

## Some notes on problems of taxonomy and nomenclature of cultivated plants

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### Abstract

The last two editions of the International Code of Nomenclature for Cultivated Plants (ICNCP) have seen a distinct reduction of the number of accepted categories due to the adoption of the culton concept. In contrast to the International Code of Botanical Nomenclature (ICBN), which is still a system exclusively for scientific use, it is the scope of the present ICNCP to provide a simple system for practical purposes and for a very diverse group of users with different intentions. Many problems related to synonymy result from the vast number of categories that have been introduced in the past. The comparison of different taxonomic works is further complicated by the sometimes very limited use of categories or their re-definition. Additional problems arise from incompatibilities between the Codes on different levels. The classification under the ICBN at present normally implies a phylogenetic background, but the ICNCP is aiming at providing a formal classification for practical use. The culton concept as a non-hierarchical system is incompatible with the hierarchical system of the ICBN, which results in problems with name conversions. Apart from these general problems, the acceptance of the ICNCP is very low as 1) for certain taxonomic aspects there is a lack of accepted categories, 2) the rules for naming cultivars are still too complicated or restrictive for practical use, and 3) the important commercial sector with trade-marks is not covered by the ICNCP. For the future, a harmonisation and consequent use of the Codes is necessary. Additionally, rules for naming clades have to be included because of the increasing amount and importance of molecular data. A great advance in this process will be the development and establishment of world-wide databases providing tools for linking and maintaining information on the relationships of plant names.

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## Introduction

The first written record on the naming of cultivars was published about 160 B.C. by Cato, yet it took more than 2,000 years before the first Code on the Nomenclature of Cultivated Plants (ICNCP) was published as a separate document in 1953. A detailed review of the history was given by the famous W.T. STEARN (1986).

The principles of the nomenclatural system have been quite stable in the past: “wild” and cultivated taxa were classified mainly on the basis of morphological characters and grouped in a hierarchical way. The classification was a formal one and the categories used were compatible. The situation remained the same when the first ICNCP was published (STEARNS 1953), but in “wild plant taxonomy” the idea of phylogenetic reconstruction instead of formal classification became more and more important. A whole host of problems came up with the use of the term “variety” as a formal category under the International Code of Botanical Nomenclature (ICBN) and simultaneously for cultivars. Various attempts to solve this problem have been made by proposing a vast number of new categories for cultivated plants.

In its last two editions (BRICKELL et al. 1980, TREHANE et al. 1995) the ICNCP has undergone dramatic changes, resulting in a reduction of the number of accepted categories and the adoption of the culton concept of HETTERSCHIED (1994) and HETTERSCHIED and BRANDENBURG (1995). This system is a non-hierarchical, open classification that is mostly incompatible with the classical system: for cultivated plants there are only two ranks (cultivar and cultivar-group) that can be placed anywhere under a genus, a species, a subspecies, a varietas or a forma. Furthermore, the same cultivar is allowed to belong to different cultivar-groups at the same time. Whereas the ICBN is still a system entirely for scientific use, the scope of the present ICNCP is to provide a simple system for practical purposes for a very diverse group of users with different intentions. As the culton concept is not very popular it is the intention to eliminate it from the next edition of the ICNCP (TREHANE 2001).

## Present situation

Because of incompatibilities between the two Codes on different levels, the present situation is rather complex:

- Whereas the classification under the ICBN (GREUTER et al. 2000) today normally implies a more or less phylogenetic background, the aim of the ICNCP (TREHANE et al. 1995) is to provide a formal classification for practical use.
- The culton concept as a non-hierarchical system is incompatible with the hierarchical system of the ICBN.

- Under the present Codes there are no rules for the treatment of clades, which become more and more important with the widespread use of molecular markers

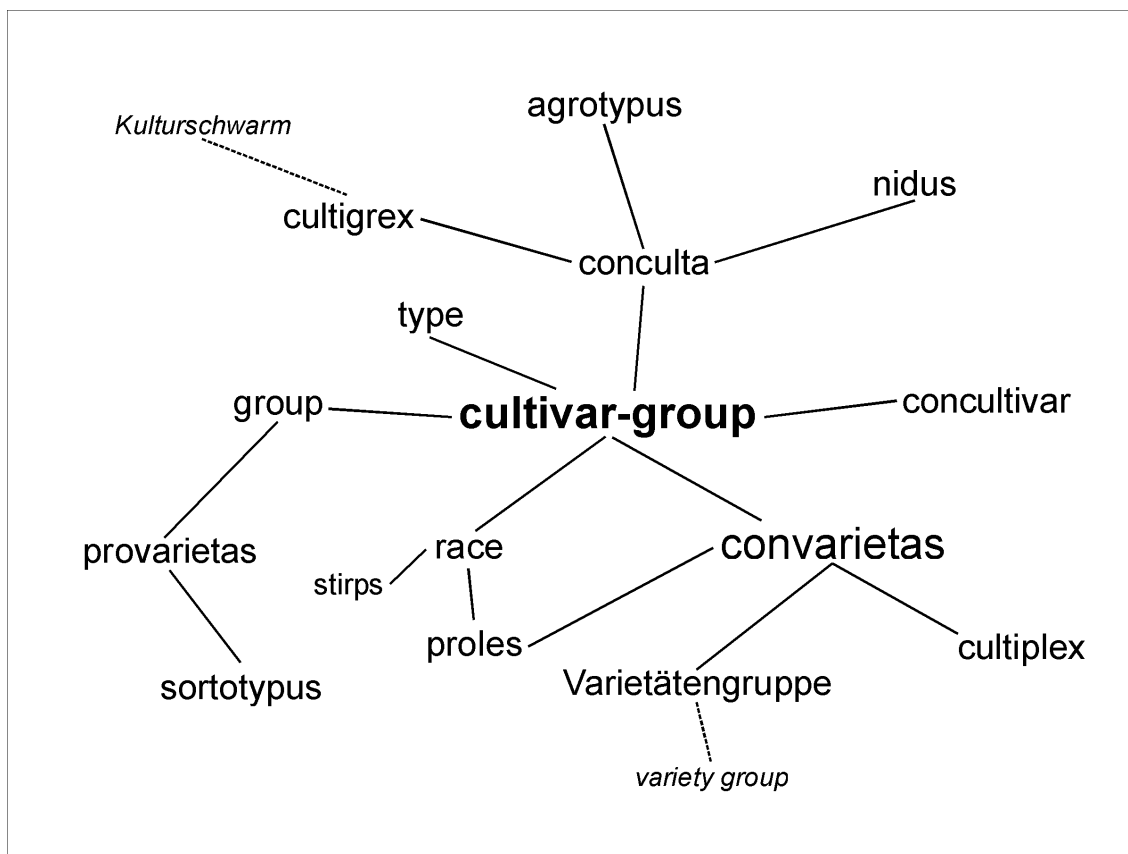
The present system is far from being satisfactory, but many problems with synonymy result from the vast number of categories and definitions from the past. The sometimes very limited use of categories or the re-definition of existing ones makes the comparison of different treatments very difficult, if not impossible. In the context of preparing “Mansfeld’s Encyclopedia of Agricultural and Horticultural Crops” (HANELT and INSTITUTE OF PLANT GENETICS AND CROP PLANT RESEARCH 2001) and the development of an online-database (OCHSMANN et al. 2003) a number of questions and problems concerning taxonomic categories and their complex relationships came up. For that reason an online-database with various information on the different taxonomic categories and their relations was developed (<http://mansfeld.ipk-gatersleben.de/taxcat2/>). An example is given in Figure 1. The information was taken from several sources. The complex nature of the “synonymy” of the taxonomic categories is obvious; besides chains of synonyms there are net-like structures, too.

Apart from these general problems the acceptance of the ICNCP seems to be extremely low because of several reasons:

1. Taxonomists working on cultivated plants constitute a minority of all practising taxonomists.
2. For certain scientific aspects there is a lack of categories accepted by the ICNCP, causing problems in the conversion of names (see example below) and a lack of information (re-use of names, no necessity of authorities).
3. The rules for naming cultivars are still too complicated or restrictive for non-taxonomists.
4. For purposes of stability there are too many exceptions from the rules.
5. The big commercial sector with trade-marks is not covered by the ICNCP.

### **Example from the Mansfeld Database**

The term “convarietas” was introduced by GREBENŠČIKOV (1949) for groups of varieties of cultivated plants that do not fulfil the criteria of subspecies. According to JIRÁSEK (1958) the terms “convar” and “convarietas” are equivalent. The “convarietas” was adopted as an accepted category by the ICBN in 1952 (LANJOUW et al. 1952), but was no longer included after the introduction of the ICNCP in 1953. In the ICNCP the term “convarietas” is only treated in the 1958 and 1961 editions (Art. 14) as a supplementary category, but is not mentioned in the 1969 edition (GILMOUR et al. 1969). Generally, the use of additional ranks is permitted by the ICBN (Article 4,



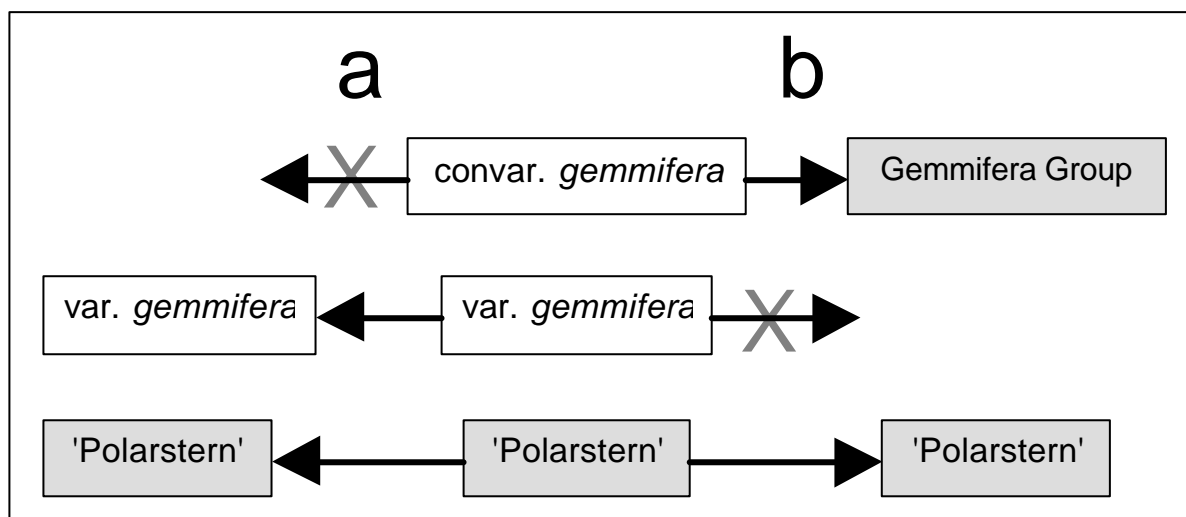
**Fig. 1: Relations between a number of taxonomic categories according to different sources (bold: accepted category according to the ICNCP; dotted lines and *Italics*: vernacular names)**

GREUTER et al. 2000: “Further ranks may also be intercalated or added, **provided that confusion or error is not thereby introduced.**” [emphasis added]), but “convarietas” is explicitly mentioned in Article 4, Note 2 of the recent ICNCP (TREHANE et al. 1995): “Prior to the introduction of cultivar-groups in this *Code*, authors may have used other designations such as ‘**convar**’, ‘sort’, ‘type’ or ‘hybrids’ as terminology equivalent to cultivar-group; **such terms are to be replaced by ‘cultivar-group’**” [emphasis added].

Though not being an accepted rank any more, the “convarietas” today still is in wide use, so that its future treatment by the Codes should be discussed further (see JEFFREY 2003).

The subspecific classification of *Brassica oleracea* ssp. *oleracea* used in HANELT and INSTITUTE OF PLANT GENETICS AND CROP PLANT RESEARCH (2001) is based on the category “convar.”. Two new combinations on the rank of “convar.” have been made in *Brassica oleracea* ssp. *oleracea*, though they seem to be in conflict with the Codes

(see above). The reason for the enduring use of “convar.” was that converting this system to a classification based on cultivar-groups would have affected 18 taxa and resulted in a loss of taxa. The two possibilities of adapting the names to the rules of the ICNCP are shown in Figure 2.



**Fig. 2: *Brassica oleracea* ssp. *oleracea*: Two possibilities of adapting the nomenclature to the rules of the ICNCP (grey boxes: ranks governed by the ICNCP)**

In the first case (Fig. 2 a) the convarieties (“convar.”) are eliminated and the varieties are maintained. In the second case (Fig. 2 b) “convar.” is converted to “cultivar-group” according to Art. 4 of the ICNCP. This would result in the elimination of all varieties (“var.”) because only cultivars are allowed below the rank of cultivar-group. It becomes obvious that important information on the taxonomic structure of the group is lost in both cases due to the elimination of categories. This loss of information is regarded as one of the major disadvantages of the culton concept even if it works well in practice in certain plant groups (e.g. *Beta*, see FRESE 2003).

Another source of trouble are some existing gaps in the definitions of the ICBN and the ICNCP (Principle 2, ICNCP, TREHANE et al. 1995): “The *International code of botanical nomenclature* (ICBN or Botanical Code) governs the botanical names in Latin form for both cultivated and wild plants, except for graft-chimeras which are entirely governed by this *Code*. **Distinguishable groups** of cultivated plants, whose origin or selection **is primarily due to the intentional actions of mankind**, are to be given epithets formed according to the Rules and provisions of the *Code*.” [emphasis added]. Depending on the subjective decision of the author a new taxon, only known from cultivation, may be described as species, subspecies, varietas or forma under the ICBN or as cultivar under the ICNCP. If a cultivated plant had been given a cultivar name, but later is found in the wild, too, the wild plant has to be newly described

under the ICBN. The same is true for many weedy forms of cultivated plants that escaped from fields or gardens and established themselves in the wild (crop-weed-complexes). On the other hand it remains questionable if laciniate or variegated forms taken into culture from the wild differ from the wild populations in the sense of Principle 2 of the ICNCP so that they can be given a cultivar name.

How can taxonomic relationships between cultivated plants and their wild relatives be expressed when two different naming systems can be used in the same plant group?

At present the ICBN also has to face dramatic changes: With the rapid developments in molecular techniques large amounts of new data are available that cannot be easily handled with a closed hierarchical naming system without a big number of nomenclatural changes (e.g. clades).

For that reason a system of “phylogenetic nomenclature” (DE QUEIROZ and GAUTHIER 1992 and 1994), that claims to provide the solution for the future, is promoted (see PhyloCode, CANTINO and DE QUEIROZ 2000). Examples using the classical system and the phylogenetic approach alternatively were presented by CANTINO et al. (1998 and 1999). The discussion regarding the PhyloCode (see ongoing discussion in *Taxon* and other journals, e.g., BRUMMITT 1997, CANTINO 1998 and 2000, DE QUEIROZ 1997, LEE 1999 and 2001) seems to suffer from misunderstandings, mainly caused by a lack of communication between “classical taxonomists” and “phylogenetic nomenclaturists”. The PhyloCode is a non-hierarchical, phylogeny-based system of rules for the naming of clades that avoids nomenclatural changes only due to the maintenance of the hierarchical structure of the names. The major disadvantages are 1) the mixing of nomenclature and taxonomy, 2) the general assumption of tree-like phylogenies (causing problems in the case of hybridisation and introgression), 3) the assumption of species as basic units, 4) the necessity of world-wide registration of names (just eliminated from the recent ICBN), and 5) the lack of reference to the ICNCP and cultivated plants.

It seems highly questionable, whether the PhyloCode will lead to a stable and objective classification, because the consequences of the application of some rules remain unclear. Instead, taxonomists who know the problems and pitfalls of synonymy, priority, and name changes already solved or avoided in the past, should work out modifications of the present (“Linnean”) nomenclatural system.

### **Some prospects for the future**

Though stability of names is one of the first principles of both the ICBN and ICNCP, one has to distinguish between changes due to new results in taxonomic research and changes due to nomenclatural reasons (e.g., name conversion or shift of ranks).

While the first type of changes will always be necessary, the second type of changes should be avoided as far as possible. In this respect, it is highly necessary to provide special rules and non-hierarchical categories for units like clades or populations of wild or cultivated plants. Additionally, the importance of nomenclature and taxonomy must be explained to non-taxonomists by better co-operation between the ICBN and ICNCP and a consequent use of the Codes by all taxonomists, avoiding ambiguous terms like “variety” for cultivars in literature.

Helpful in this respect will be the development and establishment of world-wide taxonomic databases providing tools for linking and keeping information on the relations of different names.

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