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## A critical review of the current taxonomy of the genus *Daphnia* O. F. Müller, 1785 (Anomopoda, Cladocera)

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### Abstract

The genus *Daphnia* O. F. Müller, 1785 (Anomopoda, Cladocera) has become a model genus for ecological, toxicological, and evolutionary studies. At the same time, *Daphnia* is a well-known example of a genus with a confused taxonomy. This review aims to identify the main sources of confusion (natural and human-caused) for the current taxonomy of *Daphnia*. A complete check-list of all species-group names of *Daphnia* was built using the available literature sources. I graphed the total number of taxa and number of valid taxa described during each year, and estimated a curve of accumulation of formal taxa from year to year. Four main periods in the history of *Daphnia* taxonomy were recognized, with the latest decades showing an increased rate of valid taxa to more than 50%. Overall, only 24 % of 361 known taxa of species rank are valid. A failure to find real, sometimes fine-scale diagnostic characters, led to a tradition of pseudo-taxonomy based mainly on the body shape and other phenotypically plastic characters, e.g. associated with defensive structures. I recommend revising the suite of taxonomically informative characters by emphasizing the anatomical details of males and thoracic limbs of both males and females. Such a revision of global scale, should be conducted in close coordination with phylogenetic studies. But this revision is impossible without accurate redescriptions of all previously described taxa, and a continuous step-by-step resolving of taxonomic problems in each species group.

**Key words:** Cladocera, Daphniidae, *Daphnia*, taxonomy

### Introduction

Biological systematics is the study of biological diversity and its origins (SSB 2014). It is one of most important directions of contemporary biology. The important part of the former is taxonomy, “the science of defining groups of biological organisms on the basis of shared characteristics and giving names to those groups” (Wikipedia 2014). Taxonomy gives us numerous new taxa of different rank, contributing to the understanding and comparative framework of biodiversity on the Earth, which is insufficiently explored at present. A progress in taxonomy is impossible without following the rule of the International Zoological Nomenclature (see ICZN 2000), which is aimed to provide the maximum universality and continuity in the naming of all animals. Ignorance of the principles of Zoological Nomenclature could result in difficulties in taxonomy of several animal groups, and the genus *Daphnia* O.F. Müller, 1785 (Anomopoda, Cladocera) is an example of such a situation.

*Daphnia* has become a model object for ecological, toxicological, and evolutionary studies (Peters & De Bernardi 1987; Lampert 2011; Smirnov 2014). At the same time, *Daphnia* is a well-known example of a genus with confused taxonomy (Hebert 1977; Korovchinsky 1996; Benzie 2005). In this critical review, I am going to analyze the recent state of the taxonomy of the genus *Daphnia* from the position of a “traditional” taxonomist. Some sentences below seem to be a repetition of the paragraphs of the International Code of Zoological Nomenclature (ICZN 2000), obvious for taxonomists. I will try (1) to discuss some existing shortcomings in the taxonomy of *Daphnia* with respect to the ICZN (2000) and (2) to emphasize the current pseudo-taxonomy that arose from a confusing foundation of phenotypically plastic traits. This conclusion may be unexpected to many *Daphnia* investigators who are not dealing with taxonomy.

Of course, *Daphnia* is a large, diverse and taxonomically difficult group (Adamowicz *et al.* 2009). But there are other cladoceran groups, which are also difficult and even more diverse. For example, the genus *Alona* Baird,

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