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Suggestions to improve the Taxonomy Index (T-Index) introduced by Valdecasas (2011)

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Citation-based evaluation of scientific publications, such as the number of total citations or the Impact Factor cannot be used "fairly" in the field of taxonomy (Krell 2000, 2002). In order to overcome this problem, Valdecasas (2011) introduced a new metric, the Taxonomy Index (T-Index). This index provides a method to evaluate the quality of taxonomic publications regardless of citations.

The T-Index was originally described as follows:

"The T-Index is measured by including only the following two variables: N_i, which is the number of new taxa discovered or revised in the clade that is being studied with rank i (e.g., order, family, etc.), and S_i, which is the number of taxa in that clade and rank after the study (Valdecasas 2011: 59)"

$$T = \sum \frac{N_i^2}{S_i}$$

During calculation of my own T-Index, I encountered with three problems that were not sufficiently explained by Valdecasas (2011) or should be improved in order to make the T-Index more "fair".

The problem of synonyms

In the original description of the index, S_i is the number of taxa in the given clade and rank after the study. The meaning of "number of taxa" must be the number of *valid* taxa in this context. This suggests that the number of taxa can only be higher after the taxonomic revision. However, synonyms are abundant in most taxonomic groups in various proportion (May & Nee 1995; Patterson 1996). Synonymising taxa, and thus, decreasing the number of valid taxa is frequent in many taxonomic revisions. A lower number of taxa after a taxonomic revision results in an even higher T-Index than the number of taxa treated (see Table 1).

TABLE 1. Species treated in two imaginary works. A: synonyms were not found, B: synonyms were detected.

	new	revised	synonym	previously known	no. of valid species after revision	T-Index
A	2	10	0	10	12	12.00
B	2	10	5	10	7	20.57

To solve this problem, I suggest adding the number of new synonyms to the number of valid species after the revision. In doing so, the definition of S_i, changes to the following: S_i is the number of taxa (valid taxa + new synonyms) in that clade and rank after the study.

The meaning of "revised"

In the introduction of N_i, "which is the number of new taxa discovered or revised ...", Valdecasas (2011: 59) does not explain the meaning of "revised". One of the criteria (no. 5) on which the T-Index is based on, states the following: "New taxa hypotheses and full revision work are accorded similar merit". Again, the meaning of "full revision" remains obscure. Earlier in the paper, the following statement appears: "a single species description that is based solely on the species diagnostic characteristics but is lacking a comparison to other members of its group is of low taxonomic value".

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This means that comparing the new species with already known congeners is desirable, and thus should be rewarded by higher T-Index. However, comparison of two species in the differential diagnosis is clearly not a "full revision" of previously known taxon. I suggest handling such cases as "revised species" under T-Index. Every time additional species are discovered, the hypothesized boundaries of known species are also put to the test, and the species limits of "old" species are also changed or clarified based on newly available data (see Wheeler 2004). To avoid "new-species-differs-from-all-congeners" type of diagnoses, as the revision of all species within a genus, I suggest that only those species which are directly mentioned in the differential diagnosis are considered.

Focusing on geographic areas

The S_i (number of taxa of the clade after the study) plays a crucial role in the amount of the T-Index. Getting high T-Index for a publication is much more difficult in case of genera having many species (see Table 2). Unfortunately it seems, that in the present form T-Index evaluates the species diversity of a genus more strongly, than the quality of the taxonomic work itself. Also, dealing with genera that contain many subgenera (i.e., "more mature taxonomy"), and thus, fewer species per a given rank, is more beneficial in terms of T-Index.

A possible solution against this biased pattern is if we focused on a single geographical area while calculating the T-Index. Many papers include the revision of a genus inhabiting a selected and well-defined area, instead of all species regardless of their distribution. Revising a genus of a determined area does not seem to require much less knowledge and taxonomic expertise. As a demonstration, I use the recent revision of the land snail genus, *Vitrea* Fitzinger 1833 inhabiting the Southern Carpathian Mountains (Deli & Subai 2011) (Table 3). The genus includes 64 species, and it is distributed from the eastern Atlantic islands to the Caucasus region and the Middle East and from northern Europe to North Africa (Welter-Schultes 2012). Many of the species have only been recorded from the type localities only. The T-Index is 12 if we consider only the Carpathian species in the formula, but it is 2.25 when all the 64 species are taken in account.

TABLE 2. Comparison of the T-Index of imaginary publications. In all papers two new species are described and ten species are revised.

new	revised	previously known	no. of species after revision	T-Index
2	10	10	12	12.00
2	10	20	22	6.55
2	10	50	52	2.77
2	10	100	102	1.41
2	10	200	202	0.71

TABLE 3. Calculating the T-Index of the paper of Deli and Subai (2011) by considering all *Vitrea* species, or only those which inhabit the area in question. Note that the number of species after revision includes the synonyms as well.

	new and revised	no. of species after revision	T-Index
only Carpathians	12	12	12
whole distribution	12	64	2.25

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