and briefly characterized. Users must decide which description their specimen seems to fit, and then they can quickly turn to the section devoted to that class. They can do this easily because each page begins with what printers call a running head. Flipping pages, they will stop when that class name first appears at the top, and there they will find a list of its orders, each one briefly characterized, each with a one-word proper name. Again, they must choose among these orders which description best agrees with the organism at hand. All the pages listing species have a running head containing the names of the relevant class and order (in this edition, those two words are followed by a genus name). For example, in volume 1, on page 603 we see across the top "INSECTA. DIPTERA." (Fig. 1). In volume 2, on page 856 we see "DIANDRIA. TRIGYNIA." (Fig. 2). In both cases, the first word is the name of a group of class rank, the second is the name of a group of ordinal rank. The order Diptera is defined at the start of the Insecta section (Linnaeus 1758: 341), and the order Trigynia is defined at the start of the Diandria section (Linnaeus 1759: 846).

It mattered not at all that Linnaeus's system of counting the stamens and pistils in a flower was artificial, as he well knew and often said, nor did it matter that counting wings was a problematic way of dividing up the insects, as he also knew (Winsor 1976). These names functioned as guideposts for users of his catalogue¹.

The disadvantage of an index

Linnaeus's undisguised self-promotion offended some of his contemporaries, who felt that in science, no one should presume to dictate to others. Charles Bonnet scoffed that this so-called System of Nature resembles an index to a large book, but one compiled by a schoolboy who hasn't read much more than the book's title². Bonnet's insult reminds us to consider the index, which was, like classification, another powerful piece of pre-computer information technology. The practice of providing access to long texts by listing significant words alphabetically has served users of books for many centuries, but an insightful historian has pointed out that causation can work in two directions. In the early years of printed books, users made their own indexes; demand from such readers drove publishers to start printing numbers on their books' pages (Duncan 2021). Naturalists before Linnaeus were already using indexes, and still today an index is an important tool in taxonomic publications. Most editions of Linnaeus's *Systema Naturae* did have an index, sometimes more than one, although the 10th edition of 1758–59 did not. Of course, a list of names, supplying page numbers where information will be found, cannot help someone who doesn't know the name of their specimen. The genius of a Linnaean catalogue was that it could help those users.

Speculation on the psychology of names: reification

Recently, while investigating Charles Darwin's early thoughts (Winsor 2023), I began to suspect that the practice of giving names to every taxon had encouraged naturalists to feel that they were discovering real entities. Psychologists call this process reification, from the Latin word for thing: *res, rei*. Historians Staffan Müller-Wille and Isabelle Charmantier have suggested that in the course of Linnaeus's life, the genus may have been to him, at first, merely an element in his paper-based information technology, having little more meaning than a label on a folder, and that his experience using this category “seems to have instilled the belief in Linnaeus that genera were ‘real’ entities...” (Müller-Wille & Charmantier 2012). This intriguing suggestion calls for careful investigation, because throughout his career Linnaeus distinguished natural from artificial groups, but I agree that something similar may have gone on with respect to the taxa he named within his higher ranks, class and order (although certainly not with respect to the ranks themselves). Leaving this speculation aside, the development of Linnaeus's own thoughts about the taxa he named has little or no relevance to the way those names functioned for users of his catalogue. Certainly, his insistence on simple, single-word names for classes and orders, not just genera, made his catalogues searchable.

¹ The name Diptera is unique, so we think of it as a taxon, but Trigynia is not unique. The names of Linnaeus's orders for plants in his artificial sexual system actually required two words: Diandria Trigynia, Triandria Trigynia, or Pentandria Trigynia. I hope a scholar of 18th century natural history, which I am not, will fill out this picture. Linnaeus published in 1738 his friend Peter Artedi's *Ichthyologia sive opera omnia de piscibus*, which has a running head. I thank László Krécsák for this information.

² “Que devons-nous donc penser de ces *Nomenclatures* fastueuses, qu'on ose nous donner pour le *Système de la Nature*? Je crois voir un Ecolier, qui entreprend de faire l'Index d'un gros in folio, dont il n'a lû que le titre & les premières pages. Et même ces premières pages du Livre de la Nature, les possédons-nous?” (Bonnet 1764: 201). Bonnet, now remembered for his promotion of the great chain of being, had made significant observations on parthenogenesis of aphids, inspired by Réaumur (Terrall 2014). In 1976, I quoted (Winsor 1976: 61) a contemporary English translation (Bonnet 1766) which I now see was incorrect. Bonnet's “ces *Nomenclatures* fastueuses” does not mean “these boasting nomenclators” (meaning Linnaeus and his ilk); it means “these lavish nomenclatures” (meaning systems of names). If Bonnet had meant “nomenclators” he would have written “nomenclateurs”. The adjective “fastueux” was used for a feast (“lavish”) or a book (“sumptuous”) rather than a person.

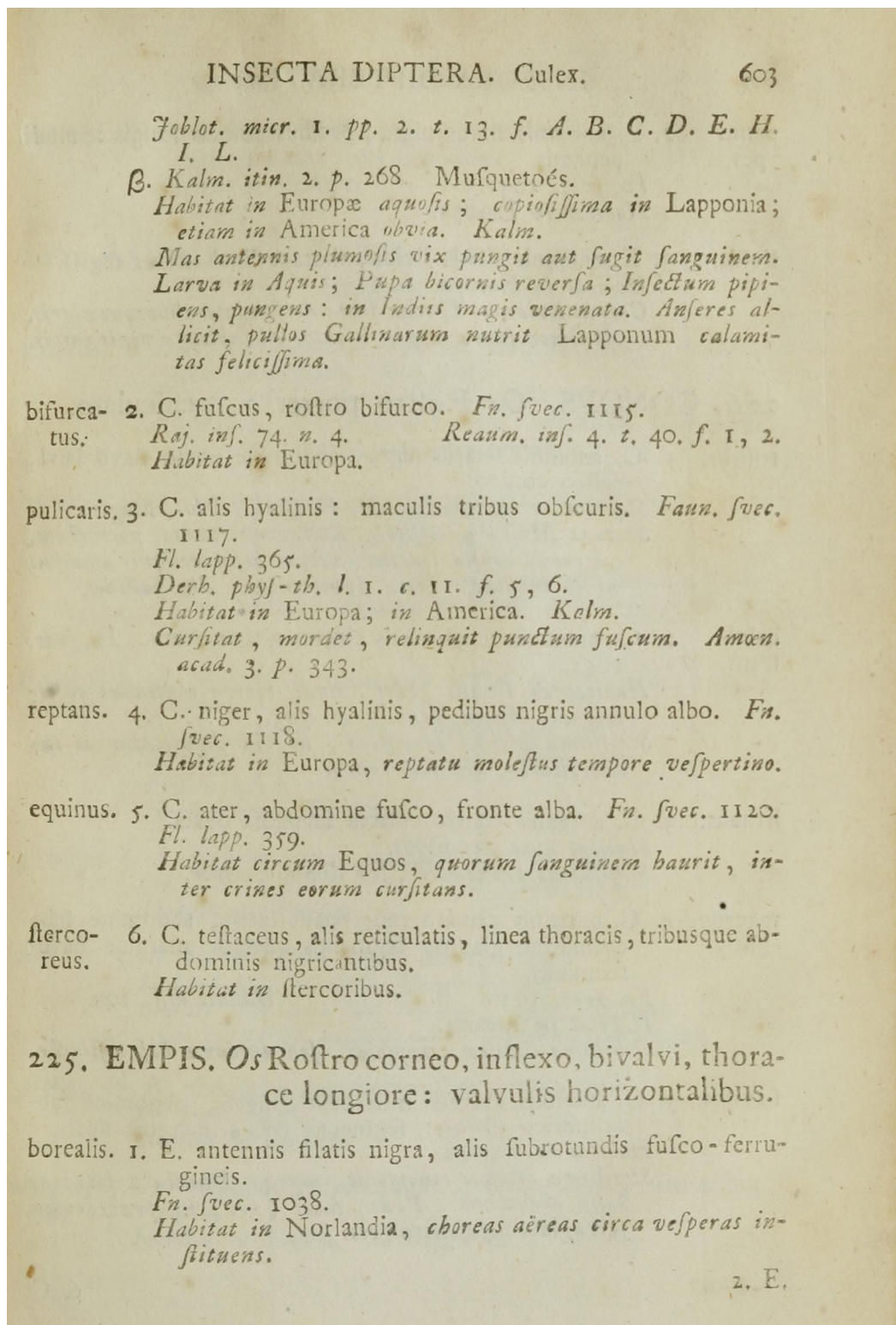


Fig. 1. Species of mosquito, from Carl Linnaeus, *Systema Naturae* (Linnaeus 1758: 603). The running head consists of the class name, Insecta, followed by the order, Diptera. The trivial epithets are at the far left. He cites three sources for *Culex bifurcatus*: his own *Fauna Svecica* of 1746 (in which each species is numbered), John Ray's *Historia Insectorum* of 1714, and Réaumur's *Mémoires pour servir à l'Histoire des Insectes*, vol. 4 of 1738.

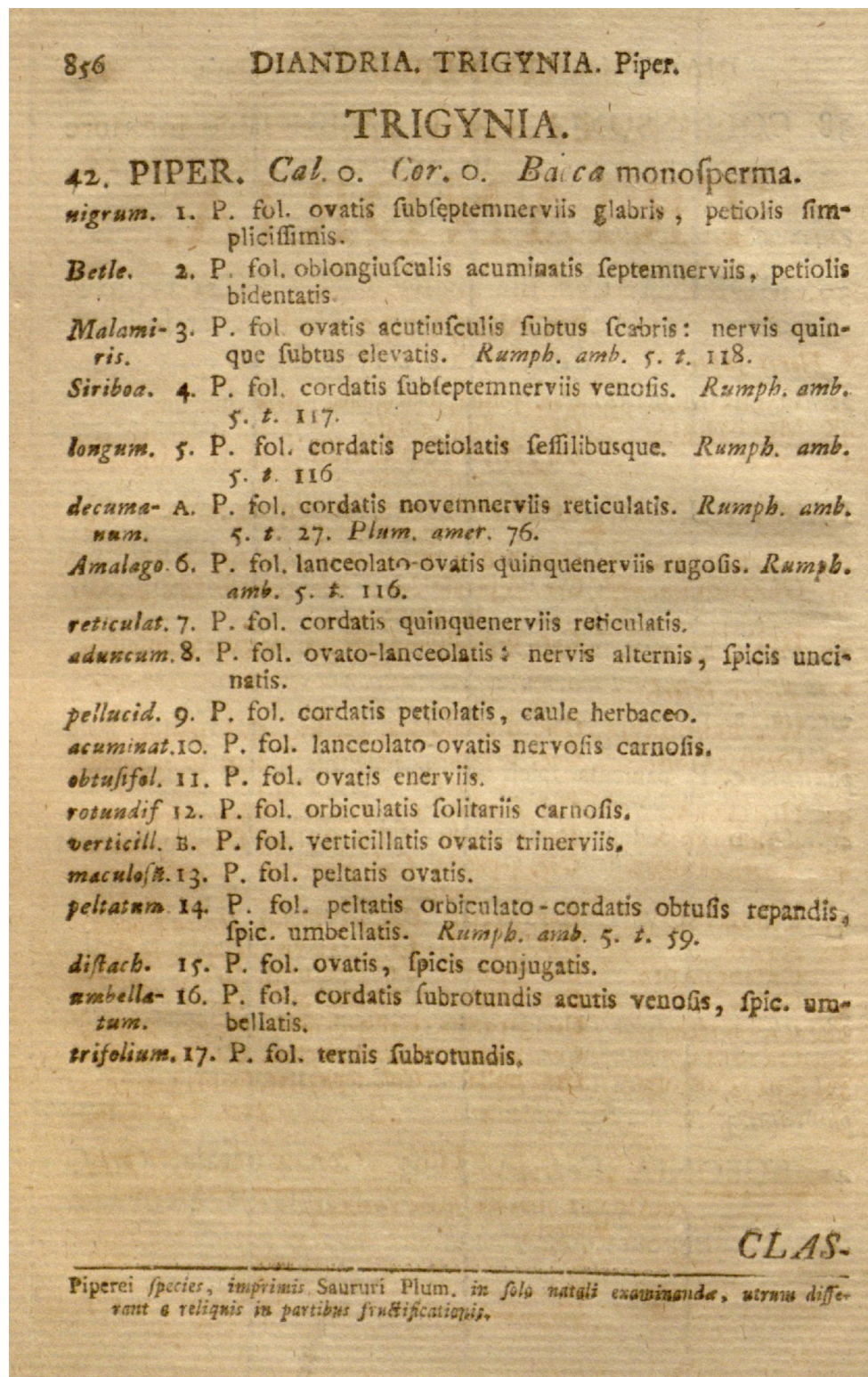


Fig. 2. Species of pepper, from Carl Linnaeus, *Systema Naturae* (Linnaeus 1759: 856). The running head consists of the class name, Diandria, followed by the order, Trigynia. The trivial epithets are at the far left. After “P.” for “Piper” comes “fol.” for “foliis” because he thought all the species in this genus could be distinguished by the shape of their leaves. He cites only two sources: G.E. Rumphius’s *Herbarium Amboinense* of 1741–50 and Charles Plumier’s *Nova Plantarum Americanarum* of 1693.

References

- Bonnet C. 1764. *Contemplation de la Nature*. 2 vols. M.-M. Rey, Amsterdam.
- Bonnet C. 1766. *Contemplation of Nature*. 2 vols. T. Longman, London.
- Dietz B. 2012. Contribution and co-production: The collaborative culture of Linnaean botany. *Annals of Science* 69 (4): 551–569. <https://doi.org/10.1080/00033790.2012.680982>
- Duncan D. 2021. *Index, A History of the*. W. W. Norton & Company, New-York.
- Freer S. 2003. Preface. In: *Linnaeus' Philosophia Botanica*: ix-xiii. Oxford University Press, Oxford. <https://doi.org/10.1093/oso/9780198501220.002.0003>
- Linnaeus C. 1736. *Fundamenta Botanica*. Salomonem Schouten, Amsterdam.
- Linnaeus C. 1751. *Philosophia Botanica*. Translated by S. Freer, 2003. Oxford University Press, Oxford. <https://doi.org/10.1093/oso/9780198501220.001.0001>
- Linnaeus C. 1758. *Systema Naturae*. 10th edition. Vol. 1. Laurentii Salvii, Stockholm. <https://doi.org/10.5962/bhl.title.542>
- Linnaeus C. 1759. *Systema Naturae*. 10th edition. Vol. 2. Laurentii Salvii, Stockholm. <https://doi.org/10.5962/bhl.title.542>
- Müller-Wille S. 2017. Names and numbers: “Data” in classical natural history, 1758-1859. *Osiris* 32 (1): 109–128. <https://doi.org/10.1086/693560>
- Müller-Wille S. & Charmantier I. 2012. Natural history and information overload: The case of Linnaeus. *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* 43 (1): 4–15. <https://doi.org/10.1016/j.shpsc.2011.10.021>
- Terrall M. 2014. *Catching Nature in the Act: Réaumur and the Practice of Natural History in the Eighteenth Century*. University of Chicago Press, Chicago. <https://doi.org/10.7208/chicago/9780226088747.001.0001>
- Winsor M.P. 1976. The development of Linnaean insect classification. *Taxon* 25 (1): 57–67. <https://doi.org/10.2307/1220406>
- Winsor M.P. 2023. Darwin's dark matter: Utter extinction. *Annals of Science* 80 (4): 357–389. <https://doi.org/10.1080/00033790.2023.2194889>

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