

# Current Problems in Nomenclature and Taxonomy of Cultivated Plants

J. Ochsmann  
KWS SAAT AG  
Grimsehlstraße 31  
37555 Einbeck, Germany  
j.ochsmann@kws.de

**Keywords:** codes of nomenclature, ICBN, ICNCP, classification, taxonomic categories

## Abstract

**In its last two editions, the International Code of Nomenclature for Cultivated Plants (ICNCP) has undergone dramatic changes, resulting in a reduction of the number of accepted categories and the adoption of the culton concept. Whereas the International Code of Botanical Nomenclature (ICBN) is still a system exclusively for scientific use, it is the scope of the present ICNCP to provide a simple system for practical purposes for a very diverse group of users with different intentions. The present problems can be assigned to three major groups: 1) classification, 2) new methods, and 3) nomenclature. The first two aspects affect the ICBN as well as the ICNCP and are due to the lack of an adequate theoretical background for the treatment of reticulate evolution. Though the present system of the ICNCP is far from being satisfactory, many nomenclatural problems result from the vast number of categories that have been introduced in the past. The sometimes very limited use of categories or their re-definition makes the comparison of different works very difficult, if not impossible. Aside from these general problems the acceptance of the ICNCP is low as 1) for certain taxonomic aspects there is a lack of accepted categories, 2) some 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. Some needs for the future can be identified: 1) harmonisation of the Codes 2) consequent use of them for new names or combinations 3) avoidance of ambiguous categories 4) inclusion of rules for naming clades. The development and establishment of worldwide databases providing tools for linking and maintaining information on the relationships of plant names will be of great help in this process.**

## INTRODUCTION

Apart from difficulties directly connected with the classification of cultivated plants, there are more general problems, such as the relations between wild and cultivated plants or the treatment of infraspecific taxa. Some of these problems were already discussed more than 15 years ago (see Styles, 1986), before the introduction of the culton concept (Hettterscheid, 1994; Hettterscheid and Brandenburg, 1995). The difficulties of hierarchical classifications in infraspecific taxa have been discussed in detail by Stace (1986), giving examples and claiming that the system used by the *International Code of Botanical Nomenclature* or ICBN (Greuter et al., 2000) does not fit the needs of a modern taxonomy.

Whereas at present the classification under the ICBN normally more or less implies a phylogenetic background, the *International Code of Nomenclature for Cultivated Plants* or ICNCP (Trehane et al., 1995) 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, resulting in problems with classifications treating cultivated as well as wild plants or converting hierarchical names according to the rules of the ICNCP.

One of the major difficulties that remain is to deal with the opposing interests of the great diversity of potential users of the ICNCP: taxonomy, plant breeding, economy and government. Even the ICBN, which is designed for scientific use only, is subject to very controversial discussions and fundamental changes (e.g. cancellation of plant registration).

## CURRENT SITUATION

The current situation of cultivated plant taxonomy and nomenclature is rather complex because there are different sources of problems. First, there are some principal difficulties with classification on low taxonomic levels that have been widely discussed for the last decades without workable solutions. Second, with the use of new techniques and the data they generate, new needs and problems arise that have to be considered by the nomenclatural *Codes*. Last, there are purely nomenclatural problems due to incompatibilities of the ICBN and the ICNCP. Some of these arise merely through inconsistencies of the wording of the two Codes, others are due to the incompatibility of the classification systems (closed versus open classification system) or the great number of categories used in the past. In the following, only some topics of the whole complex are discussed in detail on the basis of examples.

### Relations between Cultivated Plants and Their Wild Relatives

Though the proportion of taxonomists working in gene banks might be very small in relation to the total number of users, one of the “classical” problems of the ICNCP since the adoption of the term “cultivar” are the relations between cultivated plants and their wild relatives (see Brandenburg, 1999; Pickersgill et al., 2004). How can these relationships be expressed when two different naming systems have to be used in the same plant group?

Though cultivated plants may be named in accordance with the ICBN below species level “*if, and only in so far as, they are identifiable with botanical taxa in these ranks*” (ICNCP, Art. 1), wild plants are fully excluded from the ICNCP. This implies that grouping cultivars or cultivar-groups together with their wild relatives needs the construction of hierarchies using subspecies, varietates and formae or the use of informal groups (see *Phaseolus vulgaris* example in Pickersgill et al., 2004).

Another possibility – though not very likely to be accepted – would be the re-adoption of convarietas as an additional category between subspecies and varietas under the ICBN (Jeffrey, 2004). This would imply, of course, the possibility of the acceptance of wild taxa at the rank of convariety and the coexistence of convarietas and cultivar-group. Both solutions contradict the intentions of the *Codes*, and would increase the problems concerned with hierarchical infraspecific classification (see below).

Another problem in gene bank work is the treatment of land-races that are a mixture of different morphological variants and thus not treated as taxonomic units by either of the *Codes*. It is highly desirable to include some instructions for the treatment of land-races in new versions of the ICNCP.

### Infraspecific Classification and Hybridisation

“The need for a system of infraspecific ranks to take account of all the different sorts of patterns of variation encountered has not been answered. This has led to the realization that the present system, as laid down in the Code, is inadequate, and to the trend alluded to above whereby ranks other than subspecies have become largely abandoned.” (Stace, 1986: 15). Although stated more than 15 years ago, these sentences still describe the present situation. Due to hybridisation and introgression, the relations are often not hierarchical but net-like, not only below the species level. The amount of hybridisation has been under-estimated for a long time (Raamsdonk, 1995), thus the nomenclatural concept for hybrids has to be revised (Appendix I, ICBN). Non-hierarchical relations cannot be classified in a closed system without creating a great number of names for all the intermediate forms. The difficulties with classifying intermediate forms, as described in the example by Stace (1986: 12-13), will be even bigger in multi-level classifications of complex cultivated plant groups (e.g. *Triticum aestivum*; Dorofeev et al., 1979). “Every opportunity should be taken to use informal systems of reference and classification to avoid overloading of the formal nomenclature. In many widespread species this has already reached such dimensions that even a monographer should not be expected to spend valuable time getting his nomenclature technically correct” (Burt, 1970: 238).

Despite the discussion of the ideological background and the limited number of categories, the culton concept seems to be more appropriate for a classification of infraspecific taxa or hybrids. Thus, certain rules for naming informal groups in non-hierarchical classifications should be included in the ICBN. Unfortunately, the discussions regarding taxonomy of plants focus on different models of speciation etc. (see Knox, 1998), taking for granted the species as basic unit and tree-like structures of evolution (see Bachmann, 1998).

The gene pool concept (Harlan and De Wet, 1971) has been paid much attention to, especially by breeders as it allows the inclusion of cultivated as well as wild plants on different levels. It is regarded as an alternative to the culton concept by some authors, but in many cultivated plants the cultivars and cultivar-groups would all belong together to the primary gene pool and information on breeding barriers is often not available.

### **Example: Convarietas**

The term convarietas (= convar, see Jirásek (1961); short form: convar.; vernacular: convariety) was introduced by Grebenšcikov (1949) as a category for groups of cultivated varieties, but different definitions were given by several authors (see Mansfeld, 1953; Jirásek, 1961; Jeffrey, 1968). It was adopted by the first ICNCP (Stearn, 1953, Art. C.29b) as “a group of cultivars within a variable species or interspecific hybrid possessing common features of importance to cultivators”. In the 1958 edition of the ICNCP (Art. 14) the convarietas was placed among the “Supplementary Categories” which only have botanical characters and are therefore governed by the ICBN. Since 1969 it is no longer listed as accepted by the ICNCP, but – as a category exclusively for cultivated plants – it is not mentioned in the ICBN, either. According to the present ICNCP, it has to be replaced by cultivar-group (see ICNCP, Art. 4.1, Note 2: “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”, but the term is still in use for different reasons: 1) In certain groups there is a lack of categories provided by the ICNCP to represent the structure of diversity. 2) In many cases the conversion into cultivar-groups would result in a high number of name changes and/or a loss of information. 3) The ICBN in general allows the intercalation of additional ranks, as long as the hierarchy of the accepted categories is maintained.

The following example is taken from Hanelt and Institute of Plant Genetics and Crop Plant Research (2001). The infraspecific classification of *Brassica oleracea* ssp. *oleracea* used there is based on the category convarietas (“convar.”). Two new combinations on the rank of convarietas 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 convarietas was that converting this system to a classification based on cultivar-groups would have affected a whole group of at least 18 taxa and resulted in a loss of taxa. Avoiding the category convarietas in accordance with the ICBN would have made necessary either the raising of all convarieties to subspecific rank (with even more nomenclatural changes) or the introduction of an additional informal category between the subspecies and the varieties. The two remaining possibilities of adapting the names to the rules of the *Codes* without the introduction of further categories are shown in Fig. 1.

In the first case (Fig. 1a) the convarieties (“convar.”) are eliminated and the varieties are maintained. In the second case (Fig. 1b) “convar.” is converted to “cultivar-group” according to Art. 4.1, Note 2 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. *Aster*, Hettterscheid and van den Berg, 1996; *Beta*, Lange et al., 1999).

### Stability Versus Priority?

Among taxonomists there is an ongoing discussion on valid publication and priority versus conservation of names. Some taxonomists doubt if it is still useful to keep priority as a general principle, especially for infraspecific names (see Burtt, 1970: 238: "... I referred to the muck-heap of two centuries of unindexed and inadequately described names. The best thing to do with a muck-heap is to leave it undisturbed so that it quietly rots down."). On the other hand it is impossible to generally exclude all names published by authors from eastern Europe or northern Asia just because the literature has not been available to western workers before the falling of the "Iron Curtain". Independent from their current nomenclatural status these names including the type specimens need to be catalogued in a database system generally available to the public.

But even for widely known names there are long-lasting discussions on the legitimacy of those names and the consequent name-changes. A recent example is the proposed name change for the cultivated apple by Mabberley et al. (2001). However, it must be stated that name-changes will always be necessary due to new results in science and therefore must be permitted.

Another sort of stability that should be achieved is the stability of nomenclatural terms and categories accepted by the *Codes*. A look on former editions of the *Codes* immediately brings up a great number of different terms and categories, some of them only valid in single editions of a code or re-defined by several authors. Unfortunately, this might be true also for one of the only two accepted categories of the present ICNCP, the "cultivar-group" (see draft of new ICNCP). Though not affecting the names themselves, the change of the category name might produce confusion, as "group" is frequently used for informal classifications under the ICBN. The situation is somewhat similar to the case of "variety", which has been used in the past as a formal category under the ICBN and simultaneously for cultivars, causing lots of problems. Various attempts to solve this problem have been made by proposing a vast number of new categories for cultivated plants, rather contributing to the problem, than solving it (see Fig. 2).

### Need for Harmonisation and Consequent Use of the *Codes*

An important, though difficult task is the harmonisation of the wording of the ICBN and the ICNCP. The two *Codes* are prepared by two different commissions and are not published simultaneously, so a harmonisation is only possible in one direction and thus very time consuming. As the last edition of the ICBN has been published in 2000, an adaptation to a new version of the ICNCP is only possible in 2005. To reduce the inconsistencies the next edition of the ICNCP has to follow the ICBN in important parts, though the wording might not be optimal with respect to cultivated plants. Several inconsistencies present in the ICNCP-1995 will hopefully be corrected in the next edition.

Under the ICBN, homonymy is permanent, but under the ICNCP, it appears that this is not always true. In one denomination class, that might include more than one genus, the names have to be unique, so a name might be rejected as a homonym. The Asteraceae genera *Lactuca* and *Cichorium* belong to the same denomination class (see ICNCP, Appendix IV), so the cultivar-group name "Cutting Group" can only be used either in *Cichorium endivia* or *Lactuca sativa*. In 1988, *Lactuca sativa* was transferred to a new genus *Pterocypsela* by Shih, which might constitute division of a denomination class under Art. 6.3 of the ICNCP (see Jeffrey, 2004), so that the cultivar-group name "Cutting Group" now could be used in *Cichorium* and *Pterocypsela*.

Another step in this direction will be the consequent use of a different terminology for the different classification systems in future editions of the *Codes* (e.g. ICBN: taxa <-> ICNCP: culta; ICBN: varietas, forma <-> ICNCP: cultivar-group, cultivar), avoiding ambiguous vernacular terms like "variety" for cultivars. It should be clear from the terms and categories, whether a hierarchical classification of the Linnaean system or an open classification based on the culton concept is used in a certain group. In this respect, it seems more important to identify the different classification systems than to express different ideological backgrounds (cf. Jeffrey, 1968; Hanelt, 1986; Hetterscheid and

Brandenburg, 1995).

Presently the acceptance of the ICNCP seems to be rather low. The reasons are different in the different groups of users. For many taxonomists working on cultivated plants and their wild relatives the ICNCP lacks the possibility of representing complex relationships (see example *convarietas*). Additionally, dealing with two *Codes* using incompatible classification systems is sometimes very difficult. On the other hand, users from the commercial sector do not need a system to express complex relationships in the names used, but a simple one for assigning cultivar names adapted to practical needs. Obviously some of the rules are still too restrictive or complicated to be used in commercial practise. Additionally, for the legal protection of cultivar names the UPOV convention (see Heitz, 1999) is relevant instead of the ICNCP. As the interests of the users are so diverse, it is obvious that the ICNCP will ever be a compromise between basic scientific needs and maximal freedom for naming and grouping cultivars. To increase the acceptance of the ICNCP by breeders and other non-taxonomists it is important to keep the rules for naming cultivars as simple as possible and give good examples how to use them. Advice is also needed on how to refer to names not covered by the ICNCP, such as orchid “*grex*” names and trade-marks.

### **Molecular Data**

With the rapid development in molecular techniques, a large amount of new data becomes available for cladistic analysis. These data cannot be handled in a closed classification system such as the ICBN without a great number of nomenclatural changes. For that reason a system of “phylogenetic nomenclature” (De Queiroz and Gauthier, 1992; 1994), that claims to provide the solution for the future, is promoted (see PhyloCode, Cantino and de Queiroz, 2000). 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. Examples using the classical system and the phylogenetic approach alternatively were presented by Cantino et al. (1997).

There is a very controversial discussion concerning the PhyloCode (see Taxon and other journals, e.g. Brummitt, 1997; Cantino, 2000; Lee, 2001), but it seems to suffer from misunderstandings, mainly caused by a lack of communication between “classical taxonomists” and “phylogenetic nomenclaturists”. In fact, general rules for naming clades are urgently needed, but they should be worked out in the frame of the ICBN and ICNCP by experienced taxonomists who know the problems and pitfalls of synonymy, priority, and name changes already solved or avoided in the past. It seems highly questionable, whether the PhyloCode would lead to a stable and objective classification, because the consequences of the application of some rules remain unclear. The major disadvantages of the proposed PhyloCode are, 1) the mixing of nomenclature and taxonomy, 2) the general assumption of tree-like phylogenies (causing problems in 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 any reference to the ICNCP and cultivated plants.

Though it seems highly improbable that cultivars will be defined solely by certain molecular characters, the wording of the ICNCP needs clarification. Art. 2.12. of the present ICNCP states that assemblages of individuals may be accepted as cultivars “..., *even though such individuals may not necessarily be genetically uniform*”, and Art. 2.18 indicates that “*all indistinguishable variants, irrespective of their origin, are treated as one cultivar*”. Unfortunately, no definition of the term “indistinguishable” is given and the role of chemical, cytological, or molecular characters remains unclear. The problems of using molecular characters in cultivar classification has been discussed by Culham and Grant (1999).

### **CONCLUSIONS**

To improve the situation of nomenclature and taxonomy of cultivated plants forces

have to be joined on different fields. Most urgently needed by ICNCP and ICBN is a general classification system that can handle net-like relationships due to hybridisation and introgression, mainly - but not exclusively - on low taxonomic levels. This also includes the treatment of molecular data, mostly presented in clades. Although long ago Stace (1986) and others demanded a change of the system for the infraspecific classification under the ICBN, the hierarchical system is still adopted. Today it is widely known that reticulate evolution is very common on low taxonomic levels, but at present, there is no initiative to adapt the nomenclatural rules. The publication of the PhyloCode clearly demonstrates the strong need for such an adaptation including molecular data. One reason for retaining the existing system might be the lack of an appropriate theoretical background for treating reticulate evolution. The discussion is focussed on different hierarchical systems (see Knox, 1998), but the hierarchical nature of the data and the existence of species as units are generally taken as basic facts. In his review, Bachmann (1998) goes one step further with questioning the whole classification system based on species. He proposes to replace the species-based concept by an individual-based one, as individuals are the basic units of variation. For the adaptation of the nomenclatural *Codes* to non-hierarchical data a broad discussion among taxonomists is needed. The focus should be put in adding special categories and rules for such data instead of abandoning the whole system. In this respect, the experiences made with the ICNCP and its open classification may be of great help.

One of the major problems of the ICNCP is the wide scope of users with different or opposing intentions. Name changes necessary from a scientific point of view may not be acceptable for economic reasons (e.g. *Chrysanthemum*, *Malus*). Therefore a compromise between precise basic nomenclatural rules and economic freedom for naming cultivated plants is needed. For a taxonomist, it is very difficult to estimate the rate of failure/success when trying to apply the ICNCP. The proportion of taxonomists seems to be very small in comparison with breeders or sellers, so that problems with complex groups may be over-represented in literature. For wider acceptance by users from the commercial sector a harmonisation and cross-referencing of the ICNCP with legal conventions (e.g. UPOV) is absolutely necessary. Otherwise two classes of cultivar names will exist, both established on different sets of rules. The overall acceptance of the ICNCP still seems to be quite low, though the rules of the ICNCP are more and more followed in scientific publications and databases. As this development will lead to an increasing amount of standardisation in nomenclature of cultivated plants, it is important to keep the terminology used in the present edition of the ICNCP and to harmonise the wording of the two *Codes*.

Some of the nomenclatural problems, that are important today, may be solved by the establishment of global online-databases that provide a basis for “multiple classifications” (see Hanelt, 1986). With increase of nomenclatural and taxonomic as well as other information stored in such databases, identification of taxa (and culta) will become more and more easy by using different names or characters. Even “transformations” between different classifications using either classical or culton names will be possible (e.g. *Beta vulgaris* subsp. *vulgaris* convar. *vulgaris* var. *rapacea* Koch (1837), s.str. = *Beta vulgaris* subsp. *vulgaris* Fodder Beet Group).

#### NOTE

Various modifications have recently been proposed by Piers Trehane in a working draft for the new edition of the ICNCP, covering all fields of nomenclature of cultivated plants. Several of these modifications will solve problems mentioned above – if adopted for the new edition – others need further discussion. As this draft is merely a basis for discussion and will therefore be modified before the publication of the new *Code*, this paper refers to the 1995 edition of the ICNCP (Trehane et al., 1995).

## Literature Cited

- Bachmann, K. 1998. Species as units of diversity: an outdated concept. *Theory Biosci.* 117:213-230.
- Brandenburg, W.A. 1999. Crop-weed complexes and the culton concept. p.145-157. In: S. Andrews, A.C. Leslie and C. Alexander (eds.), *Taxonomy of cultivated plants*, 3<sup>rd</sup> Intl. Symposium, Royal Botanic Gardens, Kew.
- Brummitt, R.K. 1997. Taxonomy versus cladonomy, a fundamental controversy in biological systematics. *Taxon* 46:723-734.
- Burt, B.L. 1970. Intraspecific categories in flowering plants. *Biol. J. Linn. Soc.* 2:233-238.
- Cantino, P.D. 2000. Phylogenetic nomenclature: addressing some concerns. *Taxon* 49(1): 85-93.
- Cantino, P.D., Olmstead, R.G. and Wagstaff, S.J. 1997. A comparison of phylogenetic nomenclature with the current system: A botanical case study. *Syst. Biol.* 46:313-331.
- Cantino, P.D. and de Queiroz, K. 2000. PhyloCode: a Phylogenetic Code of Biological Nomenclature. <http://www.ohiou.edu/phylocode/>
- Culham, A. and Grant, M.L. 1999. DNA markers for cultivar-identification and classification. p.183-198. In: S. Andrews, A.C. Leslie and C. Alexander (eds.), *Taxonomy of cultivated plants*, 3<sup>rd</sup> Intl. Symposium, Royal Botanic Gardens, Kew.
- De Queiroz, K. and Gauthier, J. 1992. Phylogenetic taxonomy. *Annu. Rev. Ecol. Syst.* 23:449-480.
- De Queiroz, K. and Gauthier, J. 1994. Toward a phylogenetic system of biological nomenclature. *Trends Ecol. Evol.* 9:27-30.
- Dorofeev, V.F., Filatenko, A.A., Migushova, E.F., Udaczin, R.A. and Jakubziner, M.M. 1979. Pšenica [Wheat]. In: V.F. Dorofeev and O.N. Korovina (eds.), *Kul'turnaja Flora SSSR. [Flora of cultivated plants] I. Kolos, Leningrad.* (in Russian).
- Grebenšikov, I. 1949. Zur morphologisch-systematischen Einteilung von *Zea mais* L. unter besonderer Berücksichtigung der südbalkanischen Formen. *Züchter* 19:302-311.
- Greuter, W., McNeill, J., Barrie, F.R., Burdet, H.M., Demoulin, V., Filgueiras, T.S., Nicolson, D.H., Silva, P.C., Skog, J.E., Treharne, P., Turland, N.J. and Hawksworth, D.L. 2000. International Code of Botanical Nomenclature (Saint Louis Code) adopted by the Sixteenth International Botanical Congress St. Louis, Missouri, July-August 1999. *Regnum Veg.* 138.
- Hanelt, P. 1986. Formal and informal classifications of the infraspecific variability of cultivated plants - advantages and limitations. p.139-156. In: B.T. Styles (ed.), *Intraspecific classification of wild and cultivated plants*, Oxford University Press, Oxford.
- Harlan, J.R. and De Wet, J.M.J. 1971. Toward a rational taxonomy of cultivated plants. *Taxon* 20:509-517.
- Heitz, A. 1999. Plant variety protection and cultivar names under the UPOV convention. p.59-65. In: S. Andrews, A.C. Leslie and C. Alexander (eds.), *Taxonomy of cultivated plants*, 3<sup>rd</sup> Intl. Symposium, Royal Botanic Gardens, Kew.
- Hettterscheid, W.L.A. 1994. The culton concept: recent developments in the systematics of cultivated plants. *Acta Bot. Neerl.* 43:78. [Abstr.].
- Hettterscheid, W.L.A. and Brandenburg, W.A. 1995. Culton versus taxon: conceptual issues in cultivated plant systematics. *Taxon* 44:161-175.
- Hettterscheid, W.L.A. and van den Berg, R.G. 1996. Cultonomy of *Aster* L. *Acta Bot. Neerl.* 45:173-181.
- Jeffrey, C. 1968. Systematic categories for cultivated plants. *Taxon* 17:109-114.
- Jeffrey, C. 2004. Theoretical and practical problems in the classification and nomenclature of cultivated plants, with examples from Cucurbitaceae and Compositae. In: Knüpfper, H. and Ochsmann, J. (Eds.): *Rudolf Mansfeld and Plant Genetic Resources. Proceedings of a symposium dedicated to the 100th birthday of Rudolf Mansfeld. Gatersleben, Germany, 8-9 October 2001.* *Schriften Genet. Ressourcen* 22:51-59.
- Jirásek, V. 1961. Evolution of the proposals of taxonomic categories for the classification

- of cultivated plants. *Taxon* 10:34-45.
- Knox, E.B. 1998. The use of hierarchies as organizational models in systematics. *Biol. J. Linn. Soc.* 63:1-49.
- Lange, W., Brandenburg, W.A. and De Bock, T.S.M. 1999. Taxonomy and cultonomy of beet (*Beta vulgaris* L.). *Bot. J. Linn. Soc.* 130:81-96.
- Lee, M.S.Y. 2001. On recent arguments for phylogenetic taxonomy. *Taxon* 50:175-180.
- Mabberley, D.J., Jarvis, C.E. and Juniper, B.E. 2001. The name of the apple. *Telopea* 9:421-430.
- Mansfeld, R. 1953. Zur allgemeinen Systematik der Kulturpflanzen. I. Kulturpflanze 1:138-155.
- Pickersgill, B., Chacón Sánchez, M.I. and Debouck, D.G. 2004. Multiple domestications and their taxonomic consequences: the example of *Phaseolus vulgaris*. In: Knüpfper, H. and Ochsmann, J. (Eds.): Rudolf Mansfeld and Plant Genetic Resources. Proceedings of a symposium dedicated to the 100th birthday of Rudolf Mansfeld. Gatersleben, Germany, 8-9 October 2001. *Schriften Genet. Ressourcen* 22:71-83.
- Stace, C.A. 1986. The present and future infraspecific classification of wild plants. p.9-20. In: B.T. Styles (ed.), *Infraspecific Classification of Wild and Cultivated Plants*, Oxford University Press, Oxford.
- Stearn, W.T. 1953. *International Code of Nomenclature for Cultivated Plants*. Roy. Hort. Soc., London.
- Styles, B.T. 1986. *Infraspecific classification of wild and cultivated plants*. Clarendon Press, Oxford.
- Trehane, P., Brickell, C.D., Baum, B.R., Hettterscheid, W.L.A., Leslie, A.C., McNeill, J., Spongberg, S.A. and Vrugtman, F. 1995. *The International Code of Nomenclature for Cultivated Plants – 1995*. (ICNCP or Cultivated Plant Code), adopted by the International Commission for the Nomenclature of Cultivated Plants, Quarterjack Publishing, Wimborne, U.K. (Regnum Veg. 133).
- van Raamsdonk, L.W.D. 1995. The effect of domestication on plant evolution. *Acta Bot. Neerl.* 44:421-438.
- Žukovskij, P.M. 1967. The nature and the span of species in cultivated plants. *Bot. Zurn. SSSR* 52:1530-1539 (in Russian, with English summary).

**Figures**

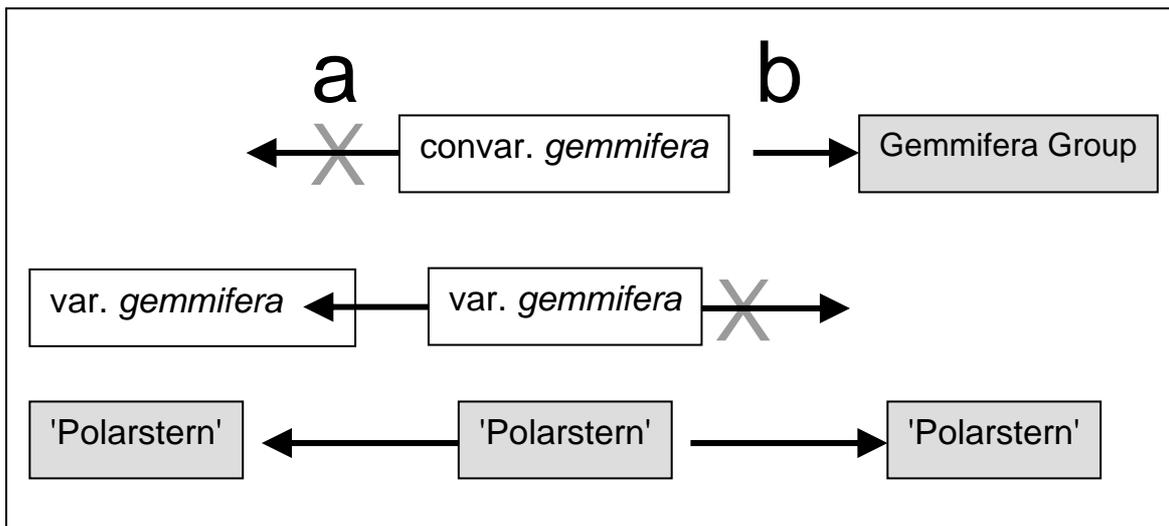


Fig. 1. *Brassica oleracea* ssp. *oleracea*: Two possibilities of adapting the nomenclature to the rules of the ICNCP (grey boxes: ranks governed by the ICNCP).

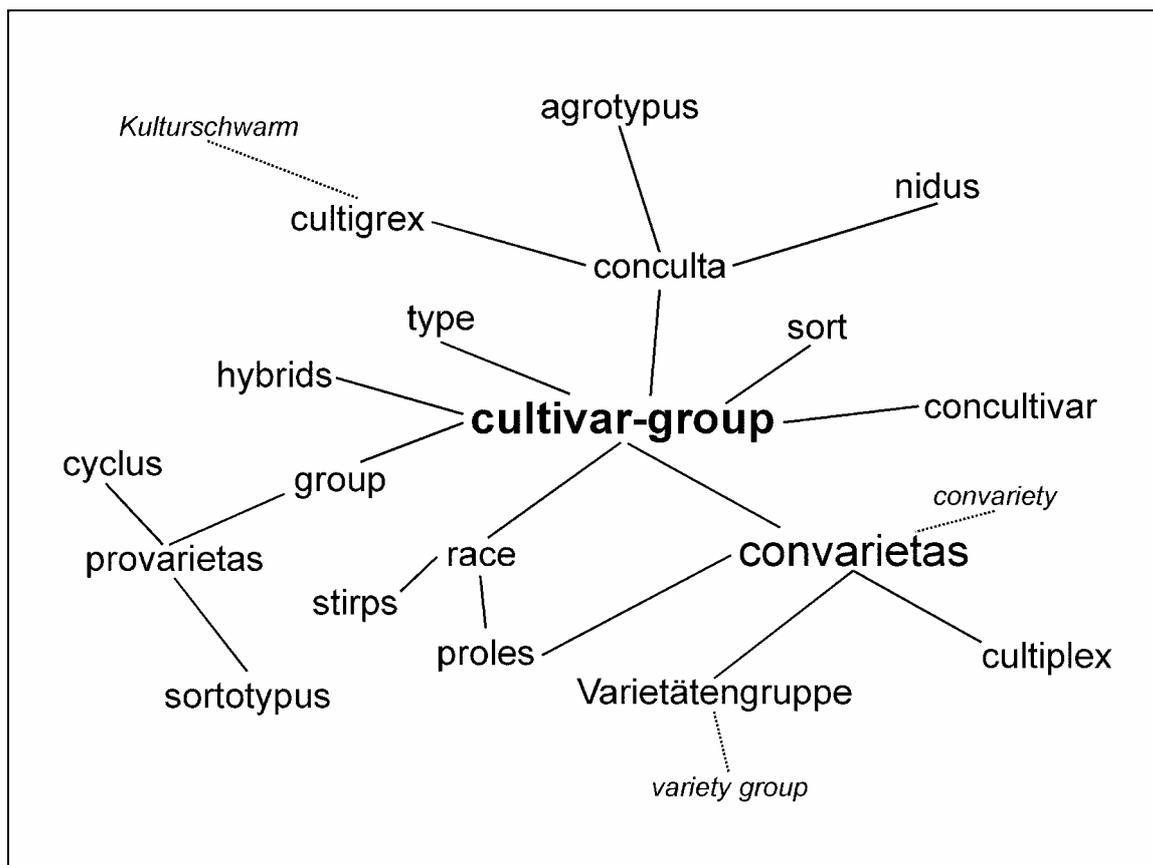


Fig. 2. Relations between a number of taxonomic categories according to different sources (Harlan and De Wet, 1971; Jeffrey, 1968; Jirásek, 1961; Mansfeld, 1953; Trehane et al., 1995; Žukovskij, 1967; and others). **Bold**: accepted category according to the ICNCP; dotted lines and *Italics*: vernacular names.