On the relative merits of italics, Latin and binomial nomenclature in virus taxonomy

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In a recent article submitted to this journal, Dr. L. Bos [2] explained at length why he was unwilling to apply the revised ICTV Code of Virus Classification and Nomenclature [19] in his new textbook of plant virology [3]. In response to that article, Dr. C. R. Pringle [26] explained some of the reasons behind the changes that had been introduced in the Code, but his explanations clearly did not satisfy Dr. Bos, who now [4] is moved to reiterate his opposition to the new ICTV rules regarding the typography of virus names. The disagreement can be exemplified in the case of the venerable tobacco mosaic virus: when one talks about the virus species, the new ICTV rules demand that it be written "*Tobacco mosaic virus*", i.e. in italics and with a capital initial, whereas Dr. Bos, in his textbook, chose instead to use the name "tobacco mosaic tobamovirus", i.e. a binomial name written in lower case Roman characters and without a capital initial.

Since the issues raised by Dr. Bos relate to changes in ICTV policy over the years which have led to the abandonment of a latinized binomial system of viral nomenclature, it may help to place some of the arguments in their historical context.

In the past, advocating the use of Latin impeded progress in viral taxonomy

To quote R. E. F. Matthews, a past president of the International Committee on Taxonomy of Viruses (ICTV), nothing releases adrenalin more readily for many virologists than the suggestion that virus species names should be latinized [16]. Although the first ICTV reports advocated a latinized viral nomenclature and created Latin family names, latinization was never implemented for species names and in the Fifth, Sixth and Seventh ICTV Reports [9, 23, 34] the rules regarding the use of Latin were abolished altogether.

Bos [4] maintains that the opposition of plant virologists towards a binomial Latin system stems from premature and ill-fated attempts to devise Latin binomials, on the basis of symptoms and host ranges, for viruses whose taxonomic position was totally unclear. As recounted by Francki [7], *Tobacco mosaic virus* has, indeed, been given a bewildering variety of Latin names over the years (Table 1) and this surfeit of undigestible names must have frightened many virologists who imagined what would happen if free reign were given

Table 1. Latin names given to *Tobacco mosaic virus* by the fertile minds of imaginative virologists[a]

Name	Inventors
Stangyloplasma iwanowskii	B. T. Palm (1922)
Marmor tabaci	F. O. Holmes (1939)
Musivum tabaci	W. D. Valleau (1940)
Phytovirus nicomosaicum	H. H. Thornberry (1941)
Nicotianavir communae	H. S. Fawcett (1942)
Minchorda nicotianae	H. P. Hansen (1957)
Protovirus tabaci	A. Lwoff and P. Tournier (1966)
Vironicotum maculans	H. H. Thornberry (1968)
Virothrix iwanowskii	A. E. Procenko (1970)

[a] Literature references to these nomenclatural gems can be found in Francki [7]

to Latin name building. Choosing between a myriad possible Latin names is a task no ICTV Committee would like to get involved in.

As recounted by Matthews [15], opposition to the latinization of virus names has been prevalent throughout the history of the ICTV. In fact, the spectre of Latin names was in part responsible for the slow adoption of the species concept in virology. The strong opposition of plant virologists to the introduction of plant virus species in viral taxonomy has been a source of dismay to successive presidents of ICTV [8, 17, 29] especially since plant virologists were ahead of animal virologists in the task of delineating separate viruses that were really equivalent to *de facto* species [17]. The unwillingness of plant virologists to accept the species category was due to two erroneous assumptions on their part. First, they assumed that the only acceptable species concept was that of biological species defined by gene pools and reproductive isolation, thereby ignoring the fact that there is no agreement at all among biologists about what a species is [10, 11, 18, 20, 22, 29, 30]. Second, they assumed that the acceptance of virus species would inevitably lead to the latinization of virus names. Milne [21], for instance, claimed that the use of the species category "logically" entailed the use of Latin, a belief which Matthews [16] pointed out was itself without logic.

Bos [4] maintains that the visceral rejection of Latin by most virologists is more a case of induced allergy than a matter of reason. The appeal to logic and reason by protagonists on both sides of the divide is rather strange since the use of Latin is actually only a matter of linguistic convention, tradition and orthodoxy. In viral taxonomy, the battle for the acceptance of viral species was finally won in 1991 [12, 25] when the imaginary threat of Latin was seen to recede following the removal of the ICTV rules that advocated latinization [9].

At present another controversy is rampant within ICTV regarding the merits of a binomial virus nomenclature, and once more a strong dislike for Latin has added fuel to the arguments of those who oppose the introduction of binomials. There is, of course, no necessary connection between binomials and the use of Latin but taxonomic traditions in biology are perceived by some to set a formidable precedent. Classical Latin binomials consist of a genus name followed by the species epithet whereas the binomial system advocated by many plant virologists, consists of an English species name followed by a genus name ending in *-virus* (i.e. *Tobacco mosaic tobamovirus*).

In both his articles, Bos [2, 4] finds some merit in Latin names like *Comovirus vignae* (instead of *Cowpea mosaic comovirus*) and *Tobravirus pisi* (instead of *Pea early-browning tobravirus*) but he agrees that the time has not **yet** come to use Latin or latinized binomials composed of a genus name (with capital initial) followed by a species epithet. Apparently, he believes it is only a matter of time before virologists finally will agree to adopt the Latin binomial system used in the nomenclature of animals, plants and microorganisms.

Binomials, latinized or otherwise

The well-known advantage of a binomial system is that the generic part of the name indicates relationship with other viruses and provides additional information about the virus characteristics [8, 29]. This advantage obviously exists irrespective of whether the genus name precedes the species name or not.

If Latin binomials such as *Comovirus vignae* were to be adopted, the word order of a genus name followed by a species name would introduce the difficulty that changes in alphabetic listing of viruses would occur whenever viruses were reassigned to other genera [26]. Bos is well aware of this problem and he has opted, therefore, for a binomial system based on English names where the genus name does not precede the species name.

There is, indeed, no need for latinization of virus names and a binomial system using existing names would be perfectly acceptable. English has replaced Latin as the language of communication in science and English names for viruses have actually become an international standard also in publications written in other languages. Bos is of course well aware of this [2]. The binomial *Tobacco mosaic tobamovirus* could become an international scientific name if approved by the virological community at large and as such it would not need a Latin version.

Although binomials are not officially recognized as scientific names by the ICTV, they are widely used in the plant virology community [1, 4]. Now that the English species name is written in italics, the adjunction of the genus epithet, also in italics, achieves a typographic homogeneity which is at least reminiscent of classical binomial names, albeit not Latin. The ICTV being a democratic organization [12, 15, 23], it cannot be excluded that at some stage in the future, a majority opinion may turn such binomial names into official names. However, proposals to such effect have so far met with little support. In using binomial names in his textbook, Bos [3] follows an unofficial system that appeals to plant virologists. However, the ICTV strives to develop a universal and unified system of nomenclature approved by all virologists, not only by plant virologists.

When coining virus names, the plant virus Study Groups within the ICTV have been careful to avoid redundancies between the genus and species names. As a result, there are today very few names of plant viruses that could not be turned into official binomials simply by adding the genus name to the species name and removing the superfluous word *virus* between the two. Examples of such names for plant viruses are given in Table 2.

It may come as a surprise to animal virologists opposed to binomial names that Frank Fenner in the index of the Second ICTV Report published in 1976 [6] used a binomial system for all viruses to which the system could be applied at the time. The benefits of referring to entries like Bluetongue orbivirus and West Nile flavivirus must have been obvious to Fenner, and the same indexing system was again used in the Third and Fourth ICTV Reports [13, 14]. In the Fifth ICTV Report [9], the binomials were only retained for

Table 2. Examples of current plant virus names and their binomial counterparts [34]

Virus name	Binomial
Maize streak virus	*Maize streak mastrevirus*
Beet curly top virus	*Beet curly top curtovirus*
Cauliflower mosaic virus	*Cauliflower mosaic caulimovirus*
Rice dwarf virus	*Rice dwarf phytoreovirus*
Potato yellow dwarf virus	*Potato yellow dwarf nucleorhabdovirus*
Rice stripe virus	*Rice stripe tenuivirus*
Cowpea mosaic virus	*Cowpea mosaic comovirus*
Tobacco ringspot virus	*Tobacco ringspot nepovirus*
Plum pox virus	*Plum pox potyvirus*
Ryegrass mosaic virus	*Ryegrass mosaic rymovirus*
Wheat streak mosaic virus	*Wheat streak mosaic bymovirus*
Southern bean mosaic virus	*Southern bean mosaic sobemovirus*
Barley yellow dwarf virus	*Barley yellow dwarf luteovirus*
Potato leafroll virus	*Potato leafroll polerovirus*
Carrot mottle virus	*Carrot mottle umbravirus*
Carnation ringspot virus	*Carnation ringspot dianthovirus*
Tomato bushy stunt virus	*Tomato bushy stunt tombusvirus*
Tobacco mosaic virus	*Tobacco mosaic tobamovirus*
Barley stripe mosaic virus	*Barley stripe mosaic hordeivirus*
Brome mosaic virus	*Brome mosaic bromovirus*
Tobacco streak virus	*Tobacco streak ilarvirus*
Beet yellows virus	*Beet yellows closterovirus*
Turnip yellow mosaic virus	*Turnip yellow mosaic tymovirus*
Potato virus X	*Potato X potexvirus*

the indexing of plant viruses while in the Sixth Report [23] the binomial system was dropped altogether. That a binomial system could be used to advantage for many of the viruses infecting vertebrates is shown in Table 3. Although such a system would be useful for indexing purposes, most animal virologists are opposed to the use of binomials as official virus names.

Animal virologists opposed to the binomial system will be quick to point out that the system would give rise to such oddities as *Influenza A influenzavirus A*, *Bovine papilloma papillomavirus* and *Rota A rotavirus*. However, oddities such as the rat *Rattus rattus* and the toad *Bombina bombina* are considered to be acceptable and their proliferation in virology could be contained by a judicious choice of genus names. Successive ICTV Executive Committees have all been confronted with the difficulty of polling the "representative" opinion of virologists worldwide [15]. In spite of this difficulty, ICTV will continue to strive for consensus and for a nomenclature that is acceptable to all virologists.

Are viruses abstract or concrete entities?

Bos [4] makes several other statements which cannot be left unchallenged. When I said [31] that taxonomic names are not appropriate when referring to physical entities like the virions found in a preparation or seen in an electron micrograph, I was referring to the fact that

Table 3. Examples of current names of vertebrate viruses and their binomial counterparts

Virus name	Binomial
Ectromelia virus	*Ectromelia orthopoxvirus*
Lumpy skin disease virus	*Lumpy skin disease capripoxvirus*
Human herpesvirus 1	*Human herpes 1 simplexvirus*
Human herpesvirus 3	*Human herpes 3 varicellovirus*
Human herpesvirus 5	*Human herpes 5 cytomegalovirus*
Murid herpesvirus 1	*Murid herpes 1 muromegalovirus*
Murid herpesvirus 4	*Murid herpes 4 lymphocryptovirus*
Human adenovirus C	*Human adeno C mastadenovirus*
Fowl adenovirus A	*Fowl adeno A aviadenovirus*
Simian virus 40	*Simian 40 polyomavirus*
Chicken anemia virus	*Chicken anemia circovirus*
Mice minute virus	*Mice minute parvovirus*
Hepatitis B virus	*Hepatitis B orthohepadnavirus*
Mouse mammary tumor virus	*Mouse mammary tumor betaretrovirus*
Murine leukemia virus	*Murine leukemia gammaretrovirus*
Human immunodeficiency virus 1	*Human immunodeficiency 1 lentivirus*
Chimpanzee foamy virus	*Chimpanzee foamy spumavirus*
Bluetongue virus	*Bluetongue orbivirus*
Sendai virus	*Sendai respirovirus*
Mumps virus	*Mumps rubulavirus*
Measles virus	*Measles morbillivirus*
Human respiratory syncytial virus	*Human respiratory syncytial pneumovirus*
Rabies virus	*Rabies lyssavirus*
Rift Valley fever virus	*Rift Valley fever phlebovirus*
Lymphocytic choriomeningitis virus	*Lymphocytic choriomeningitis arenavirus*
Poliovirus	*Polio enterovirus*
Foot-and-mouth disease virus	*Foot-and-mouth disease aphthovirus*
Hepatitis A virus	*Hepatitis A hepatovirus*
Infectious bronchitis virus	*Infectious bronchitis coronavirus*
West Nile virus	*West Nile flavivirus*
Sindbis virus	*Sindbis alphavirus*
Rubella virus	*Rubella rubivirus*

abstract classes like species or families cannot be seen or centrifuged. It certainly is not possible to centrifuge the species *Tobacco mosaic virus*, the genus *Enterovirus* or the family *Picornaviridae*. Some virologists may incorrectly write that they have inoculated the species *Nicotiana tabacum* with one or other viral species, instead of saying that they inoculated a tobacco plant (a member of the species *Nicotiana tabacum*) with a member of a viral species. Precision in a scientific publication is, indeed, desirable and can be achieved by referring once, for instance in the Materials and methods section, to the taxonomic placement of the virus under study (species X, genus Y, family Z). Thereafter, vernacular names can be used throughout the publication. However, no conceptual precision would remain if one followed Bos [4] and called the virus that infects a plant an abstraction. An infecting virus is no more an abstraction than an infected plant. Bos is confusing a class

name (the species name) which designates a single abstract object with what logicians call a general term (designated by the vernacular virus name) which denotes any number of concrete objects or entities, each member of an abstract class [27, 28]. Virions correspond to one phase of the life cycle of a virus [32] and viruses are actually concrete entities which, however, can be members of the abstract class corresponding to a virus species [29, 30]. It is precisely because virologists continuously need to refer to concrete objects which replicate and cause disease (abstractions do not cause disease) that vernacular names will continue to be used. Tobacco plants will therefore continue to be inoculated with tobacco mosaic virus (no italics because it is a concrete object) rather than with abstractions like *Tobacco mosaic virus* or *Tobacco mosaic tobamovirus*. The need for introducing the abstract class of species in viral taxonomy and for distinguishing vernacular names from species names has been explained at length elsewhere [29, 30, 32, 33]. It is also important to distinguish between the concrete entity called a virus and a single, discrete virus particle or virion [32]. Whereas a virion possesses intrinsic biochemical and structural properties, a virus, on the other hand, possesses in addition a number of relational and emergent properties that become actualized, for instance during the viral replication cycle, when the virus forms an integrated whole with its host cell. A virus can thus not be reduced to the physical constituents and chemical composition of a virion, and it is necessary to include in its description the functional activity it possesses inside its host, as well as a variety of other biotic interactions.

Viruses are not microorganisms

Another misconception that needs to be rectified is that the species concept and the use of binomials and Latin are appropriate in virology because viruses are organisms. The rationale for using the species concept in viral taxonomy is that viruses are biological entities and not simply chemicals. Viruses possess genes, replicate, evolve and are adapted to particular biotic habitats and ecological niches. However, viruses cannot capture and store free energy and they are not functionally active outside of their host cells. Although viruses are pathogens, they should not be confused with pathogenic microorganisms. Only cells and multicellular systems possess the emergent property of being alive and this property is not present in subcellular organelles or individual molecules. A virus becomes part of a living system only after its genome has been integrated in the host cell and viral replication is made possible through the metabolic activity of the cell. Viruses are **not** living organisms and they occupy a unique position in biology. Since they are not functionally active outside of their host cells, they lead only a kind of borrowed life [32, 33].

The unique position of viruses in the biological realm fully justifies the policy of the ICTV over the years not to blindly follow the traditions of biological or bacterial nomenclature. When Bos [2, 4] asserts that biological nomenclature requires that viral species names be written in a certain way and that it also requires scientific names of viruses to carry a genus affiliation, he simply refuses to acknowledge that the ICTV, as the voice of the international virological community, has been quite happy to follow its own rules and code. Virologists have never accepted that they **must** behave in a certain way and adhere to certain rules because a Biological Nomenclature Code says so. When Bos [2] objects to the allegedly revolutionary practice of the ICTV of writing species names with a capital letter (which is not in line with biological names like *Homo sapiens* where the *sapiens* species epithet is not written with a capital letter) he is likely to leave virologists totally unmoved.

It could also be argued that the binomial *Homo sapiens* is the species name, in which case it is written with a capital letter.

The value of writing virus species names in italics

It is quite bizarre for Bos to state [2] that the name *Cowpea mosaic virus*, because it is not a binomial, has no scientific connotation whatsoever and does not identify the agent. The name certainly did identify the agent when it was written in lower case Roman script and it is hard to see why it no longer does so when written in italics.

The value of using italics is that it reinforces in a visible manner the status of virus species as a taxonomic entity. It is a moot point whether genus names like *Tobamovirus* or *Enterovirus* should be considered modern Latin words and if the use of italics in such cases is simply a convenient way to indicate that these terms refer to formal, abstract classes. The use of italics for species names serves the same function and in languages other than English, it also indicates the alien nature of the term. Italicized English is simply replacing italicized Latin.

Papers written in French will continue to use the name "virus de la rougeole" and will need to refer only once to the alien taxonomic name *Measles virus*. Since the majority of virology reference texts are written in English, the name *Measles virus* will be readily understood by most virologists, irrespective of their mother tongue, and it does away with the need to invent additional Latin names. In a recent French textbook of viruses infecting ornamental plants [1], the binomial system shown in Table 2 was followed throughout. In addition to the vernacular French name of each virus, the English name together with the genus designation, both in italics, served as a standard scientific designation. This textbook was written before the new ICTV Code was published [19] and the authors used italics even for names that have not been officially approved by ICTV as authorized species names. Using italics only for ICTV approved species names has the advantage that strain names (not in italics) are readily distinguished from species names.

Bos [2, 4] objects to the *in toto* italicization of plant virus names on the grounds that it no longer allows a distinction to be made between certain vernacular plant names written in Roman characters such as nasturtium (belonging to the species *Tropaeolum majus*) and the Latin name *Nasturtium* which is a different plant species altogether. Since there are no virus species with these names (nasturtium ringspot virus is a strain of *Broad bean wilt virus*) his objection is a purely theoretical one. Most plant viruses infect a large number of different hosts and a plant such as pelargonium can be infected by as many as 14 different viruses [1]. The term pelargonium appears in the name of only four of these viruses. However, plant virus names should never be taken to imply a unique relationship with a single host.

Bos [2] maintains that the italicisation of whole plant virus names is "a matter of playing the ostrich". My retort would be that his reaction reminds me of a quixotic attack on windmills, albeit not Dutch ones.

What's in a name?

L. Bos is obviously fond of some of the quaint names that have been given to plant viruses and he claims that these names embody information about which crops were infected, now or in the past, and about the symptoms that are produced [4]. The names clearly have a meaning to him as a phytopathologist and he acknowledges the fact that molecular biolo-

gists may be less interested in the origin and meaning of plant virus names. However, I find it hard to believe that he would not concede that most vernacular names of plant viruses are highly misleading. Francki [8] pointed out that "the name arabis mosaic virus tells us only that the virus produces mosaic symptoms on arabis plants, a disease of little economic consequence. It does not tell us that strains of the virus can cause diseases such as raspberry yellow dwarf, rhubarb mosaic, grapevine vein banding, hop line pattern and many others which are of considerable agricultural importance". Another example is the name lily symptomless virus which is equally misleading since the virus can produce severe symptoms in certain lily varieties. Such names do have a meaning but it may not be the meaning we want [24].

Rule 2.3 of the International Code of Virus Classification and Taxonomy [19] wisely states that "the primary purpose of naming a taxon is to supply a means of referring to the taxon, rather than to indicate the characters or the history of the taxon". Bos [4] implies that this rule leads to the degradation of virus names into mere meaningless codes and he suggests that the names Pringle, Van Regenmortel and Bos are also meaningless codes. He seems to be unaware of the fact that members of the species *Homo sapiens* tend to attach special meanings to the names of their fellow members [5]. I hope he will believe me when I say that Bos is not a meaningless code. Bos is one of our most senior and respected plant virologists and his name will continue to be "meaningful" to all students and scientists in his field for many years to come.

References

1. Albouy J, Devergne J-C (1998) Maladies à virus des plantes ornementales. Editions INRA, Paris
2. Bos L (1999) The naming of viruses: an urgent call to order. Arch Virol 144: 631–636
3. Bos L (1999) Plant viruses, unique and intriguing pathogenesis – a textbook of plant virology. Backhuys, Leiden
4. Bos L (2000) Structure and topography of virus names. Arch Virol 145: 429–432
5. Carroll JM (1985) What's in a name? An essay in the psychology of reference. W. H. Freeman, New York
6. Fenner F (1976) Classification and Nomenclature of Viruses. Second Report of the International Committee on Taxonomy of Viruses. Intervirology 7: 1–115
7. Francki RIB (1981) Plant virus taxonomy. In: Kurstak E (ed) Handbook of plant virus infections and comparative diagnosis. Elsevier, Amsterdam, pp 3–16
8. Francki RIB (1983) Current problems in plant virus taxonomy. In: Matthews REF (ed) A critical appraisal of viral taxonomy. CRC Press, Boca Raton, pp 63–104
9. Francki RIB, Fauquet CM, Knudson DL, Brown F (1991) Classification and Nomenclature of Viruses. Fifth Report of the International Committee on Taxonomy of Viruses. Springer, Wien New York (Arch Virol [Suppl] 2)
10. Ghiselin MT (1997) Metaphysics and the origin of species. State University of New York Press, New York
11. Hull D (1997) The ideal species concept – and why we can't get it. In: Claridge MF, Dawah HA, Wilson MR (eds) Species: the units of biodiversity. Chapman and Hall, London, pp 357–380
12. Martelli GP (1992) Classification and nomenclature of plant viruses: state of the art. Plant Dis 76: 436–442
13. Matthews REF (1979) Classification and Nomenclature of Viruses. Third Report of the International Committee on Taxonomy of Viruses. Intervirology 12: 132–296
14. Matthews REF (1982) Classification and Nomenclature of Viruses. Fourth Report of the International Committee on Taxonomy of Viruses. Intervirology 17: 1–199
15. Matthews REF (1983) The history of viral taxonomy. In: Matthews REF (ed) A critical appraisal of viral taxonomy. CRC Press, Boca Raton, pp 1–35
16. Matthews REF (1985) Viral taxonomy. Microbiol Sci 2: 74–75
17. Matthews REF (1985) Viral taxonomy for the nonvirologist. Ann Rev Microbiol 39: 451–474

18. Mayden RL (1997) A hierarchy of species concepts: the denouement in the saga of the species problem. In: Claridge MF, Dawah HA, Wilson MR (eds) Species: the units of biodiversity. Chapman and Hall, London, pp 381–424
19. Mayo MA, Horzinek MC (1998) A revised version of the International code of virus classification and nomenclature. Arch Virol 143: 1645–1654
20. Mayr E (1982) The growth of biological thought. Diversity, evolution and inheritance. Harvard University Press, Cambridge
21. Milne RG (1984) The species problem in plant virology. Microbiol Sci 1: 113–122
22. Mishler BD, Donoghue MJ (1982) Species concepts: a case for pluralism. Syst Zool 31: 491–503
23. Murphy F, Fauquet CM, Bishop DHL, Ghabrial SA, Jarvis AW, Martelli GP, Mayo MA, Summers MD (1995) Classification and Nomenclature of Viruses. Sixth Report of the International Committee on Taxonomy of Viruses. Springer, Wien New York (Arch Virol [Suppl] 10)
24. Ogden CK, Richards K (1985) The meaning of meaning. Routledge and Kegan, London
25. Pringle CR (1991) The 20th Meeting of the Executive Committee of ICTV. Virus species, higher taxa, a universal database and other matters. Arch Virol 119: 303–304
26. Pringle CR (1999) Editorial. Virus Nomenclature. Arch Virol 143: 1645–1654
27. Quine WV (1960) Word and object. MIT Press, Cambridge, pp 233–243
28. Quine WV (1981) Predicates, terms and classes. In: Theories and things. Harvard University Press, Cambridge, pp 164–167
29. Van Regenmortel MHV (1989) Applying the species concept to plant viruses. Arch Virol 104: 1–17
30. Van Regenmortel MHV (1990) Virus species, a much overlooked but essential concept in virus classification. Intervirology 31: 241–254
31. Van Regenmortel MHV (1999) How to write the names of virus species. Arch Virol 144: 1041–1042
32. Van Regenmortel MHV (1999) Virus species. In: Granoff A, Webster RG (eds) Encyclopedia of virology, 2nd ed. Academic Press, New York, pp 1937–1943
33. Van Regenmortel MHV (2000) Introduction to the species concept in virus taxonomy. In: Van Regenmortel MHV, Fauquet CM, Bishop DHL, Carstens EB, Estes MK, Lemon SM, McGeoch DJ, Maniloff J, Mayo MA, Pringle CR, Wickner RB (eds) Seventh ICTV Report. Academic Press, New York San Diego, pp 3–16
34. Van Regenmortel MHV, Fauquet CM, Bishop DHL, Carstens EB, Estes MK, Lemon SM, McGeoch DJ, Maniloff J, Mayo MA, Pringle CR, Wickner RB (2000) Seventh ICTV Report. Academic Press, New York San Diego

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