

Possible house-keeping and other draft proposals to clarify or enhance the naming of fungi within the *International Code of Nomenclature for algae, fungi, and plants* (ICN)

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Abstract: The 10th International Mycological Congress (IMC10), to be held in August 2014, will be the last before the 19th International Botanical Congress (IBC) scheduled for July 2017 at which changes in the ICN will be adopted. IMC10 will therefore be the last opportunity for mycologists as a whole to debate and propose clarifications and other changes they would like to see made in the ICN which was adopted in Melbourne in 2011. In order to stimulate debate, draft proposals are presented here on ten topics: terminology of the new lists; protection against unlisted names; priority for sexual morph typified names; removal of exemptions for lichen-forming fungi; extension of sanctioning to additional works; extending conservation to additional ranks; names with the same epithet; registration of typifications subsequent to valid publication; sequenced epitypes; and generic homonyms in other kingdoms. It is anticipated that the draft proposals presented here will be abandoned, refined, or supplemented by debates at the Genera and Genomes symposium in Amsterdam in April 2014 and during IMC10, and also by other comments received from individual mycologists or other bodies. Formal proposals will then be prepared for presentation and decision at the IBC in 2017.

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INTRODUCTION

The changes in nomenclatural procedures made at the 18th International Botanical Congress (ICB) in Melbourne in July 2011 were dramatic and represented the start of a new era in the nomenclature of organisms governed by the *International Code of Nomenclature for algae, fungi, and plants* (ICN; McNeill *et al.* 2012). Some of the changes relating to fungi in particular were especially ground-breaking, not least in ending the separate naming of asexual and sexual morphs of the same fungus, requiring key information related to the publication of new fungal names to be deposited in a recognized repository in order for the names to be validly published, and providing for the development of protected lists of names (Hawksworth 2011). These topics had been the subject of prior detailed discussions by a broad spectrum of mycologists at the 9th International Mycological Congress (IMC9) in Edinburgh in 2010 (Norvell *et al.* 2010), and the One Fungus = One Name symposium in Amsterdam in April 2011 (Hawksworth *et al.* 2011).

In starting to implement the provisions of the ICN, however, it soon became apparent that some of the measures adopted required tidying-up “house-keeping”

proposals in order to clarify guidance on how they should be implemented (Anon. 2012, Gams *et al.* 2012a, b). In addition, several issues of importance for mycology were not progressed at the Melbourne ICB. The next opportunities for mycologists to discuss what changes they would like to see will be at the Genera and Genomes symposium in Amsterdam in April 2014, and the 10th International Mycological Congress (IMC10) in Bangkok in August 2014. As IMCs are held every four years, IMC10 will be the last IMC before the next International Botanical Congress, which is to be held in Shenzhen, China, in July 2017. It is important, therefore, that mycologists take the opportunity of IMC10 to make their views known as to what further changes in the ICN should be made. It should be noted that IMCs currently have no formal nomenclatural mandate with respect to the ICN, an issue raised at IMC9 (Norvell *et al.* 2010) and which is currently being explored by a special subcommittee established by the Melbourne Congress; the issue of the future governance of fungal nomenclature is consequently not covered below.

Another topic not covered here is the issue of naming fungi only known from environmental sequences. This is an issue of major concern (Hawksworth *et al.* 2011, Hibbett *et al.* 2011, Taylor 2011) upon which it seems difficult to make firm

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proposals until the technical issue of preserving type material can be addressed.

The purpose of this paper is to stimulate discussion by presenting drafts of possible proposals on 10 topics pertinent to the nomenclature of fungi. These proposals are not being formally made here, as it is anticipated that they will be either discarded or further developed during the 2014 meetings, and special sessions for this have been set aside in the programme of IMC10. Following the views of mycologists participating in IMC10 in particular, and also comments received by mycologists in general, the intention is to prepare a set of formal proposals supported by a broad range of mycologists for publication in *Taxon* later in 2014. Those proposals will then be scrutinized by the Nomenclature Committee for Fungi (NCF) established by the Melbourne Congress, and voted on at the Nomenclature Section meetings held just prior to the 19th IBC in 2017.

As all mycologists use the scientific names applied to the fungi they work with, comments and suggestions are encouraged from those who generate or work with fungal names either as individuals, committees, or other bodies.

PROPOSALS

Terminology of the new lists

The ICN adopted in Melbourne did not provide formal titles for the new lists of fungal names to be proposed for protection or rejection. This has proved confusing to mycologists, and the protected lists have often been referred to as conserved in discussions and presentations. Several suggestions have been made: Accepted vs. Rejected (Anon 2012), Prioritized vs. suppressed (Gams *et al.* 2012a), White-listed vs. Black-listed (Anon 2012), and List-accepted vs. List-demoted (Gams *et al.* 2012b). The issue was considered at the "One Fungus = Which Gene(s)?" symposium in Amsterdam in 2013, when "Protected vs. Suppressed" was favoured (Anon. 2013). This last pair of antonyms has the dual advantage of being distinctive and conveying in the titles the status of the listed names. In order to grant the lists definite titles, the following changes will be required:

Prop. 1. Art. 14.13 second sentence, insert "**protected**" before "lists".

Prop. 2. Art. 56.3 first sentence, replace "rejected" by "**suppressed**", and in the second sentence insert "**suppressed**" before "lists".

Prop. 3. Art. 56.4 and Rec. 56A, insert "or suppression" after "rejection".

Protection against unlisted names

In order to be effective as a force for stability in the nomenclature of fungi, mycologists have taken the view that names accepted in the newly authorized protected lists of names are safeguarded against all unlisted names (Anon. 2013, Kirk *et al.* 2013). This is necessary to address the possibility of instability through the resurrection of long-unused or little-used names, as a result of either the re-

location and examination of previously unassessed type material, or typifications subsequent to valid publication, of which neotypifications pose a particular threat. This was the type of protection envisaged for the list of names in current use for *Trichocomaceae* (Pitt & Samson 1993), and advocated in a special resolution adopted by the Tokyo Congress in 1993 (Greuter *et al.* 1994). In order to provide this degree of protection, the current wording needs to be modified as it only refers to protection against listed competing synonyms. Further, if listed names are treated as protected against unlisted names, the obligation to cite any competing synonyms becomes superfluous, although it may be desirable to retain that option. As unlisted names may be taken up from time-to-time and new taxa continue to be described, the lists will need to be open for revision by successive congresses. Names on the lists do, however, need to be subordinate to the lists of conserved names to cover instances where names on the protected lists compete in different classifications and the younger is preferred. The following proposals aim to effect these various requirements:

Prop. 4. Art. 14.13 second sentence, replace all after "types" with "**and are protected against any competing listed or unlisted synonyms (including sanctioned names) except as provided for by conservation (Art. 14.1). Lists of protected names remain open for revision through the procedures described above**".

Prop. 5. Art. 14.16 second sentence, insert "**or protection**" after "conservation", and "**Art. 14.13**" after "also".

Priority for sexual morph typified names

The new Art. 57.2 in the Melbourne *Code* endeavoured to ensure that precedence was granted to names with a sexual morph as the name-bearing type, over ones with asexual types, when the latter had priority by date of publication. It stated that in cases where both names were "widely used for a taxon", a name typified by an asexual morph "is not to displace the teleomorph name(s) unless and until a proposal to reject the former [the teleomorph name] under Art. 56.1 or 56.3 or to deal with the latter under Art. 14.1 or 14.13 has been submitted and rejected". While the intent of this provision is commendable, there is no automatic penalty under the *Code* for non-compliance. An author not following this rule, however, risks the choice being overturned following a proposal to either conserve the later sexually-typified name, or include it on a Protected List. Also, the time involved in preparing formal rejection proposals and then waiting for a ruling deters mycologists from making such proposals. The issues can be dealt with through the new protected lists of names, as recognized in the *Code*, but that process again moves slowly at the rank of species and has not yet been started for most groups of fungi.

In practice, mycologists are endeavouring to follow the spirit of this provision, using pointers to decide whether a name is "widely used" (Hawksworth 2012), but almost none are following the formal rejection route. As there is no penalty for not following the current Art. 57.2, this would be more appropriately rephrased and presented as a Recommendation.

Prop. 6: Art. 57.2, renumber as “**Rec. 57A**” and replace all after “priority” by “**should not be taken up, and the teleomorph-typified name should be submitted for inclusion in a future protected list of names (Art. 14.13).**”

Removal of exemptions for lichen-forming fungi

Lichen-forming fungi had traditionally been excluded from the provisions of the former Art. 59, and there was concern expressed from the floor at the Melbourne Congress that failure to exempt them from the new provisions could be destabilizing, Art. 57.2 being of particular concern. In consequence, the parenthetical statement “including lichenicolous fungi, but excluding lichen-forming fungi and those traditionally associated with them taxonomically, e.g. *Mycocaliciaceae*” was incorporated into Arts. 14.13, 56.3, and 57.2. This concern, however, appears to be unfounded and based on the misconception that a lichen thallus with either no ascomata/basidiomata or only spermatia were separate morphs in the sense of previous *Codes*, and so a name with a type bearing ascomata/basidiomata should be given preference unless the rejection procedures detailed in Art. 57.2 had been followed. Specimens of a lichen which are sterile, with spermatia, or have sexual structures are not pleomorphic fungi as they do not represent independent stages in a life-cycle, as a thallus is the “morph characterized by the production of asci/ascospores, basidia/basidiospores . . .” (McNeill *et al.* 2006) as that same structure will produce them, whether or not the sexual structures are actually present on a particular specimen. Even where a lichen produces more than a single type of conidium of which only one may be spermatial, as in some species of *Micarea* and *Opegrapha*, it is the same thallus that also forms ascomata. There may be rare exceptions such as the lichenicolous lichen *Lecidea verruca* (which occurs on *Aspicilia* species) which is reported to have spermatia and ascomata on separate thalli (Poelt 1980), but such rare cases hardly justify such large-scale exemptions in the *Code*. It should be noted that mycologists dealing with other fungi have not normally named spermatial morphs separately under previous *Codes*, for example in *Diaporthe*.

This situation parallels that in relation to the time when sanctioning was introduced at the Sydney Congress in 1981. Lichen-forming fungi were exempted pending a study of the implications. That study revealed that very few names would have to change, although some were well-known species (Hawksworth 1986). The consensus, however, was that that was a small price to pay for exclusion of decisions over biology in nomenclatural matters, a proposal for deletion made (Holm *et al.* 1986), and the change was effected at the Berlin Congress in 1987.

The most unfortunate result of the current special provision, however, is that it precludes the lists of protected and suppressed names including lichen-forming fungi, which is hardly in the interests of stability. This would mean that in orders, families, and genera including both lichen-forming fungi and those with other life-styles, the lichenized taxa would have to be omitted. The deletion of this exemption has consequently already been advocated (Anon. 2012, 2013, Kirk *et al.* 2013).

Prop. 7: Arts. 14.13, 56.3, and 57.2, delete “(including lichenicolous fungi, but excluding lichen-forming fungi and those traditionally associated with them taxonomically, e.g. *Mycocaliciaceae*).”

Extension of sanctioning to additional works

The concept of sanctioned names was introduced into the *Code* at the Sydney Congress in 1981 when the later starting points for selected groups of fungi were abandoned, and the date for the start of their nomenclature reverted to 1 May 1753. Essentially, names adopted in the former starting-point works were protected against any other names for the same taxon, whether treated in those works or not. The system has served mycology well, and avoided the need to make numerous separate conservation proposals. In order to simplify the task of preparing and processing lists of protected names, Amy Y. Rossman (unpubl.) suggested that there should be a possibility for later monographs to be granted the same nomenclatural status as sanctioned names, subject of course to approval by the Nomenclature Committee for Fungi (NCF). As Appendix VI in the *Code* lists suppressed works, a new complimentary Appendix might be better termed one of protected works. The concept of protected works is already established to some extent in zoological nomenclature in the “Official List of Works” (Melville & Smith 1987) though the status varies work by work as determined by the plenary powers of the International Commission on Zoological Nomenclature (ICZN; ICZN 1999). Examples of works that *might* be proposed for such status in the case of ascomycetes include the monographs of Wehmeyer (1933), Degelius (1954), Ju & Rogers (1996), Simmons (2007), Lücking (2008), and Braun & Cook (2012).

Rec. 50E.3, recommending use of the “:” notation to indicate the sanctioned status of a name, introduced from the floor at the Sydney Congress in 1981, has not been universally adopted by mycologists and continues to cause confusion. The desirability of having some such citation had been discussed in detail by the IMA’s Nomenclature Secretariat committee on later starting points for several years prior to that Congress, and rejected because of the potential of misunderstandings – mixing the place of publication with an indication of nomenclatural status. Sadly, 33 years after the introduction of the notation, the place of sanctioning is still often cited as if it is the place of valid publication of a name rather than the actual place of valid publication. Sanctioning places were made an exception for the requirement to cite basionyms with full bibliographic information when making new combinations when the starting point dates for some groups of fungi were moved back to 1753 at the Sydney Congress (Art. 41.8(b)). I see no justification, however, for permitting this exception for all time, and so a proposal to end this practice after the next Congress is also incorporated below.

As the sanctioned status of a name can be referred to in nomenclatural discussions in the same way as considerations of effective or valid publication and legitimacy, a special notation seems superfluous except in formal full bibliographical nomenclatural treatments, and that is also embodied in the proposals made here.

The following proposals would enable the protection now afforded to sanctioning works to be extended, and the last

would permit the unification of “protected” and “sanctioned” works into a single category.

Prop. 8. Art 13.1 (d) first sentence, insert “**or other works specified in the List of Protected Works (App. XX)**” before “, are sanctioned”.

Prop. 9. Art. 15.6 insert a new paragraph: “**Art. 15.7 (new). In addition to the sanctioned works specified in Art. 13. 1 (d), additional works dealing with the names of fungal organisms (Pre. 8) may be placed on a List of Protected Works (App. XX) on the recommendation of the Nomenclature Committee for Fungi and the General Committee. All names and typifications accepted in those works are to be treated as sanctioned (Art. 15.1), subject to any exemptions or limitations authorized by the General Committee.**”

Prop. 10: Art. 15, insert a new Recommendation: “**Rec. 15A (new): In a full bibliographic citation of a sanctioned name or a name accepted in a work on the List of Protected Works (App. XX), and following the place of valid publication of the name, a full and direct reference to the sanctioned or protected work should be provided, prefixed by a colon “:”.**”

Prop. 11: Art. 41.8 (b), insert after “or”: “**prior to 1 January 2019.**”

Prop. 12: Rec. 50E.3, delete the Recommendation.

Prop. 13: Instruct the Editorial Committee to revise the above proposals so that sanctioned works are treated as protected works and included with the latter in App. XX instead of being detailed in Art. 13.1 (d).

Extending conservation to additional ranks

Art. 14.1 allows for the conservation of names in the ranks of family, genus, and species, but not names in other ranks. Extension of the provision to other specified ranks, or even all ranks, was discussed at the Melbourne Congress in 2011, but not approved. This is unfortunate for mycology as the Article consequently may preclude, in particular, the use of familiar names in the rank of genus from being taken up as names at the rank of subgenus and section. This is of relevance to cases where, for instance, it would be desirable to adopt familiar generic names with a sexual name-bearing type as names of subgenera or sections within genera with a sexual name-bearing type – but a name in the same rank already exists. For example, if it were considered desirable to accept *Neosartorya* as a subgenus within *Aspergillus*, the earlier subgeneric name *Fumigati* W. Gams *et al.* 1985 would have precedence, precluding the use of the form “*Aspergillus (Neosartorya) fumigatus*”. Such cases could not always be dealt with through the new Protected Lists of fungal names alone, as the act of making a change in rank and at the same time listing synonyms in the same rank would render the new combination illegitimate. Conserved names, however, are treated as legitimate even if illegitimate when published.

In addition, protection of the names of orders, and higher taxa such as classes and phyla, would be welcomed by many biologists, as at present authors may adopt names they prefer regardless of priority of publication or established use. The current provisions for conservation require a name to be conserved against specified ones that otherwise would have to be adopted, and as priority does not apply at ranks above family (Art. 11.10), that option is precluded. To date, mycologists in general have been responsible in this regard, but it is wise to endeavour to close a stable door before a horse escapes, and that could be achieved through having Protected Lists of names in the rank of phyla, classes, and orders.

In order to accommodate the conservation of ranks between genus and species, the following proposal is made:

Prop. 14. Art. 14.1 first sentence, insert “**subgenera and sections,**” after “genera”.

Names with the same epithet

It was a common practice from the early 20th century for mycologists to use the same species epithet when introducing a name for a previously undiscovered morph of a species. The various editions of the *Code* had prohibited the combination of names of pleomorphic fungi typified by an asexual morph into a genus of which the type species was typified by a sexual morph. With the abolition of the separate naming of states of pleomorphic fungi in 2011, names now compete on an equal basis regardless of whether the name-bearing type is sexual or asexual. This means that there are situations where a well-known epithet is threatened simply because an author used the same epithet with a type belonging to a different morph. For example, under the current ICN, *Ceratocystis paradoxa* (Dade) C. Moreau 1952 is based on the name *Ceratostomella paradoxa* Dade 1928, which was introduced for the newly discovered sexual morph of *Sporoschisma paradoxum* De Seynes 1886. As De Seynes’ name cannot be transferred into *Ceratocystis* because the combination exists, based on Dade’s name, the earliest available species name is, however, the almost unused *Stilbochalara dimorpha* Ferd. & Winge 1910 which the ICN decrees should be taken up in *Ceratocystis* as the correct name.

This is clearly an undesirable situation, as authors such as Dade had been at pains to minimize disruptions in names by re-using the same epithet. However, something of a converse situation was provided for in earlier *Codes*, where new combinations of a name with an asexual type were made under a sexually typified generic name, such names were treated as being of new species provided other conditions for valid publication were met, including a description of the often newly discovered sexual morph. This practice was followed regardless of the author having used “comb. nov.” rather than “sp. nov.”, or equivalent forms.

Hawksworth *et al.* (2013) discussed this problem, and concluded that it could be solved by adopting the reverse of what was permitted under earlier *Codes*. They proposed that names introduced for sexual morphs which used a pre-existing epithet proposed for an asexual morph should be treated as new combinations and not new species. This would be consistent with what the authors in such cases were

doing, that is describing a new morph of a species and not a new species because the rules then in force prohibited them from making new combinations in such cases. Consequently, in the *Ceratocystis* example above, the correct name for the species would be *C. paradoxa* (De Seynes) C. Moreau, not "(Dade) C. Moreau" and *Stilbochalara dimorpha* would no longer be a threat and could continue in synonymy. In order to implement this change, and cover the converse situation, the following proposal is made:

Prop. 15: Art. 59, insert a new paragraph: "**Art. 59.2. If, prior to 1 January 2013, an author in introducing a new species name for the morph of a fungus which had an earlier name typified by a different morph, adopted the same species epithet as that of the previously described morph, the author's name is to be treated as a new combination and not that of a new species with a separate type. Designations such as "sp. nov." and ascriptions excluding the earlier name are to be treated as formal errors requiring correction.**"

Registration of typifications subsequent to valid publication

While it is a relatively straightforward process to designate, in the absence of a holotype, a lectotype, or neotype, or an epitype where the existing type is "demonstrably¹ ambiguous", historically there has been no way of determining if such nomenclatural acts have previously been published. Indeed, it may be only serendipity that the place in which such a designation was made is located as such acts have not been catalogued in the *Index of Fungi* and its predecessors, and nor are these routinely listed in published abstracts. This issue is of increasing importance in mycology as a result of the advent of the practice of designating sequenced epitypes where molecular data are not available for the name-bearing type. The "One-Fungus = Which Name?" symposium held in Amsterdam in 2012 was unanimous in the opinion that such typifications should be deposited in a database (Anon. 2012). Two of the recognized repositories of key nomenclatural data on new fungal names, *Index Fungorum* and *Mycobank*, responded to this need and are already issuing locally unique identifiers for later typification events. Some mycologists are routinely using this facility, and an increasing number of mycological journals require this as a part of their editorial policies. It consequently seems logical that, in order for later typifications to be recognized as effectively published, after the Shenzhen International Botanical Congress (IBC) in 2017 their details should be required to be deposited in one of the approved repositories for fungal names. In order to implement this provision, the following changes would be required:

Prop. 16: Art. 9, insert a new provision to follow Art. 9.23: "**9.24. For typifications subsequent to the valid publication of names of organisms treated as fungi (including fossil fungi and lichen-forming fungi) under this Code (Pre. 8) published on or after 1 January 2019 to be effective, the inclusion of an identifier issued by a recognized repository (Art. 42.3) is an additional requirement (Art. 42.1 and 42.2).**"

Prop. 17: Art. 42.1, add a new sentence: "**On or after 1 January 2019, the citation of such an identifier is also required for typifications published subsequent to the valid publication of names of such organisms to be effective.**"

Prop. 18: Art 42.2, insert after the sentence ending "synonym": "**The minimum elements of information that must be accessioned for typifications published subsequent to the valid publication of names are those required by Art 9.21, 9.22, and 9.23.**"

Sequenced epitypes

Jørgensen (2014) correctly draws attention to the uncertainty of the phrase "demonstrably ambiguous" in Art. 9.8, which provides for the recognition of epitypes. He points out that in the example given in the ICN, Art. 9 Ex. 9, which concerns the designation of a sequenced epitype for the lectotype of a Linnaean lichen name, the authors did not demonstrate that they could not obtain DNA from the 18th century specimen. Indeed, it would be irresponsible to destroy fragments of historic types on the off-chance that DNA might be recovered. Clarity is needed on this point as epitypes are now routinely designated by mycologists in cases where no sequence data are available and cannot be easily obtained from name-bearing types. As Jørgensen points out, new technology may in due course facilitate the reliable recovery of DNA from ancient specimens, but that is not yet the case. The continuation of the practice is crucial to systematic mycology today. Without it numerous names would remain of unfixed application, and many new names would have to be introduced as already published and often familiar names could not be taken up. In order to resolve this situation, the following small change to the current wording of Art. 9.8 is proposed, which will retain the current essence of the provision and at the same time endorse what is now common practice:

Prop. 19: Art. 9.8 first sentence, delete "**is demonstrably ambiguous and**".

Generic homonyms in other kingdoms

Art. 54 of the Melbourne *Code* rules that "consideration of homonymy does not extend to the names of taxa not treated as algae, fungi, or plants" except as qualified in that Article. Principle 2 of the bacterial *Code* (Sneath 1992), however, rules that the nomenclature of bacterial groups is not independent of that for algae, fungi, and protozoa; i.e. that names in those groups must be considered if a bacterial name is an homonym. Rec. 54A of the Melbourne *Code* does recommend the avoidance of names that already exist for zoological and bacterial taxa, but is not mandatory. Following discussions with zoological *Code* representatives on the International Commission on Bionomenclature, it is expected that a parallel recommendation will be placed in the next edition of the zoological *Code*. A definite ruling to prohibit, for new names, inter-*Code* homonymy across all codes from a future date would be ideal. This possibility is becoming increasingly practical

¹See also Prop. 19 regarding the use of "demonstrably".

with the availability of inter-kingdom databases such as the *Catalogue of Life* (<http://www.catalogueoflife.org/>), but would represent a significant change in how the different codes have operated since the mid-19th century. As a first step towards that long-term goal, it would be prudent to bring all groups of microscopic organisms into line. That is especially important as cases where organisms traditionally treated as protozoa, for example, prove to be members of the kingdom *Fungi*.

Prop. 20. Art. 54.1, insert “**Prior to 1 January 2019,**” before “Consideration”.

Prop. 21. Art. 54, insert a new provision after Art. 54.1, “**Art. 54.2. On or after 1 January 2019, newly proposed names of organisms treated as algae or fungi under this Code that are homonyms of the name of a bacterial or protozoan taxon are illegitimate.**”

Prop. 22. Rec. 54A, insert “**of plants**” before “under.”

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