



A Brief Guide to Establishing Phylogenetically Defined Names under the *International Code of Phylogenetic Nomenclature (PhyloCode)*

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Abstract

To facilitate preparation of nomenclatural treatments that follow the *PhyloCode*, we provide here an outline of the requirements in a form that may be used like a checklist. Requirements and recommendations are categorized as pertaining to publication, protologue content, the defined clade name, or the phylogenetic definition. Two sample protologues are included to illustrate the elements that need to be included to establish a name under the *PhyloCode*. In addition, we provide detailed instructions for registering a name in RegNum, as required by the *PhyloCode*.

Key words: *PhyloCode*, phylogenetic nomenclature, RegNum, clade name, phylogenetic definition

Introduction

We have noticed that some recent publications attempting to establish names under the *PhyloCode* (Cantino and de Queiroz 2020) have not included all the required elements. Because the requirements for establishing clade names under the *PhyloCode* differ from those for establishing taxon names under the rank-based codes, and because some authors may not be familiar with the rules of the *PhyloCode*, we thought it would be useful to outline those requirements in the form of a checklist.

Articles and Recommendations cited below refer to *PhyloCode* version 6 (2020). When consulting them, the associated Notes and Examples should also be read. The *PhyloCode* is easily consulted at <http://phylonames.org/code/>.

Only the rules pertinent to establishment of clade names are covered in this checklist. Not included are the rules pertaining to (for example) determining precedence among names after they are established (Arts. 12–15), the use of species names (which are not governed by the *PhyloCode*) in conjunction with clade names (Art. 21), and governance of the *PhyloCode* (Art. 22).

Publication Requirements

The following requirements apply to the publication in which the name is to be established:

- It must be peer-reviewed (Art. 4.2).
- It may be in printed and/or electronic form but must satisfy the conditions detailed in Art. 4.2. There are additional recommendations regarding electronic publication (Rec. 4.4A, 4.4B).
- Printed works and other materials that do *not* count as publications under the *PhyloCode* are listed in Art. 4.6.

Requirements and Recommendations pertaining to the Protologue

The protologue comprises everything associated with a name when it is first established in a publication—e.g., description, illustrations, geographic distribution. Although the *PhyloCode* is silent about protologue form, we suggest here that substituting a table covering multiple names for a series of textual protologues will often be problematical because some of the information required or recommended to establish a name will not fit into a tabular format. For example, the rationale for selecting a name from among several that could be applied to the clade of concern would frequently not fit in a table.

Under the *PhyloCode*, the following information must be included in the protologue:

- The clade name that is being established, with the names of the nominal author(s) and—if it is a preexisting name that is being converted to a phylogenetically defined name—the date of the original publication (Art. 9.15).
- Designation of the clade name as new or converted (Art. 9.2).
- Registration number (Art. 7.2e).
- Phylogenetic definition (Arts. 9.3, 9.4).
- Citation of a reference phylogeny or statement about the distribution of supporting apomorphies (Art. 9.13); if more than one reference phylogeny is cited, one of them should be designated as the primary reference phylogeny (Rec. 9.13B).
- If the specifiers in the definition are not shown on the reference phylogeny, then it must be stated how the specifiers are related to the taxa that are included in the reference phylogeny (Art. 11.11).
- Hypothesized composition of the clade (Art. 9.14).
- For converted names, bibliographic citations (including all the information detailed in Art. 9.16) demonstrating prior application of the name to a taxon approximating the clade for which it is being established (Art. 9.15).
- Recommendation: In cases where more than one preexisting name has been applied to a group approximating the clade to be named, the rationale for choice of a name should be provided (Recs. 10.1A, 10.1B).
- Recommendation: The protologue should include a description, diagnosis, or list of apomorphies (Rec. 9C).

Requirements pertaining to the Defined Name

- The name must be a single word, begin with a capital letter, be composed of more than one letter, and consist exclusively of letters of the Latin alphabet as used in contemporary English (Art. 17.1).
- Other letters, ligatures, numerals, apostrophes, or diacritical signs are not allowed, except that a hyphen is to be included in the following cases (Art. 17.1):
 - The name is a panclade name (Art. 10.3).
 - The name has an apomorphy-based definition and is formed in accordance with Article 10.8 (involving use of the prefix *Apo-*).
 - The name is based on the preexisting name of a subdivision of a genus (see Rec. 10F).
 - The name is based on a preexisting name preceded by a taxon-related prefix such as *Phyto-*, *Phyco-*, *Myc-*, *Prokaryo-*, or *Zoo-* in the situation covered by Recommendation 10D.
- It must be registered in RegNum (Art. 8.1). See registration instructions at the bottom of this document.
- It must apply to a clade that either appears on the reference phylogeny or is delimited by the cited apomorphies (Art. 9.13).
- If a preexisting name has been applied to a taxon approximating the clade to be named or to a paraphyletic group originating in the same ancestor, that name must be chosen (Art. 10.1) except under conditions described in Article 10.2; a new name may be used if the clade has no preexisting name or all preexisting names (or their homonyms) have already been established for other clades (for these and other conditions see Art. 10.2). See also Recs. 10.1A, 10.1B, 10A, 10B, 10C, 10D, 10E, and 10F.
- A clade name may not be converted from a preexisting specific or infraspecific epithet or name in the species group (Art. 10.10).

- The names of total clades can either be preexisting names (applied to groups approximating the clade to be named) or new names formed by adding the prefix *Pan-* (including the hyphen) to the previously- or simultaneously-established name of the corresponding crown clade (for details see Arts. 10.3, 10.4, 10.6, 10.7 and Rec. 10.4A).
- In addition, there are rules and recommendations that apply only to names of crown clades that, under rank-based nomenclature, correspond to a monogeneric “higher” taxon (Rec. 10G) and certain apomorphy-based clades (Arts. 10.8, 10.9).

Requirements and Recommendations pertaining to the Phylogenetic Definition

- It must be written in English or Latin (Art. 9.3).
- Recommendation (9.4A): The standard wordings provided in Arts. 9.5–9.7 and 9.9–9.10 should be used; if an alternative wording is used, a standard abbreviated definition (as provided in Arts. 9.5–9.7 and 9.9–9.10; see also Note 9.4.1) should be included. Examples of recommended wordings:
 - minimum-clade definition—“the smallest clade containing A and B”;
 - maximum-clade definition—“the largest clade containing A but not Z”;
 - apomorphy-based definition—“the clade for which M, as inherited by A, is an apomorphy”.
- Recommendation: If an apomorphy-based definition is used, and if the apomorphy is a complex character that could have evolved in a stepwise fashion, then the author should identify which aspect(s) of that apomorphy must be present for an organism to be considered to belong to the clade thus defined (Rec. 9.7B).
- If a panclade name is used, its definition must follow Article 10.5: for example, “the total clade of the crown clade [name of the crown clade]” (see Art. 10.5 for alternative wordings).
- Specifiers must be species, specimens, or apomorphies, *not* subordinate clades (Art. 11.1).
- When a species is used as a specifier, the author and publication year of the species name must be cited (Art. 11.3).
- When a type specimen is used as a specifier, the species name it typifies and the author and publication year of that species name must be cited (Art. 11.5).
- Specimens that are not types may be used as specifiers only in the situations listed in Article 11.7, and additional information must be provided (Arts. 11.8, 11.9).
- When a clade name is converted from a preexisting name that is typified under a rank-based code or is derived from the stem of a typified name, then the type species or type specimen of that typified name must be an internal specifier (Art. 11.10).
- Either the specifiers must be included in the reference phylogeny or a statement must be included indicating how the specifiers are related to the taxa that are included in the reference phylogeny (Art. 11.11).
- If the definition is intended to prevent the use of the defined name under certain hypotheses of relationships, composition, or both, see Articles 11.12–11.14.
- Recommendation: Definitions of converted clade names should attempt to capture the spirit of traditional use to the degree that it is consistent with the contemporary concept of monophyly. To accomplish this goal, internal specifiers of converted clade names should be chosen from among taxa that have traditionally been considered part of the taxon associated with the name being converted, and they should not include members of subtaxa that have traditionally been considered not to be part of that taxon (Rec. 11A).
- Recommendation: Ichnotaxa and ootaxa should not be used as specifiers (Rec. 11C).
- Recommendation: In a minimum-clade definition, it is best to use a set of internal specifiers that includes representatives of all subclades that plausibly may be sister to the rest of the clade being named (Rec. 11D), unless doing so would be contrary to Rec. 11A and/or 11B.
- Recommendation: In a maximum-clade definition, it is best to use a set of external specifiers that includes representatives of all clades that plausibly may be sister to the clade being named (Rec. 11E).
- Recommendation: If the intent is to establish two names as applying to sister clades regardless of the phylogeny, guidance on constructing the definition is provided in Recommendation 11F.
- Recommendation: When defining the names of low-level clades that coincide with or overlap the boundaries of species, see Recommendation 11H.

Guidelines for registering a name in RegNum

To access RegNum visit www.phyloregnum.org and create an account. Before attempting to register a name, it is advisable to search the database for that name, in case it has already been registered (even with a temporary registration number) by another author.

Once ready to start the submission, click on the tab “Create Submission”, and enter the proposed name in the “Name” field (Fig. 1). After creating the new record, three main tabs will appear: “Clade Name”, “Specifiers”, “Definition”.

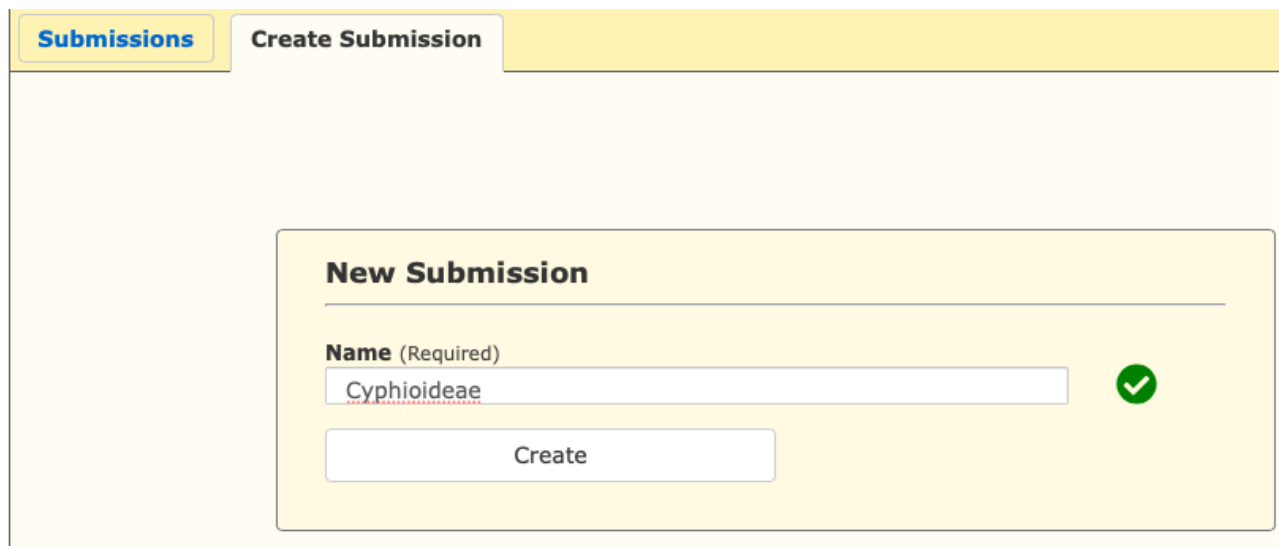
The image shows a web interface for creating a new submission. At the top, there are two tabs: "Submissions" and "Create Submission". The "Create Submission" tab is active. Below the tabs, there is a form titled "New Submission". The form has a "Name (Required)" field containing the text "Cyphioideae". To the right of the text input field is a green checkmark icon, indicating that the name is valid. Below the name field is a "Create" button.

FIGURE 1. The tab used to create a new submission.

The “Clade Name” tab

The “Clade Name” tab (Fig. 2) includes basic nomenclatural information regarding the proposed clade name. A pull-down menu will allow the selection of the proposed definition type (minimum clade, maximum clade, etc.). The definitional author(s) represent the author(s) of the phylogenetic definition of the proposed clade name, and if this is a preexisting name (validly published according to one of the biological codes of nomenclature or in use but not governed by any code prior to implementation of the *PhyloCode*; see Art. 6.2), then the corresponding box needs to be checked and the appropriate code (if any) selected, in which case a *converted clade name* will be created. If the “Preexisting Name” box is not checked, RegNum will generate a *new clade name* by default. The definitional citation window, accessed by the “update” button, includes basic information about the article/book where the definition is/will be published (Fig. 2). Depending on which category is selected from the “Type” menu (Book, Journal or Book Section), there will be a variety of different fields to fill. Ideally, the more information the better, but author(s), title, year and page number(s) are required to correctly generate a citation. For articles with many authors, enter the first few authors (perhaps two or three) followed by *et al.* in the author’s name field. All other fields (e.g., DOI, URL, Keywords, etc.) are optional. The information entered in this window will likely need updating after the article/book is published, with any changes in the title, page numbers, etc. The citation for the pre-existing name (the author(s) and publication of the original name that is now being defined phylogenetically) can be entered and updated by clicking the “Edit reference” link (Fig. 3). As for the definitional citation, only author(s), title, year, and page number(s) are required. Therefore, with the exception of a few fields in the “Definitional Citation” and preexisting name citation windows, all fields in the “Clade Name” tab are required.

Clade name: Cyphioideae
Name string: Cyphioideae W. G. Walpers 1852 [N. Cellinese], converted clade name.

Clade Name | **Specifiers** | Definition

Clade Name: Cyphioideae ✓

Definition Type: Minimum Clade - Standard
A minimum-clade definition associates a name with the smallest clade that contains two or more

Definitional Author(s)
 First: Nico Middle: Last: Cellinese
[\[add another\]](#) [\[remove\]](#)

Definitional Citation

Type	Title	Author(s)
Journal	Cyphioideae	N. Cellinese

[Update](#)

Pre-existing Name

Code: ICN - the botanical code

Nominal Author(s): [\[Edit reference\]](#)
 W. G. Walpers

Comments:

Update reference for definition

Type: Journal Article

Article Title: Cyphioideae

Journal: Bulletin of Phylogenetic Nomenclature

Author(s): First: N. Middle: Last: Cellinese
[\[add another\]](#) [\[remove\]](#)

Year: XXXX **Edition:** **Volume #:** X **Page(s):** XX-XX

Figure: **Keywords:**
ISBN/ISSN:

URL: **DOI:**

[Save](#)

Registration number: 819
[Save](#) [Submit for review](#)

FIGURE 2. The “Clade Name” tab.

Clade name: Cyphioideae
Name string: Cyphioideae W. G. Walpers 1852 [N. Cellinese], converted clade name.

Clade Name | **Specifiers** | Definition

Clade Name: Cyphioideae ✓

Definition Type: Minimum Clade - Standard
A minimum-clade definition associates a name with the smallest clade that contains two or more

Definitional Author(s)
 First: Nico Middle: Last: Cellinese
[\[add another\]](#) [\[remove\]](#)

Definitional Citation

Type	Title	Author(s)
Journal	Cyphioideae	N. Cellinese

[Update](#)

Pre-existing Name

Code: ICN - the botanical code

Nominal Author(s): [\[Edit reference\]](#)
 W. G. Walpers

Comments:

Update reference for pre-existing name

Type: Journal Article

Article Title: Cyphioideae

Journal: Annales Botanices Systematicae

Author(s): First: W. Middle: G. Last: Walpers
[\[add another\]](#) [\[remove\]](#)

Year: 1852 **Edition:** **Volume #:** 2 **Page(s):** 1037

Figure: **Keywords:**
ISBN/ISSN:

URL: **DOI:**

[Save](#)

Registration number: 819
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FIGURE 3. Within the “Clade Name” tab, a pop-up window includes reference information.

The “Specifiers” tab

The “Specifiers” tab (Fig. 4) shows the list of specifiers selected for the proposed phylogenetic definition. By clicking on “Add specifier” a pop-up window will show different fields depending on whether “species” or “specimen” is selected as the “Type” of specifier. Importantly, the next pull-down menu (“Kind”) will allow the user to state whether a specifier is internal or external, and extant or extinct. If “Species” is selected as the specifier “Type”, the “Taxon name” is required, in addition to the author(s) and year of publication. Information such as UBIO, NCBI or TreeBase IDs is optional. If “Specimen” is selected as the specifier “Type”, in addition to the required “Taxon name”, author(s), and year of publication, there is a free-text field for specimen description (optional), reference to a published image (e.g., URL), and/or important notes such as the institution holding the specimen. Ideally, “Specifier URL” should be entered when available; otherwise, required fields include “Collection number” and “Collector(s)”. If the collector(s) name(s) is(are) not known, “anonymous” [or “unknown” or “not given”] should be entered.

Type	Kind	Name	Author(s)	Publication Year
species	internal extant	Cyphia bulbosa	Bergium	1767
species	external extant	Campanula latifolia	L.	1753
species	external extant	Lobelia cardinalis	L.	1753
species	external extant	Cyphocarpus rigescens	Miers	1848
species	external extant	Nemacladus ramosissimus	Nutt.	1843
species	internal extant	Please enter a specifier name.	Please update to include last name for author.	Please enter a public...

FIGURE 4. The “Specifiers” tab showing the pop-up window where data on a specifier are entered.

The “Definition” tab

The “Definition” tab includes fields for verbatim entry of the proposed phylogenetic definition (“Verbatim Definition”) and any qualifying clause (Fig. 5). The citation for the primary reference phylogeny on which the definition is based is required. This citation may or may not be the same as the definitional citation listed in the clade name tab. For example, the primary phylogeny may have been previously published in a different article. Any additional reference phylogenies that support the definition can be added here (optionally).

Verbatim Definition:
The crown clade originating in the most recent common ancestor of *Cyphia bulbosa* Bergium 1767 and all extant organisms or species that share a more recent common ancestor with *Cyphia bulbosa* Bergium 1767 than with *Campanula latifolia* Linnaeus 1753, *Lobelia cardinalis* Linnaeus 1753, *Cyphocarpus rigescens* Miers 1848, and *Nemacladus ramosissimus* Nuttall 1843.

Qualifying Clause
none

Primary Reference Phylogeny

Type	Title	Author(s)
journal	Please update to include title...	Please update to include last... Update

Additional Reference Phylogenies

Type	Title	Author(s)
book	Please update to include title...	Please update to include last... Update Delete

Page 1 of 1 Add

FIGURE 5. The “Definition” tab where the user can state the phylogenetic definition verbatim and list one or more reference phylogenies.

Upon entering all required information (except information that would be unknown prior to publication, such as article date and page numbers), submit the record for review using the “Submit for review” button at the bottom of the tab (only submitted records are public and can be searched and viewed), but not more than one month before the name and definition are submitted for publication.

Upon publication of the article, inform the database administrator, who will approve the record or request missing information from the author or any data that might have changed during the revision and/or proofing process. The contact details of the administrator responsible for managing RegNum content can be found in the “Help” button on the top right end of every screen.

Literature Cited

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<https://doi.org/10.1201/9780429446276>

Two Sample Protologues adapted from *Phylonoms: a Companion to the PhyloCode* (de Queiroz *et al.* 2020)

The literature cited and addresses of the authors are excluded in these examples but would be included in the larger paper of which the protologue is a part.

***Campanuloideae* Burnett 1835: 942, 1094, 1110 [N. Cellinese], converted clade name**

Registration Number: 21

Definition: The crown clade originating in the most recent common ancestor of *Campanula latifolia* Linnaeus 1753, *Wahlenbergia linifolia* A. de Candolle 1830, and *Platycodon grandiflorus* (Jacquin) A. de Candolle 1830.

Reference Phylogeny: Cellinese *et al.* (2009: Figs. 2–3). See also Eddie *et al.* (2003: Fig. 1), Haberle *et al.* (2009: Fig. 3).

Composition: The clade *Campanuloideae* comprises mainly temperate taxa, with approximately 1,050 species, mostly occurring in the Old World. Two large taxa within the *Campanuloideae* are *Campanula* (approximately 420 species) and *Wahlenbergia* (approximately 260 species).

Diagnostic Apomorphies: Possible non-DNA synapomorphies for *Campanuloideae* include scalariform vessel perforations and verrucose pollen surface (Gustafsson and Bremer 1995), and stylar hair invagination (Erbar and Leins 1989, 1995; Leins and Erbar 1990; Judd *et al.* 2008), although basal taxa such as *Platycodon* have not been thoroughly investigated.

The invagination of stylar hairs is a process occurring during a late stage of the secondary pollen presentation mechanism. In *Campanuloideae*, this syndrome involves pollen being deposited onto stylar hairs, which subsequently invaginate, leaving a glabrous, pitted style (Erbar and Leins 1989, 1995).

Comments: The monophyly of *Campanuloideae* is strongly supported by molecular phylogenies (Eddie *et al.* 2003; Cellinese *et al.* 2009; Haberle *et al.* 2009). These studies also revealed that the species of *Campanuloideae* fall into three clades: one including the campanuloids, another the wahlenbergioids, and a third including the platycodonoids (Eddie *et al.* 2003; Cellinese *et al.* 2009; Haberle *et al.* 2009). Because these three clades are well supported and include all of the *Campanuloideae*, a minimum-crown-clade definition with three specifiers works well.

The name *Campanulaceae* was applied to this clade by Shetler and Morin (1986), Kolakovsky (1994), and Takhtajan (1997). However, following Wagenitz (1964) and Cronquist (1981), most authors have used the name *Campanuloideae* for this clade, applying the name *Campanulaceae* to a more inclusive clade. The latter application of these two names is adopted here.

***Pan-Bovidae* F. Bibi and E. S. Vrba, new clade name**

Registration Number: 262

Definition: The total clade of the crown clade *Bovidae*.

Reference Phylogeny: Figure 1 in Hassanin *et al.* (2012).

Composition: The crown clade of *Bovidae* and all extinct organisms that are more closely related to *Bovidae* than to any other extant pecorans. For taxa contained in the crown, and for potential stem species, see *Bovidae* and *Cavicornia* in this volume.

Diagnostic Apomorphies: Although extant species can easily be distinguished from other crown pecorans, no unambiguous stem bovids are known. The problem is that the same apomorphy—un-branched, non-deciduous cranial appendages covered with a permanent keratin sheath (= bovid horns *sensu* Janis and Scott 1987)—that diagnoses *Cavicornia* relative to all other fossil and Recent pecorans also diagnoses *Bovidae* relative to all other crown pecorans. Furthermore, ‘bovid horns’ are unlikely to diagnose *Pan-Bovidae* even though all currently known extinct taxa that might qualify as stem bovids possess such horns (e.g., *Eotragus spp.*). These three nested taxa have different theoretical compositions, and their diagnoses are expected to eventually differ accordingly. As a practical matter, however, it is currently impossible to differentiate *Pan-Bovidae* from either *Cavicornia* or *Bovidae*.

Comments: Although *Bovidae* is arguably the name most commonly associated with this clade, that is largely a consequence of having failed to distinguish clearly between the crown clade (*Bovidae*; this volume), its total clade (*Pan-Bovidae*), and the origin of its distinctive horns (*Cavicornia*; this volume). *Pan-Bovidae* is proposed to make a distinction between names applied to crown vs. total clades in keeping with the broader goals of the ICPN to develop a general nomenclatural system for all biologists.