

Perspectives on binomial names of virus species

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In recent years, the ICTV has been criticized [3, 4, 6] for its unwillingness to turn the unofficial binomial names of plant virus species used by many plant virologists into official names. It seems timely, therefore, to spell out the implications of such a binomial system if it were used for all the official species names that appeared in the 7th ICTV Report [11]. Only if this is done, will it be possible for virologists to assess both the advantages and disadvantages of a binomial system. It is hoped that the present note will elicit many responses from individual virologists.

In the proposed binomial system, the word virus appearing at the end of the current official species name is replaced by the genus name, which also ends in «-virus». For example,

Tobacco mosaic virus becomes *Tobacco mosaic tobamovirus*

Plum-pox virus becomes *Plum-pox potyvirus*

Rice dwarf virus becomes *Rice dwarf phyto-reovirus*

Potato virus X becomes *Potato X potexvirus*

The obvious advantage of such a system is that inclusion of the genus name in the species name indicates relationships with other viruses and thus provides additional information about the properties of the virus.

Plant virologists have been careful to coin genus names in accordance with the ICTV International Code and as a result, the binomial system is readily applicable to plant viruses. For viruses infecting vertebrates, the system could also be useful since binomials would be more informative than the current names. Thus,

Bluetongue virus would become *Bluetongue orbivirus*

Yellow fever virus would become *Yellow fever flavivirus*

Human herpesvirus 5 would become *Human herpes 5 cytomegalovirus*

This system should be applied only to the accepted official virus species names that at present are written in italics and not to tentative species, strains, serotypes etc. Only the official binomial names of virus species would thus be written in italics.

In the case of virus names that contain the word «phage», the genus name could simply be added at the end. For example,

Bacillus phage AP50 would become *Bacillus phage AP50 tectivirus*

Alteromonas phage PM2 would become *Alteromonas phage PM2 corticovirus*

An alternative would be to remove the term phage altogether, which could result in names such as *Bacillus AP50 tectivirus* and *Alteromonas PM2 corticovirus*.

One argument used against the introduction of official binomial names is that long established virus names would have to be abandoned. This, however, is not the case since classical names could be retained and used as vernacular names when the taxonomic position of the virus is not being considered. Measles virus (not in italics) would continue to be used alongside the official binomial *Measles morbillivirus* (in italics), which would be used only in a taxonomic context and would appear as such in texts written in languages other than English. The fact that the vernacular name and the binomial species are different would be an advantage since this would highlight the distinction between the virus as an infectious entity and the abstract species taxon, a distinction which at present relies only on the use of italics.

It must be pointed out that a number of difficulties would arise if a binomial system were adopted universally for all virus species listed in the 7th ICTV Report. These would be:

1. In several families of the *Caudovirales* there is no genus name, which prevents the binomial system from being used. For instance,

Enterobacteria phage T4 belongs to the genus «T4-like viruses»

Lactococcus phage c2 belongs to the genus «c2-like viruses»

The same is true for certain viruses in the families *Caulimoviridae*, *Filoviridae*, *Caliciviridae* and *Herpesviridae*. Thus,

Petunia vein clearing virus belongs to the genus «Petunia vein clearing-like viruses»

Marburg virus belongs to the genus «Marburg-like viruses»

Norwalk virus belongs to the genus «Norwalk-like viruses»

Gallid herpesvirus 2 belongs to the genus «Marek's disease-like viruses»

This problem could be solved only if proper genus names were introduced.

2. In some families, such as the *Reoviridae*, *Parvoviridae*, *Baculoviridae* and *Papillomaviridae*, the species name already includes the genus name. For example,

Mammalian orthoreovirus in the genus *Orthoreovirus*

Rotavirus A in the genus *Rotavirus*

Junonia coenia densovirus in the genus *Densovirus*

Trichoplusia ni granulovirus in the genus *Granulovirus*

Human papillomavirus in the genus *Papillomavirus*

To avoid repeating the same word twice, the current species name could be altered slightly, as in,

Rotavirus A could become *Rota A rotavirus*

Aquareovirus A could become *Aquareo A aquareovirus*

Cypovirus 1 could become *Cypo 1 cypovirus*

Leishmania RNA virus 1-1 could become *Leishmania RNA 1-1 leishmanivirus*

Trichoplusia ni ascovirus 2a could become *Trichoplusia ni asco 2a ascovirus* or

Trichoplusia ni 2a ascovirus

In other cases, names such as *Mammalian orthoreovirus*, *Human papillomavirus* and *Trichoplusia ni granulovirus* could be kept as a binomial with the last word now indicating the genus affiliation.

3. In cases where the current species name ends in the suffix «-virus», this could be dropped to prevent the word virus appearing twice in the binomial name. For example, *Poliovirus* could become *Polio enterovirus*
Human herpesvirus 1 could become *Human herpes 1 simplexvirus*
4. When the current genus name, for instance in the families *Orthomyxoviridae* and *Poxviridae*, does not follow the Code, which states that the genus name should end in «-virus» [9, 11], some binomials become highly repetitive, such as *Influenza A virus influenzavirus A* and *Melolontha melolontha entomopoxvirus entomopoxvirus A*.
This could be solved by coining new genus names such as *alphainfluenzavirus* and *alphaentomopoxvirus*, as has been done for genera in the *Retroviridae* (*Alpharetrovirus*, *Betaretrovirus* etc). This would then lead to names like *Influenza A alphainfluenzavirus*.
5. In a few cases, the genus name can lead to confusion because it is used in an existing virus name for an entity that belongs to another genus. For example, *Junonia coenia densovirus* belongs to the genus *Densovirus* (*Parvoviridae*) but *Bombyx mori densovirus* belongs to the genus *Iteravirus*. Such a problem could be solved by changing the names into binomials such as *Junonia coenia densovirus* and *Bombyx mori iteravirus*.

The above examples show that in order to adopt a universal binomial system, a number of current names that appear in the 7th ICTV Report [11] would have to be altered in order to achieve a coherent system. However, in the majority of cases a binomial system could be introduced simply by replacing the word virus at the end of the current official species name by the name of the genus. A list of many current virus species names together with their binomial equivalents can be consulted via ICTVnet (www.danforthcenter.org/ILTAB/ICTVnet/).

The question remains whether a binomial system of this sort, which changes all current species names, would be welcomed by a majority of virologists. Although plant virologists commonly use the system as unofficial names, ICTV is bound by Rule 3.1 of its International Code of Virus Taxonomy and Nomenclature [9, 11] to have a single universal naming system applicable to all viruses.

One possible solution is to consider the binomial names simply as synonyms of the existing official species names. Plant virologists have been doing so for many years [1, 2]. Furthermore in the indices of earlier ICTV reports published in 1976, 1979 and 1982 [5, 7, 8] binomial names such as Bluetongue orbivirus and West Nile flavivirus were used for all the viruses to which the system could be applied at the time.

The issue being debated at present is whether it would be advisable to turn such binomials into official names to be written in italics [10, 12].

The ICTV would welcome reactions from the virological community regarding the possible introduction of binomial names. Comments should be posted via ICTVnet at – www.danforthcenter.org/ILTAB/ICTVnet/.

The feasibility is also being considered of canvassing the opinion of all virologists attending the 12th International Congress of Virology to be held in Paris, 28th July–1st August 2002.

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