



A (very) brief vademecum on biological nomenclature

Luigi Naselli-Flores · Koen Martens ·
Sidinei M. Thomaz · Diego Fontaneto

Published online: 11 July 2022

© The Author(s), under exclusive licence to Springer Nature Switzerland AG 2022

This editorial is aimed at explaining why the editors of *Hydrobiologia* are so concerned with biological nomenclature and why we ask our authors the utmost precision when referring to species in their papers. In particular, the Instructions for Authors of the journal specify that “When a species name is used for the first time in an article, it should be stated in full, and the name of its describer should also be given” (https://www.springer.com/journal/10750/submission-guide-lines?IFA#Instructions%20for%20Authors_Scientific%20style). In the next lines, we want to show that this is not just an old fashion formalism, but a necessity to correctly and univocally identify the biological

subjects that are the basis of the research published in this journal. Moreover, *Hydrobiologia* is a generalist journal giving voice to research embedded in a wide ecological and evolutionary context, carried out in any kind of aquatic ecosystem, and considering all their biological entities from small viruses onwards to large whales! Thus, the work of a, for example, fish biologist, should be readable for a botanist and vice versa. This achievement can be reached by avoiding as much as possible the jargon typical of each discipline (as the so called “common names” can be considered) and allowing the unequivocal identification of the targeted biological entities.

Carl Linnaeus is one of the most famous scientists of all time. He had the merit to systematise biological classification through establishing the practice of binomial nomenclature which is widely used nowadays. To fully appreciate the importance of this invention, one must consider that, before the so-called “Linnean revolution”, taxonomists were in trouble every time they had to name a species, since this required a long description of the basic characteristics of the organism itself. These characteristics were often subjectively selected and the same biological entity could have different “names” depending on what was considered “important” for the taxonomist who was naming it. *Geranium supinum*, *rotundo Batrachiordes crasso tomentosum folio, radice rufescente, longius radicata*—according to Paolo Boccone, an Italian botanist active at the end of the XVII century, was a “Geranium growing little above

L. Naselli-Flores (✉)

Department of Biological, Chemical and Pharmaceutical Sciences and Technologies (STEBICEF), University of Palermo, Palermo, Italy
e-mail: luigi.naselli@unipa.it

K. Martens

OD Nature, Freshwater Biology, Royal Belgian Institute of Natural Sciences, Brussels, Belgium
e-mail: KMartens@naturalsciences.be

S. M. Thomaz

DBI/PEA/Nupélia, Universidade Estadual de Maringá, Maringá, PR, Brazil
e-mail: smthomaz@nupelia.uem.br

D. Fontaneto

Water Research Institute (IRSA), National Research Council of Italy (CNR), Verbania Pallanza, Italy
e-mail: diego.fontaneto@cnr.it

the ground, with rounded leaves similar to that of *Ranunculus batrachioides* but hairy and succulent, and with a reddish and deeply embedded root". Even though we can suppose that this plant was a member of the genus *Geranium*, it is not easy to identify what kind of species it could be, also because "*Ranunculus batrachioides*" was just the summary of a similarly "extended name" that Paolo Boccone had given to a different plant.

The monumental work of Linnaeus was aimed at univocally and universally naming all the then known botanical and zoological species, **avoiding duplicates and overlaps**. The two-volume *Species Plantarum*, published in 1753, is thus considered the starting point of the botanical nomenclature, whereas the 10th edition of his *Systema Naturae* published in 1758 marks the official onset of zoological nomenclature. The immediate and wide adoption of the Linnean binomial nomenclature probably represented the end of a nightmare for all those botanists and zoologists who, after Linnaeus, dedicated their career to cataloguing the biological entities that populate our biosphere. The work of completing and modifying the immense catalogue of life is still in progress and, as soon as the number of species increased (along with the degree of specialization needed to correctly describe them), taxonomists felt the necessity to establish rules addressed at the correct naming of species and at minimizing the risk of duplicates. Rules and recommendations that govern biological taxonomic nomenclature can differ for botanical, zoological or prokaryotic entities and are collected in three main rulebooks, named "Codes":

- The International Code of Nomenclature for algae, fungi, and plants—**ICNAFP** (<https://www.iapt-taxon.org/nomen/main.php>)
- The International Code of Zoological Nomenclature—**ICZN** (<https://www.iczn.org/the-code/the-code-online/>)
- The International Code of Nomenclature of Prokaryotes—**ICNP** (<https://www.the-icsp.org/bacterial-code>)

All these Codes recommend to accompany species names with that of their authors, at least when species names are cited for the first time in a scientific paper. In particular, the **ICNAFP**, among "Rules and Recommendations" (Chapter VI, Sect. 1 "Author

citations", Article 46.1), states: *In publications, particularly those dealing with taxonomy and nomenclature, it may be desirable, even when no bibliographic reference to the protologue is made, to cite the author(s) of the name concerned.* The **ICZN** is even more explicit and the "Recommendation 51A. Citation of author and date" states that *The original author and date of a name should be cited at least once in each work dealing with the taxon denoted by that name.* The **ICNP** does not contain specific recommendations about the name of species' describer, but by reading the Code it appears that this is also considered important for the univocal characterisation of species.

In fact, the name of the describer that follows the binomen (genus name + species epithet) not only offers information about who described that species (and eventually when) but in some way summarises the "history" of the classification work that was necessary to describe that species.

In addition, it is important to consider that genus names are unique only within a Nomenclature Code. Actually, it is unlikely that an expert botanist is also an expert zoologist, and also among zoologists it is unlikely that an arachnologist would know the taxonomy of rotifers just as well (by the way, Bdelloidea is a superfamily of mites as well as a class of rotifers). Therefore, it may happen that organisms belonging to different kingdoms share the same genus name and even the same binomen. These names are called "hemihomonyms" and in spite of their validity they can be misleading. Several hundreds of genus name duplication occur, as well as many binomial names, mainly between zoology and botany. A few examples:

- *Asterina gibbosa* (Pennant, 1777) is a sea star, but *Asterina gibbosa* Gaillard is a fungus.
- *Centropogon australis* (White, 1790) is a fish, but *Centropogon australis* Gleason is a plant of the family Campanulaceae.
- *Cuspidaria cuspidata* (Olivi, 1792) is a bivalve mollusk, but *Cuspidaria cuspidata* (M. Bieb.) Takht. is a plant of the family Brassicaceae.
- *Gaussia princeps* (T. Scott, 1894) is a copepod, but *Gaussia princeps* H. Wendl. is a palm tree.
- *Ficus variegata* Röding, 1798 and *Tritonia pallida* Stimpson, 1855 are marine gastropods, but *Ficus variegata* Blume and *Tritonia pallida* Ker Gawl.

are respectively a fig tree and a plant of the family Iridaceae.

- *Orestias elegans* Garman, 1895 is a fish, but *Orestias elegans* Ridl. is a plant of the family Orchidaceae.
- *Amaryllis* is both a plant genus and also a genus of crustacean amphipods.
- *Calopteryx* is both a genus of damselflies and of plants in the family Ericaceae.
- *Coris* is a fish genus [e.g., *Coris julis* (Linnaeus, 1758), the Mediterranean rainbow wrasse] but also a plant genus of the family Primulaceae (e.g., *Coris monspeliensis* L.).

We hope that it is evident, analysing the (not exhaustive) list of species and genera reported above, that the only way to distinguish those species is to refer to the name of the describer.

Moreover, it is also evident that the way to refer to the name of the describer is different when considering “plants” and “animals”. The most striking differences are in the rules adopted in the appropriate Nomenclature Code. In particular, the name of the describer, according to the **ICNAFP**, can be abbreviated and the year of publication is not required. Conversely, according to the **ICZN** (and to the **ICNP**), the name of the describer must not be abbreviated and adding the year of publication is warmly recommended.

The use of parentheses in the different Nomenclature Codes is a bit more complex, since rules for this are also slightly different for animals, plants (including algae, fungi and cyanobacteria) and bacteria.

With regard to zoological species, and according to the **ICZN**, when (and only when) a species underwent taxonomic revision and it was transferred to another genus, the name of the original describer has to be put in parentheses. E.g., *Anguilla anguilla* (Linnaeus, 1758): Linnaeus described this species as *Muraena anguilla* and later on the species was moved to the genus *Anguilla*. Conversely, in the absence of taxonomic revision, the name of the describer never goes in parentheses, as in the case of, e.g., *Daphnia magna* Straus, 1820.

With regard to botanical species (which can also include cyanobacteria), the nomenclatorial rules are

listed in the **ICNAFP**. According to this Code, the name of the describer follows the name of the species and the year of publication is not needed. E.g., *Fagus sylvatica* Linnaeus or *Fagus sylvatica* L. When a species underwent taxonomic revision and it was moved to another genus, the name of the original describer must be put in parentheses and the name of the author(s) of the last revision should be added. E.g., *Persicaria amphibia* (Linnaeus) Delarbre. In this case, Linnaeus described this species as *Polygonum amphibium* and later on the species was moved to the genus *Persicaria*.

With regard to prokaryotic species, the nomenclatorial rules are listed in the **ICNP** and according to this Code, it is “advisable” to report the name of the describer and the year of first publication. E.g., *Staphylococcus aureus* Rosenbach, 1884. When a species underwent taxonomic revision and was moved to another genus, the name of the original describer should be put in parentheses and the name of the author(s) of the last revision (and the year of publication) has to be added. E.g., *Staphylococcus epidermis* (Winslow & Winslow, 1908) Evans, 1916.

Last but not least, besides the specialised literature, the internet (e.g., <https://www.catalogueoflife.org/>; <https://www.marinespecies.org/>; <https://www.gbif.org/species/>; <https://www.algaebase.org/>; <http://fada.biodiversity.be/>) represents a quite useful resource to find the name of the describer of the vast majority of species, and to check for their correctness.

We hope that this brief review and these tips can help our authors and readers to understand why it is relevant to add names of describers (and date of publication, if required by the appropriate Code) to the species names themselves, at least the first time that they are used in a paper, or in a table with a species list.

Publisher’s Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.