Nomenclature of Cultivated Plants: a Historical Botanical Standpoint

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Abstract

Prior to publication of the first edition of the *International Code of Nomenclature of Cultivated Plants (ICNCP)* some 50 years ago, the only rules governing the naming of cultivated plants were those that also dealt with plants in the wild, the forerunners of the present *International Code of Botanical Nomenclature (ICBN)*. Even today, the Preamble to the *ICBN* states that its "rules and recommendations apply to all organisms traditionally treated as plants", but also goes on to say that the *ICNCP* "deals with the use and formation of names for special plant categories in agricultural, forestry, and horticultural nomenclature." The need for the *ICNCP* and the way in which the two *Codes* interact are addressed. The progressive independence of plant nomenclature from taxonomy, the theory and practice of classification, is outlined from Linnaeus's development of the binomial to the adoption of the type method. In general, the *ICBN* makes no assumptions as to the methods, principles or purposes of taxonomy, save one, that the units of taxonomy, the taxa being named, are in some way nested in a hierarchy of ranks. Variation at and below the species level, whether in wild or cultivated plants, is not readily accommodated in a hierarchical structure. On the other hand, the need to communicate and hence name the enormous diversity of cultivated plants at such levels is manifest. The *ICNCP* provides the rules by which this can be achieved. Cultivated plants fall under the provisions of the *ICBN* in so far, but only in so far, as they fall within the general system of classification of plants; beyond that the provisions of the *ICNCP*, which do not require an extensive and obligatory hierarchy of entities, and do not presume that desirable groupings are necessarily non-overlapping, apply.

INTRODUCTION

As explained by Piers Trehane in the previous paper (Trehane, 2004), separate rules for the naming of cultivated plants are a relatively recent development, going back only some 50 years. Prior to publication of the first edition of the *International Code of Nomenclature of Cultivated Plants* in 1953 (Stearn, 1953), the only rules governing the naming of cultivated plants were those that also dealt with plants in the wild, i.e., the successive editions of the *International Rules of Botanical Nomenclature* (Briquet, 1906; 1912; 1935) (or the *International Code of Botanical Nomenclature* as it became in 1952 – Lanjouw et al., 1952), and their predecessors, such as Alphonse de Candolle's *Lois* (Candolle, 1867). Art. 40 of the *Lois* dealt with the names of plants of horticultural origin and read (English translation, Candolle, 1868): "Seedlings, half-breeds of uncertain origin, and sports should receive from horticulturists fancy names in common language, as distinct as possible from the Latin names of species or varieties. When they can be traced back to a botanical species, subspecies, or variety, this is indicated by a succession of names (*Pelargonium zonale*, Mrs. Pollock)." This provision survived substantially unchanged as Art. 35 in all three official editions of the *International Rules of Botanical Nomenclature* (Briquet, 1906; 1912; 1935). Interestingly at the VI International Botanical Congress in Amsterdam in 1935, this Article was amended by adding the requirement: "Fancy epithets will be preceded by the letter 'c'", presaging the recognition of the "cultivar" (Camp et al., 1947; Sprague, 1950). (For a fuller history of the roots of the *ICNCP* in the rules of botanical nomenclature see Stearn (1952, 1953) and for a more

radical view on the history of cultivated plant classification and nomenclature, see Hetterscheid et al. (1996)).

The naming of cultivated plants goes back, however, to the very beginnings of binary nomenclature, to Linnaeus's *Species Plantarum* in 1753 (Linnaeus, 1753), where, for example, some of our modern brassica crops can be distinguished as named variants of *Brassica oleracea*, each prefixed by a Greek letter, since 1981 treated formally as botanical varieties (i.e., in the rank *varietas*), cf. *ICBN* Art. 35.4 (Greuter et al., 2000).

INDEPENDENCE OF NOMENCLATURE AND TAXONOMY

In nomenclatural terms, Linnaeus's great achievement was to provide a mechanism for the separation of the name of a species from the characters distinguishing it from its congeners. This arose through his invention of the one-word specific epithet, which, with the generic name, provided Linnaeus's "*nomen triviale*" that we now consider the scientific name of a species, as opposed to the "*nomen specificum legitimum*" of Linnaeus and previous botanists that enumerated the diagnostic features of each species. This represents the first and vitally important step in separating nomenclature from taxonomy, separating the names applied to plants from the process of classifying them, because, prior to that, whenever a species was added to a genus, the *nomen specificum legitimum*, providing the diagnostic characters of the species, would in all probability also change. The mid-19th century saw the first codifications of rules of biological nomenclature, that for plants being enshrined in the Candolle's *Lois* referred to above (Candolle, 1867). The principle of priority of publication as the criterion for choosing between competing names for the same taxonomic group (taxon) dates to that time.

The second important step in separating plant nomenclature from plant taxonomy came with the development of the type method for determining the application of a name. This had a chequered history in botany, with its adoption by botanists in the United States (in the *American Code* – Arthur et al., 1907) long before its acceptance by the international community as a whole. This only came about in 1930 at the V International Botanical Congress in Cambridge, England, with the completion of the rapprochement between the *International Rules* and the *American Code* (Briquet, 1931; 1935) begun at the IV International Botanical Congress in Ithaca, New York, in 1926 (Duggar, 1929 2:1413-1597,1781-1782). The type method meant that the name of a taxon became substantially independent of its circumscription. The name became fixed to a reference point, the type, and, so long as that element remained within the taxon, its name was retained, even with substantial changes in circumscription. Of course, when two or more taxa are combined, and the types of more than one name fall within the circumscription of the combined taxon, the principles of priority of publication of the names involved applies.

I discuss this not to bore you with a long history of botanical nomenclature – I would refer those who are interested to the excellent account by Nicolson (1991) – but to emphasize that biological nomenclature (for the same processes have occurred in zoology) seeks to be as independent as possible of the theory and practice of taxonomy – of the processes of classification. Indeed in its Preamble, the current edition of the *International Code of Zoological Nomenclature* (Ride et al., 1999) states that "none [of its provisions] restricts taxonomic thought or actions". The success of our rules of nomenclature in doing this is well illustrated by the fact that the current system of scientific nomenclature in biology was developed under a paradigm of special creation, survived the Darwinian revolution intact, was unaffected by the conflicts of pheneticists, eclecticists and cladists in the 1960's and 1970's, and remains, 250 years after its origin, the universal mechanism for communication about the products of biodiversity. Even the current PhyloCode initiative (Cantino and De Queiroz, 2000), although with broader goals, is focused on communication at the level of major evolutionary lineages, not at that of genera and species, and, moreover, is an initiative that fails to appreciate the flexibility and capability of the existing system, so-called "Linnaean nomenclature" (cf. Kress, 2002).

CONSTRAINTS WITHIN THE CODES OF BIOLOGICAL NOMENCLATURE

But, of course, biological nomenclature is not totally divorced from taxonomy – from the process of classification. The obvious link, one that everyone immediately recognises, is in the binomial system itself. The name of a species incorporates the name of the genus to which it is assigned and so the name of a species may change with a taxonomic change in generic circumscription, which may even have ripple effects such as in the recent conclusion by Farjon (2002) that one of the two parents of the widely planted ×*Cupressocyparis leylandii*, the species hitherto known as *Chamaecyparis nootkatensis*, belongs, with a recently discovered cypress from Vietnam, in a new genus, *Xanthocyparis*. Being now considered to represent a hybrid between a different pair of genera, the Leyland Cypress must, therefore, change its hybrid generic formula, and becomes ×*Cuprocyparis leylandii*, Farjon astutely minimising the extent of the change.

The alternative, a uninomial system, would make the task of naming and communicating perhaps millions of species a nightmare of complexity. Moreover, as studies of "folk-taxonomies" show (cf. Berlin et al., 1973), the noun-adjective binomial is the normal way for all cultures to communicate about the basic units of their natural world, and, indeed, seems to be an inherent component of human communication.

In the context of the nomenclature of cultivated plants the other, slightly less obvious, constraint is much more important. As I said earlier, biological nomenclature, as expressed in the international *Codes*, makes no assumptions as to the methods, principles or purposes of taxonomy – save one, that the units of taxonomy, the taxa being named, are in some way nested, as in the hierarchy of ranks recognized in the botanical *Code*, though not necessarily so formalized. Minimally, each species is included in one and only one genus, and each genus in one and only one family – the "box-within-box" arrangement as it has been described (Davis and Heywood, 1963: 7). That such a nested hierarchical system generally works extremely well is undoubtedly a function of evolution, of descent with modification, and with strong selection pressure against the maintenance of every possible modification. There are, however, many situations in non-domesticated organisms in which it does not work well, and some, indeed, in which it could never be expected to. In general, wherever "hybridization", in the broadest sense of that word, is an important factor, a strict hierarchical classification, and hence nomenclature, will prove troublesome. These situations range from organelle symbiosis in protist evolution, through any form of lateral gene transfer, e.g., in parasitic organisms, to complex "polyploid pillar" situations in which the products of speciation at the diploid level may still be usefully recognized, although the morphological variation patterns have become blurred at higher ploidy levels. Hierarchical classification is also likely to be difficult to apply in situations of rapid evolutionary divergence without sufficient selection to ensure discontinuity of variation, and this situation is very common at and below the species level in, for example, colonizing species.

THE SCOPE OF THE *INTERNATIONAL CODE OF BOTANICAL NOMENCLATURE*

In the words of the Preamble to the *International Code of Botanical Nomenclature (ICBN)* (Greuter et al., 2000) its "rules and recommendations apply to all organisms traditionally treated as plants". Clearly this covers not just plants in the wild, but also plants in cultivation, including those deliberately bred for commercial purposes in agriculture, forestry and horticulture. Cultivated plants certainly remain plants. This is not, of course, a matter of territorial dispute. The Preamble to the *ICBN* goes on, for example, to say that the "*International code of nomenclature for cultivated plants [ICNCP]* .... deals with the use and formation of names for special plant categories in agricultural, forestry, and horticultural nomenclature."

The distinction between the *Codes* – and indeed the need for a separate *ICNCP* – very largely rests on the assumption in the *ICBN*, just discussed, that the units being named, the taxa, can usefully be arranged in a nested hierarchy of non-overlapping groups. Fundamentally, it is not the issue of whether plants are wild or cultivated, whether evolving under natural selection with or without human aid, or even whether the products

of carefully tailored breeding programmes, it is a matter of whether the elements being classified are amenable to this hierarchy of ranks implicit in the *ICBN*, or whether "special plant categories" are needed to communicate effectively about them.

Until 1953, apart from the provisions for "fancy names" described above, there was no option and very often the botanical rank of variety (*varietas*), or sometimes that of form (*forma*) was used for what we would today clearly regard as a cultivar – or in other cases (e.g. *Brassica oleracea* var. *botrytis* L.) as a cultivar-group. Moreover, any attempt to classify cultivars, whatever they were called, inevitably required that this was done in a hierarchical framework. The *ICBN*, unlike the *ICZN*, is quite flexible in this regard, permitting any number of ranks at any level (e.g. within the species), "provided that confusion or error is not thereby introduced" (Art. 4.3). Examples of this approach, which continued, of course, after the development of the *ICNCP*, is the classification of cultivated *Beta* by Helm (1957) and of other cultigens described by his colleague Mansfeld (1959). Indeed, hierarchical classification of cultigen diversity was a characteristic of the Gatersleben school and was applied in many groups (cf. van der Berg, 1999).

The development of this type of complex infra-specific hierarchy was not, however, peculiar to taxa containing cultivated plants. It was the norm for all groups of plants in which there was extensive variation at and below the species especially in German literature at the end of the 19th and beginning of the 20th centuries (cf. Ascherson and Graebner, 1896-1938). It was only with the increased understanding of evolutionary mechanisms at and below the species level that came with "The New Systematics" just before and after World War II (Huxley, 1940; Heslop-Harrison, 1953) that extensive hierarchical classification of variation in naturally occurring plant populations came to be abandoned. Extensive variation in wild populations at and below the species level, although often economically important and worthy of communication, e.g., in weeds, is rarely compatible with a strict nested hierarchy of ranks (cf. McNeill, 1976; 1982). And the same seems generally to be true of variation in crop plants (cf. Pickersgill et al., 1979; Hetterscheid and van der Berg, 1996; van Raamsdonk and van der Maesen, 1996).

As a result of the general appreciation of this fact, both for wild and cultivated plants, there has been, over the past 40 or 50 years, a tendency in plant taxonomy to recognize only those components of the overall variation of plants that are reasonably discrete, eschewing any attempt to name formally minutiae of infraspecific variation. This is clearly seen in the policies and recommended taxonomic practice of influential works, such as *Flora Europaea* (Tutin et al., 1964-1980) and the ongoing *Flora of North America* (Flora of North America Editorial Committee, 1993), in which only one infraspecific rank is permitted, the morpho-geographic subspecies or its equivalent. The net result is that mainstream taxonomy, and hence nomenclature, does not often consider it useful to recognize variants, however important to human society, that fall within a single species or represent the products of hybridisation of several species. This taxonomic, and hence nomenclatural, vacuum applies not only to plants deliberately bred for human use or enjoyment, where it is rather to be expected, but also to segments of variation within wild populations that may have economic value, e.g., because of particular ornamental features, but which are viewed by plant taxonomists merely as part of a continuum of variation within a single species. This is often a result of greater knowledge arising from more extensive field collecting, as was the case in the revisions of subgenera and sections of the genus *Rhododendron* by Cullen and Chamberlain some twenty years ago (Cullen, 1980; Chamberlain, 1982), as a result of which many hitherto recognized "species", much loved by gardeners, turned out to be no more than segments of continuous variation in wild populations of other species, resulting in some species names being synonymised, sometimes without trace, i.e., not even recognised as subspecies or varieties.

THE RELATIONSHIP OF THE *INTERNATIONAL CODE OF NOMENCLATURE FOR CULTIVATED PLANTS* WITH THE *INTERNATIONAL CODE OF BOTANICAL NOMENCLATURE*

The need is thus clear for a separate set of rules to communicate about the components of variation in plants that are not readily accommodated in the hierarchical system of classification that the *ICBN* reflects. For plants in cultivation, the *International Code of Nomenclature for Cultivated Plants (ICNCP)* fills that role. What, then, is the relationship between the *ICNCP* and the *International Code of Botanical Nomenclature*, the *ICBN*?

As I have made clear, and as is enunciated in Principle 2 of the *ICNCP* (Trehane et al., 1995), the provisions of the *ICBN* cover the naming of all plants, wild and cultivated, in so far as these fall within the framework of the general system of botanical classification that the *ICBN* reflects. There are probably some botanists who would take the view that all individual plants, even if only existing in cultivation, should be assigned to a species, and would, therefore, have at least a Latin binomial. Of course, there are many important groups of cultivated plants for which this is the case, *Beta vulgaris*, *Brassica oleracea*, *Daucus carota*, *Triticum aestivum* and *Vicia faba* to name only a few, but there are others, particularly where interspecific hybridization has been an important component in the origin of plants in cultivation, where to do so would be extremely difficult, if not impossible. [As an aside, I do, of course, recognize that this is most certainly also true of *Triticum aestivum*, but I do not want at this point to get into the issue of widely accepted botanical taxa that are entirely composed of cultivated plants.] Most botanists are, therefore, quite prepared to refer at least some plants in cultivation only to a generic name under the *ICBN*, as, say, *Rosa* 'Peace' or *Tulipa* 'Peer Gynt', and the provisions of the *ICNCP* (Art. 1.1) reflect this.

As will, I think, be evident from what I have been saying, I believe that the point of linkage between the application of the *ICNCP* and that of the *ICBN* is at the lowest rank at which the cultivated plant in question is assigned to a botanical taxon. Taxonomic judgement being a subjective matter, this will not always be the same point for every investigator and *Codes* of nomenclature should not legislate on such matters. Effectiveness in communication will be the determinant of choice. It seems to me, for example, that cultivar-group classifications of *Beta vulgaris* and *Brassica oleracea*, as discussed by van den Berg in the 1998 Edinburgh symposium (van der Berg, 1999; cf. also Lange et al., 1999), are much more convenient than those of the Gatersleben school (Helm, 1957; Mansfeld, 1986) involving a detailed hierarchy under the *ICBN*, but the latter are not incorrect, and need not be legislated against: the appropriate registration authority or users in general will make the choice.

Finally, I should say something, I suppose, about culta and "cultonomy", even though I still feel the need to include the latter term in quotation marks. I do believe that both terms are useful, especially the former, if only in order to make a clear distinction between the different framework under which the *ICBN* operates – that of a nested hierarchy of taxa – from that under which the *ICNCP* operates, namely a single series of distinguishable units (cultivars) that may be structured in a diversity of modes or not structured at all. Moreover, where there is structure, this need not necessarily be hierarchical, and may readily shift with shifting priorities for communication. Elsewhere (McNeill, 1998) I have emphasised the purpose of the recognition of the group as the key difference between a culton and a taxon. I have tried in this paper to put this into clearer context.

The general system of classification of all plants deals with taxa, regardless of the philosophy of classification and regardless of the evolutionary or selection processes involved; those elements of variation that are important for communication about cultivated plants, but which are not incorporated in the general system of classification, usually because they are within the lowest level recognised in that system, are solely cultivated plant groups, or culta. This is true whether these are segments of the variation of wild populations that we wish to distinguish on transplanting to our gardens, or the

products of highly sophisticated technological breeding programmes that are unlikely ever to survive in the wild. Moreover, if, by contrast, a deliberately bred cultivar, a culton, were to establish itself in natural habitats, behaving as a species, it would be recognized within the general system of botanical classification as such, i.e., as a taxon. This appears to have happened with the widely naturalized nothospecies *Crocosmia* ×*crocosmiiflora* (montbretia) that arose as an artificial hybrid between *C. aurea* and *C. pottsii*. As I have previously emphasised in discussing this example (cf. McNeill, 1998) we are not shackled by the method of evolution of a particular group of plants; the decision as to whether it should be treated as a taxon or as a culton rests on how it behaves – whether it belongs, as a taxon, in the general botanical information system, or whether the special plant categories of the *ICNCP*, i.e., culta, are needed in order to communicate about it.

CONCLUSIONS

The development 50 years ago of the *International Code of Nomenclature for Cultivated Plants* was a major step forward in facilitating communication about components of plant diversity that are important to humankind but that are not considered by most plant taxonomists to be appropriate components of the general system of plant classification, with its implicit hierarchical arrangement of groups. The *International Code of Botanical Nomenclature* provides the rules by which names are applied within the general system of plant classification and cultivated plants fall under its provisions as far as, but only as far as, they fall within that classificatory system. Beyond that, the provisions of the *ICNCP* apply and to distinguish its differing non-hierarchical framework, the concept and terminology of the cultivated plant group (culton) distinguished from the taxonomic groups (taxa) of the general system are useful.

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