

Pitfalls of describing new taxa in the age of on-line publications and how to get out of there

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Summary

Over the past three decades, scientific articles became accessed predominantly via the Internet as electronic copies. This promoted the wide usage of electronic-only journals, which started to be used by some researchers for publishing new taxonomic names and nomenclatural acts without registration in ZooBank as required by the Amendment of International Code of Zoological Nomenclature for electronic publications since 2012, resulting in unavailability of such names and acts. Here we describe this situation, explain the current requirements of the ICZN and the way how to validate the previously unsuccessful nomenclatural changes.

The following taxa of Trypanosomatidae (Euglenozoa: Kinetoplastea), originally published in on-line journals as unavailable due to lack of ZooBank registration, are validated here: *Novymonas* Kostygov et Yurchenko, gen. nov., *Novymonas esmeraldas* Votýpka, Kostygov, Maslov et Lukeš, sp. nov., *Phytomonas borealis* Ganyukova, Frolov et Kostygov sp. nov., *Phytomonas lipae* Frolov et Kostygov sp. nov., *Jaenimonas* Votýpka et Hamilton, gen. nov., and *Jaenimonas drosophilae* Votýpka et Hamilton, sp. nov. Subspecies *Crithidia luciliae thermophila* Roitman, Mundim, de Azevedo et Kitajima, 1977, stat. nov., is raised to species status: *C. thermophila* Roitman, Mundim, de Azevedo et Kitajima, 1977. The following new subjective synonyms are proposed: *Crithidia thermophila* = *C. confusa* Maslov et Lukeš, 2009, syn. nov. and *Crithidia fasciculata* Léger, 1902 = *Crithidia luciliae* (Strickland, 1911), syn. nov.

Key words: Availability, nomenclature, Trypanosomatidae

Introduction

According to the basic principles of zoological nomenclature established by Linnaeus and later developed and finally codified in the form of the International Code of Zoological Nomenclature (ICZN), any new name or nomenclatural act must be properly published in order to become available (ICZN, 1999). Until recently, publication almost exclusively implied printing multiple identical copies on paper by one of conventional methods. However, in the XXI century, electronic scientific journals became quite common and many of them earned high reputation. Therefore the International Commission on Zoological Nomenclature issued an amendment of the current Code expanding the valid methods of publication and allowed edition by a method ensuring “widely accessible electronic copies with fixed content and layout” (ICZN, 2012a). Nevertheless, the Commission was not much confident in the durability and invariability of such content, and, for that reason, introduced a new Article 8.5, requiring registration in the Official Register of Zoological Nomenclature (ZooBank) with “evidence in the work itself that such registration has occurred” (ICZN, 2012a). Despite this amendment was published simultaneously in two leading taxonomic journals (ICZN, 2012a, b), it was unnoticed by many researchers. Moreover, over the past three decades articles in traditional printed journals became accessed predominantly via the Internet as electronic copies, therefore the transition to open access electronic-only journals became virtually seamless. All the above resulted in that some researchers, including the co-authors of this work, started publishing new nomenclatural acts in electronic journals being unaware of the invalidity of such acts according to the ICZN. This was further conditioned by the unawareness of reviewers and journal editors.

In this work, we want to attract the attention of the protistological community to this issue and validate some names and nomenclatural acts, published with the ignorance of the above rules. Here we summarize and discuss the requirements of the ICZN to be met for the availability of names and acts proposed after 2012 (ICZN, 1999, 2012a). In addition, we validate some taxonomic names and nomenclatural acts, which have been unavailable because of the above-mentioned mistakes, thereby providing a model of how this can be done.

Overview of availability criteria

In this section, we outline the current requirements of the ICZN. For convenience, we refer to the corresponding articles in its fourth edition (ICZN, 1999) or, in the case of the articles 8, 9, 10, 21 and 78, to their versions amended in 2012 (ICZN, 2012a).

In order to be considered as published, works with new names and nomenclatural acts must be publicly obtainable after their issue either as electronic documents with fixed content and layout (e.g. PDF/A) or multiple copies printed on paper using ink or toner (articles 8.1.3 and 8.4.1). In the case of electronic publication, a work must contain information about the date when it was issued (article 8.5.2), be registered in the Official Register of Zoological Nomenclature – ZooBank (<http://zoobank.org/>) (article 78.2.4), and contain a statement about this registration (articles 8.5.3). This can be done either by mentioning the date of this registration or by providing its unique LSID (Life Science Identifier) associated with the corresponding record in the Zoobank database (preferable). In addition to registering publications, authors are encouraged to do the same for the names and nomenclatural acts proposed within these publications, although this is not mandatory.

Every new name proposed either for a newly described taxon or a previously existing one (a new substitute name), must be explicitly indicated as new (article 16.1). The ICZN recommends to accompany new names at first appearance in the text with such expressions as “new family”, “new genus”, “new species”, “new substitute name”, or abbreviations like “fam. nov.”, “gen. nov.”, “sp. nov.”, and “nom. nov.”, respectively (recommendation 16A). The explicit indication is also mandatory for nomenclatural acts: designation of a name-bearing type (e.g. “neotype, here designated”) or a new synonym (syn. nov.), change of name status (stat. nov.), as well as actions of the first revising author. Any name proposed for a new taxon must be followed by a text (usually entitled as description or diagnosis) with information, allowing to distinguish this taxon from others, or a reference to a publication, where such information is available. The description must contain a name-bearing type designation (articles 13.3, 13.4). For species-group taxa (species and subspecies), this is either a single specimen (holotype) or series of specimens (syntypes) (articles 73.1, 73.2). For protists it is more

frequently a hapantotype (a special case of collective holotype) representing a series of directly related individuals (cells) either on a preparation or in a culture (article 73.3). It is also mandatory to indicate the name and location of the collection, where the name-bearing type(s) will be deposited (article 16.4). For genus-group taxa (genus and subgenus) a type species (ICZN, 1999: 13.3, 13.4) and family-group taxa (superfamily, family, subfamily, tribe, etc.) a type genus must be designated (article 16.2). If a new proposed name replaces a previous homonymous one for a taxon that existed before, its type is preserved automatically (article 13.1).

There are also rules on how new taxonomic names should be formed. In general, they must contain only letters of the Latin alphabet (at least two for species- and genus-group taxa) and be useable as words (i.e. pronounceable). A species-group name must be published in unambiguous combination with a generic name (article 11.9). For a genus-group name, there is also a requirement for the word to be considered as a noun in the nominative singular (article 11.8). In order to avoid homonymy, it is recommended to check for the presence of the new proposed name in *Nomenclator Zoologicus* (<http://www.ubio.org/NomenclatorZoologicus/>), containing information about the zoological taxonomic names published in 1758–2004 as well as other taxonomic databases, which is best achieved with web search engines. It is also advisable to avoid homonymy with existing botanical and bacterial generic names. Names of the family-group taxa must be derived from the stem of the type genus name with the addition of the standard suffixes: -oidea for a superfamily, -idea for a family, -inae for a subfamily, -ini for a tribe, -ina for a subtribe (articles 11.7.1, 29).

Concerning nomenclatural acts, there are many special conditions to be satisfied especially for a designation of lectotype (articles 74.1, 74.7) or neotype (article 75), subsequent designations of type species (articles 69, 70), and actions of First Reviser (article 24.2). Although such acts are often subject to mistakes, given that they are published much less frequently and that a detailed explanation of all relevant requirements would be quite voluminous, we prefer to refer readers to the text of the above-listed articles of the ICZN.

Nomenclatural section: the way out

Any author should be aware that all the criteria reviewed above must be fulfilled at the same time, i.e.

in a single paper. Therefore supplying subsequently only the missing piece of information in form of an erratum is not sufficient to validate the name. Therefore when validating an unavailable taxon, it is mandatory to provide the following: (i) new name; (ii) indication that it is new (e.g. by sp. nov.); (iii) diagnosis or bibliographical reference to it; (iv) type designation; (v) type depository (in case of species). When publishing the validation paper in an online-only journal, ZooBank registration must be included.

The names and nomenclatural acts treated below were published in online-only journals without the required ZooBank registrations, therefore being unavailable for the purpose of zoological nomenclature (article 8.5.3), and are validated here. The authors of this paper act in this section mostly as editors of the text. The names and all required evidence are cited from the original publications with only minor corrections (by the authors) and therefore the original authorship of the validated names is respected. The authorship and publication year of the validated taxa should be afterwards cited as, e.g. *Novymonas Kostygov et Yurchenko, 2020* or *Novymonas Kostygov et Yurchenko, 2020* in Kment et al. (2020).

Class Kinetoplastea Honigberg, 1963
Order Trypanosomatida Kent, 1880
Family Trypanosomatidae Doflein, 1901
Genus *Crithidia* Léger, 1902

Crithidia thermophila Roitman, Mundim, de Azevedo et Kitajima, 1977, stat. nov., here emend. Kostygov, d'Avila-Levy et Yurchenko

= *C. luciliae thermophila* Roitman, Mundim, de Azevedo et Kitajima, 1977

= *C. confusa* Maslov et Lukeš, 2009, syn. nov. (see comments)

= *C. deanei* Carvalho, 1973 (in part, see comments).

Type material: Hapantotype (by monotypy), axenic culture ATCC 30817 deposited in American Type Culture Collection (ATCC; Manassas, Virginia, United States; <http://atcc.org>), see comments.

Diagnosis: Corresponds to that of *C. confusa* (Jirků et al., 2012) (see comments).

Comments: Detailed justification of the taxonomic changes based on molecular evidence has been provided previously (Ishemgulova et al., 2017). The name *Crithidia thermophila* has priority over the name *C. confusa* (junior subjective synonym). Isolate ATCC 30818 (*C. hutneri*) and the aposymbiotic

strain ATCC 30969 derived from ATCC 30255 culture (*Angomonas deanei*) also belong to this species. The original description of *C. luciliae* thermophila did not specify a hapantotype (Roitman et al., 1977), but according to the ICZN article 73.1.2 (ICZN, 1999), this information may be unambiguously derived from the record associated with the culture ATCC 30817 in the ATCC database. Reliable species identification is not possible based on the original description (Roitman et al., 1977), but a detailed characterization was provided for *C. confusa* (Jirků et al., 2012).

Crithidia fasciculata Léger, 1902

= *Crithidia luciliae* (Strickland, 1911) Wallace et Clark, 1959, syn. nov.

Comment: As judged by the analysis of molecular sequences, the type culture of *C. luciliae* ATCC 14765 does not differ from *C. fasciculata* (Ishemgulova et al., 2017)

Genus *Novymonas* Kostygov et Yurchenko, gen. nov.

Diagnosis: Monoxenous, genuine insect host unknown; promastigotes and choanomastigotes; the only known species bears multiple vacuole-enclosed β -proteobacterial cells in the cytoplasm. The full description has been published earlier (Kostygov et al., 2016).

Etymology: The generic name honors Frederick George Novy, an American bacteriologist and parasitologist who pioneered studies of insect trypanosomatids. He was the first to document structures (“diplosomes”) (Novy et al., 1907) that were later proved to be bacterial endosymbionts in *Strigomonas culicis*. The name also relates to the word *nový* (“new” in many Slavic languages), reflecting the novelty of the discovered trypanosomatid-bacterium association (Kostygov et al., 2016). Gender neutral.

Type species: *Novymonas esmeraldas* Votýpka, Kostygov, Maslov et Lukeš, sp. nov., here designated.

Novymonas esmeraldas Votýpka, Kostygov, Maslov et Lukeš, sp. nov.

Diagnosis: For the full description and other details see (Kostygov et al., 2016).

Etymology: The species name (*esmeraldas*) is derived from the name of the province in Ecuador where the host of this parasite was collected (Kostygov et al., 2016). Noun in apposition.

Type host: *Niesthrea vincentii* (Westwood, 1842) (Hemiptera: Heteroptera: Rhopalidae).

Site: Intestine: hindgut. Only short choanomastigote-like cells have been observed *in situ* (Kostygov et al., 2016).

Type locality: Ecuador, Esmeraldas Province, Vicinity of Atacames (00°52'31"S; 79°50'32"W).

Type material: The name-bearing type, a hapantotype, is a Giemsa-stained slide of the clonal isolate E262AT.01, deposited in the research collection of the Life Science Research Centre, Ostrava, Czech Republic (accession code 2015/E262AT.01/S). Axenic cultures of the primary (E262AT) and clonal (E262AT.01) isolates are deposited in the research collections of the Life Science Research Centre of the University of Ostrava, Department of Parasitology at Charles University, Prague, and Institute of Parasitology, Česká Budějovice, Czech Republic.

Genus ***Phytomonas*** Donovan, 1909

Phytomonas borealis Ganyukova, Frolov et Kostygov, sp. nov.

Diagnosis: Long vermiform promastigotes in host midgut $34.8 \pm 7.7 \mu\text{m}$ long and $1.3 \mu\text{m} \pm 0.1 \mu\text{m}$ wide, flagellar length roughly equal to that of cell body; nucleus ($3.8 \pm 1.0 \mu\text{m} \times 1.3 \pm 0.1 \mu\text{m}$) and kinetoplast ($0.71 \pm 0.10 \times 0.2 \pm 0.05 \mu\text{m}$) located at $7.3 \mu\text{m} \pm 1.9 \mu\text{m}$ and $2.0 \pm 0.6 \mu\text{m}$ from the anterior cell end, respectively. For additional details, see (Ganyukova et al., 2020).

Gene sequences: The species can be identified by the sequences of 18S rRNA and gGAPDH genes (GenBank accession numbers: MN442620 – MN442623 and MN434073 – MN434074, respectively) (Ganyukova et al., 2020).

Etymology: The specific epithet *borealis* is a Latin adjective (*boreālis*) meaning “northern”. It was selected to emphasise the presence of this species in northern European Russia (Ganyukova et al., 2020); adjective.

Type host: *Picromerus bidens* (Linnaeus, 1758) (Heteroptera: Pentatomidae) (non-specific host) (Ganyukova et al., 2020).

Location within host: midgut (Ganyukova et al., 2020).

Type locality: Russia: Novgorod Oblast, village Oksochi (58°39'N; 32°47'E).

Type material: Giemsa-stained slide Pic3_16 (hapantotype) deposited in the research collection of Parasitic Protists of the Zoological Institute RAS (St. Petersburg, Russia) along with additional smears

Pic1_16, Pic7_16; Pic9_16 (from Novgorod Oblast) and Pic38_17, Pb2_18; Pb7_18; Pb10_18 (from Pskov Oblast).

Phytomonas lipae Frolov et Kostygov, sp. nov.

Diagnosis: Two morphotypes are present in host's salivary glands: 1) elongated promastigotes varying in size from 12 to 70 μm , and 2) small cells (6–11 μm) with no free flagella (endomastigotes). The anterior third of the body is widened, the posterior one is narrow and elongated; flagellum length is not greater than 1/3 of the promastigote's cell body; both nucleus and kinetoplast are located in the anterior part of the cell. The nucleus (2.5 $\mu\text{m} \pm 0.5 \mu\text{m}$) is located in 2.9 $\mu\text{m} \pm 1.1 \mu\text{m}$ from the kinetoplast and 6.6 $\mu\text{m} \pm 1.6 \mu\text{m}$ from the anterior end. The compact kinetoplast (0.7 $\mu\text{m} \pm 0.1 \mu\text{m}$ \times 0.2 $\mu\text{m} \pm 0.1 \mu\text{m}$) is positioned in 1.7 $\mu\text{m} \pm 0.6 \mu\text{m}$ from the anterior end. For additional details see (Frolov et al., 2019).

Sequences: The species can be identified by the sequences of 18S rRNA, gGAPDH, HSP83, and ITS1/ITS2 region (GenBank accession numbers: MK036047–MK036051, MK050458–MK050461, MK258191, and MK053634, respectively) (Frolov et al., 2019).

Etymology: The specific name, *lipae*, honors Prof. Jerzy J. Lipa, who probably first observed promastigotes of this species in the dock bugs *Coreus marginatus*, but mistakenly identified them as a developmental stage of another trypanosomatid parasite, *Blastocrithidia raabei*, coinfecting the same host species (Frolov et al., 2019).

Type host: *Coreus marginatus* Linnaeus, 1758 (Hemiptera: Heteroptera: Coreidae).

Location within host: Present in the M1 (partly M2) midgut, hemolymph, and lumina of salivary glands, as well as within the cells of salivary glands (Frolov et al. 2019).

Type locality: Russia: Novgorod Oblast, village Oksochi (58°39'N, 32°47'E).

Type material: The name-bearing type, a hapantotype, is a Giemsa-stained slide of the dissected salivary glands (isolate Cor4sg) it was deposited along with the axenic cultures Cor4, Cor49, and Cor203 in the Research Collection of Parasitic Protists of the Zoological Institute of the Russian Academy of Sciences (St. Petersburg, Russia).

Jaenimonas Votýpka et Hamilton, gen. nov.

Diagnosis: Distinct monoxenous lineage in 18S rRNA and gGAPDH gene-based phylogenies;

parasite of the gut of fruit flies. Detailed description is available elsewhere (Hamilton et al., 2015).

Etymology: The generic name honors John Jaenike of the University of Rochester, Rochester, NY, who has made important contributions to the field of host-parasite ecology and evolution, with much of his research focused on natural populations of *Drosophila*. “Monas” (Greek) — monad; third declension (monas); feminine; the word monas is included in many generic names of flagellates (Hamilton et al., 2015).

Type species: *Jaenimonas drosophilae* Votýpka et Hamilton, sp. nov., here designated.

Jaenimonas drosophilae Votýpka et Hamilton, sp. nov.

Diagnosis: Detailed description is available elsewhere (Hamilton et al., 2015).

Etymology: The species name is derived from the name of the typical host, a *Drosophila* species (Hamilton et al., 2015). Noun in genitive case standing in apposition.

Type host: *Drosophila falleni* Wheeler, 1960 (Diptera: Drosophilidae).

Site: Intestine: midgut (Hamilton et al., 2015).

Type locality: United States, Connecticut, Vicinity of West Hartford (41°46'04"N, 72°45'14"W).

Type material: Hapantotype (Giemsa-stained slide 2006/ Dfal-01/S), axenic cultures of the primary isolate (Dfal-01), and clonal line (Dfal-01.02) are deposited in the research collections of respective institutions in Prague, Ostrava, and Budweis, Czech Republic.

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