

The Crop Concept in Cultonomic Classification

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Abstract

In the 1995 *International Code of Nomenclature for Cultivated Plants* (ICNCP) the cultivar and cultivar-group are used as the main categories to classify cultivated plants. In order to link the cultonomic classification to the taxonomic (botanical) classification it might be desirable to indicate to what botanical category the cultivated plants are to be assigned. This link between cultonomy and taxonomy is best established at a level above the cultivar-group. The sum total of cultivar-groups constitutes the crop, and it is suggested to recognize the crop as a culton and use it to define the relationship between groups of cultivated plants and the categories of the botanical classification governed by the *International Code of Botanical Nomenclature* (ICBN). The crop category is also the logical choice to function as denomination class. By applying the crop concept the dependence of classification and nomenclature of cultivated plants on botanical classification and nomenclature with its implicit threat of instability is reduced.

INTRODUCTION

Cultonomy aims at the classification of cultivated plant material using only few classification categories. The main reason for this is a reluctance to establish extensive hierarchic systems, because hierarchy is characteristic for the realm of taxonomy, not cultonomy. Natural variation displays hierarchical structure caused by divergent evolutionary processes. The classification procedure applied to naturally occurring, wild taxa is very different from that of cultivated material (Fig. 1). A taxonomist will want to put a newly found, previously unknown wild plant in its proper place in the phylogenetic system (viz. where it is playing its evolutionary role as part of one of the populations that constitute a species or an infraspecific category). Ideally, the proper place of the new taxon can be established and is permanent. A newly developed cultivar, on the other hand, will be accommodated in a man-made system of practical groups, that is flexible and may change under the influence of developments in plant breeding and marketing strategies.

Assigning a cultivated plant to its place in a cultonomic classification is not the same kind of activity as classifying a plant in a taxon. It involves attributing it to a crop, considering whether there is a subdivision within that crop (in cultivar-groups) and, if so, to what group the new cultivar could be assigned.

LINKING TAXONOMIC AND CULTONOMIC CLASSIFICATIONS

For a cultonomic classification we need to do no more, but one might want to be able to refer a cultivated plant to a category in the botanical taxonomic classification. This is a secondary consideration. For practical purposes it is important to know what kind of product the cultivar represents. Its alliance to a taxon in botanical classification is an academic matter, often leading to frustration with users of those classifications when taxonomic research necessitates name changes (cf. the contribution of John Valleau in this symposium, aptly called: "Plant name changes: good science, angry growers and confused gardeners"). Unfortunately, legal documents are using the, sometimes inade-

quate, taxonomic names, in order to pinpoint the identity of plant material.

The link between taxonomic and cultonomic classifications should, as I have argued in Edinburgh (van den Berg, 1999) be established not on the level of cultivars and cultivar-groups, but at the level of a category containing all cultivar-groups and ungrouped cultivars of a particular product: the crop. The nature of this link remains in my opinion rather weak. At best, one might look for an equivalent taxon, without trying to equate a cultonomic category with a taxonomic one because of the basically different purposes of these classifications described above.

There are basically three situations when trying to establish a link between a crop and an equivalent taxon:

1. In many cases the crop has undergone a long domestication history, involving extensive hybridization between species, with back-crossing and repeated selection leading to a situation where it is impossible to confidently assign cultivated material to a species. In these cases the equivalent taxon might be a genus or even nothogenus.
2. If only a part of a taxon has been taken into cultivation, there will still be a wild species from which the crop originated, and this species, or even an infraspecific category, can be appointed as the taxon equivalent to the crop if one is really sure that the cultivated material arose within this taxon and no other taxon was ever involved in its domestication history. Fig. 2 gives examples of different taxonomic levels that have been used to accommodate crops. Unfortunately, in many cases we just do not know enough to establish equivalence, and the level of our ignorance seems to increase on lower taxonomic levels, where the use of infraspecific categories only appears to convey exact information. In many crops an artificial solution was chosen to separate cultivated from wild material using subspecies. This leads to seemingly comparable categories with very different content. The subspecies category is used very differently in the taxonomy of wild plants (and even there conflicts about the proper use - with or without a geographical component - have arisen). Also, competing classifications will exist in many cases, making the choice of an equivalent taxon difficult (cf. the different taxonomic classifications of the red beech).
3. In exceptional cases a crop is co-extensive with a taxon. By definition this taxon then is a cultigen: a taxon consisting solely of cultivated material. A species like *Triticum aestivum* has no wild representatives, no population structure and no natural distribution area. In fact, such a cultigen lacks everything a taxon should have, but it is nomenclaturally indistinguishable from a taxon. Establishing equivalence between a crop (bread wheat) and such a taxon (the "species" *Triticum aestivum*) is not really very informative. The cultigenic status of a taxon can even be debatable. In potato the modern cultivars are assigned to *Solanum tuberosum* subsp. *tuberosum*. This subspecies was thought to be derived from subsp. *andigena* (encompassing the Andean cultivars/landraces that were already developed before the Spanish conquest) by transportation to Europe and adaptation to long day circumstances. Apparently, there are populations of *Solanum tuberosum* subsp. *tuberosum* growing wild in Chile (where the plants also were adapted to long day circumstances). From these Chilean populations the European potatoes were derived after the *Phytophthora* disaster. The precise definition of the cultigen remains unclear in this case, and it is questionable whether it is realistic to invoke co-extensivity when searching for equivalent taxa.

A NEW CULTON: THE CROP

The use of taxon names to indicate crops may always lead to instability through name changes made necessary by corrections of nomenclatural mistakes or progress in taxonomic research leading to re-evaluations of the boundaries and relationships of taxa. To avoid this one could either freeze the taxonomic names and use standard lists, or not use the taxonomic name at all, replacing it by a standardized crop name. The crop should then be recognized as a third type of culton in the new ICNCP. This would also solve the problem of different origins of the same product: in analogy to Article 2.18 of the current ICNCP (Trehane et al., 1995), stating that origin is irrelevant to membership of cultivated

plants to cultivars, it would not matter whether a cauliflower is derived from *Brassica oleracea* or another *Brassica* species (if this was possible), as long as it is recognizable to belong to the crop at hand.

In multi-crop genera (like *Solanum*, *Prunus*, *Allium*, *Citrus*) we need the crop level to be able to indicate which product we mean. Traditionally, the species level has been used (e.g. *Prunus armenica* - apricot; *Prunus dulcis* - almond; *Prunus persica* - peach; etc.). The example of *Citrus* shows very clearly that Linnean species names do a poor job in this respect, while standard crop names like orange, lemon, grapefruit are perfectly suitable for cultonomic purposes. A problem to be solved would be how to ensure the equivalence of crop names in different languages.

Crop names would need to be standardized, and crops will need to be circumscribed in order to establish which products we are referring to. A definition for the crop as culton was proposed by Hetterscheid et al. (1999): the sum-total of cultivars and cultivar-groups make up the crop. In the same volume, Green (1999) noted that cultivar-groups were sometimes applied at the crop level within complex species, but at other times as a rank within a crop. He pointed at the need to classify cultivars within cultivar-groups, particularly when a cultivar-group was equivalent to a crop and proposed a new rank, the cultivar-subgroup below cultivar-group to meet this need. The present proposal intends a three level cultonomic system (see Fig. 1) where adjusting the crop-level should take care of these problems. In the case of orchids, the crop level should obviously be below the family *Orchidaceae* as, indeed, the several genera and nothogenera constitute different products.

In practice, e.g. in ornamentals, standard crop names are already derived from the names of genera by applying the same name as the genus for the crop, but using the names without a capital first letter and not italicized. Thus it is clear whether one refers to the genus *Begonia* (one of three genera in the family *Begoniaceae*, and a relevant entity when considering the phylogeny of that family and its allies) or to begonia (indicating a crop consisting of cultivars). Using crop names, even if derived from a taxonomic name, would avoid the instability in taxonomic nomenclature (e.g. referring to chrysanthemums whatever the outcome of the *Chrysanthemum* / *Dendranthema* dispute).

It would be highly desirable if the standardized crops would also constitute denomination classes. It is within the crop, not the “genus or nothogenus” (Article 6, ICNCP, 1995), that a cultivar epithet should not be duplicated. The new ICNCP should adapt the crop concept and try to promote the use of a standardized system of crops rather than the system of denomination classes ranging from family to (combinations of) cultivar-groups as presently employed by UPOV.

CONCLUSIONS

- Cultonomic classification should consist of a three-level system with the culta:
 - cultivar
 - cultivar-group
 - crop
- A standardized system of recognized crops should be established, making use of standardized common names.
- If a link between cultonomic and taxonomic classification is felt desirable it should be on the crop level and be understood only to provide an indication of the taxon that might be considered equivalent to the crop. Co-extensivity is hardly a relevant issue in this respect and only applicable in the case of cultigens.

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Figures

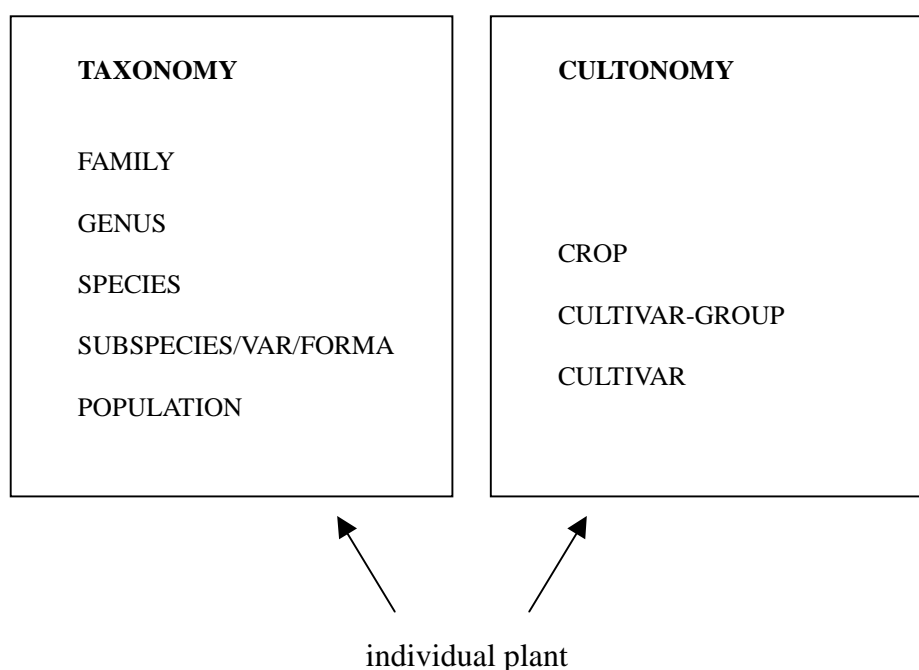


Fig. 1. Taxonomic and cultonomic classification categories.

GENUS	SPECIES	SUBSP.	VAR.	FORMA
<i>Rosa</i>				
<i>Pyrus</i>	<i>communis</i>			
<i>Beta</i>	<i>vulgaris</i>	<i>vulgaris</i>		
<i>Solanum</i>	<i>tuberosum</i>	<i>tuberosum</i>		
<i>Lactuca</i>	<i>sativa</i>		<i>capitata</i>	
<i>Brassica</i>	<i>oleracea</i>		<i>gemmifera</i>	
<i>Fagus</i>	<i>sylvatica</i>		<i>atropunicea</i>	
<i>Fagus</i>	<i>sylvatica</i>			<i>atropurpurea</i>

Fig. 2. Examples of different taxonomic levels used to accommodate crops.