Catalogue of Palaearctic Coleoptera

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Curculionoidea II

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FINIS CORONAT OPUS

The arrival at the end of a large project extended over many years, like this Catalogue, brings a bouquet of mixed feelings to the Editors. First, naturally, is the overwhelming feeling of great accomplishment. However, with it also comes certain sadness with an unanswered question: is this really an end, or will there be someone to continue the task, perhaps in a different form? Only the future may have an answer.

We cannot help but to return to that moment at an informal meeting of several coleopterists in Prague in October 1996 that, thanks to the initiative of David Král and Jan Farkač, gave birth to this Catalogue (see page 13 in volume 1). Looking back, we were amazingly naïve, not having previous experience, in assessing what kind and how much of work such a task requires. But in the long run this naïvety turned out to be a positive factor, because without it we would probably never have been brave enough to start the project. The two Prague coleopterists, Jan Růžicka and late Karel Hůrka, were also involved in early stages of the project; their contribution is gratefully acknowledged.

Entirely in line with that naïvety, the completion date for the publication of the Catalogue was originally planned for 2002, or no later than 2003, and to include all taxa published before January 1, 2000. How reality was different! We had a large number of contributing authors, mostly experts of particular groups, and help of many colleagues, and yet we needed ten additional years to complete the project. There were many hurdles to overcome, but the main reason for delays were the difficulties for authors to absorb all relevant published information. While bibliographical information available online significantly facilitated the task, the endless lists of online taxa did hardly meet needs. The Editors and Coordinators, who had to bring many files to the required level of quality, found out fast that expertise in taxonomy and quality of the submitted catalogue parts are not necessarily correlated.

The order Coleoptera exhibits the highest species richness, and is also one of the ecologically most diverse groups of animals. The Catalogue provided the badly needed modern overview of Palaearctic Coleoptera and it is not surprising that it was accepted by the community of coleopterists with great interest and appreciation. Published reviews were overwhelmingly positive and the work was even called "a milestone", or "magnum opus entomologicum" that is bound to become "the most used reference work on beetles (Insecta, Coleoptera) of the 21th century" in some of them. However, it is impossible to please everybody, and the Catalogue was deemed "untestable and unusable" by one critic who misunderstood its scope and purpose. Some other colleagues who requested a "full catalogue" were evidently unaware of the fact that it would require another dozen of years of strenuous effort that would obviously not meet the approbation of all authors.

Another special aspect of the Catalogue is that the Editors have carried the entire project through to its successful end without any financial support. Obviously there are still taxonomists among us, both professional and amateur, who are willing to accept unpayed hard work, if they believe in its usefulness. This is particularly pleasing these days when many scientists would not work on larger projects unless financial support was ensured.

As "The end crowns the work", here a few concluding numbers that show the scope of the Catalogue: 202 contributing authors, 6 052 pages, 18 468 available genus-group names, 170 778 available species-group names, 7 625 new nomenclatural and taxonomic acts.

Per aspera ad astra!

A PLEA FOR ALPHA-TAXONOMY

The work on the Catalogue provided us with unexpected, deep insight into the present situation in taxonomy. Although possibly biased, we consider the facts we encountered important enough to be discussed.

To avoid confusion, the term "taxonomy" is understood as the study of formalized groups of organisms, the taxa, and its primary role is the recognition and definition of such groups, beginning with the species. The term is derived from the Greek word "taxis", meaning arrangement or grouping. Within taxonomy, alpha-taxonomy defines and distinguishes species and groups of species, and is distinct, although partly overlapping, with beta- and gamma-taxonomy, concerning relationships and populations, respectively.

Adequately defined species and groups of species, or groups of populations, concern biodiversity, and are prerequisites for studies of phylogeny, biogeography, ecology, as well as for providing the basic information for applied biological research (e.g., efficient control of pests, identification of vectors of parasites, etc.). Work in these fields, when based on poor taxonomy, provides erroneous information and is fundamentally useless, regardless of methodology and high standards that may appear to meet with professional success. Meanwhile, outsiders, including decision makers, may never be aware of the underlying alpha-taxonomy, which remains invisible, ignored, and unreferenced.

Is this perhaps the main reason for the ever-progressing impediment of alpha-taxonomy?

Conservation of diversity of life on our planet is a concern for every human, including all those who choose to ignore problems. Conservation of habitats is essential for conservation of life. Thus, to a large extent it is a matter of politics and economy, depending on implementation of long-term priorities over short-term profits. The information about what accounts for the diversity of life is a matter for taxonomists. *A priori*, it would seem logic to focus more on the forms of life existing immediately around us than to search for hypothetical traces of life trillions of kilometres away, and to direct at least as much financial support to the task as to other fields in biology. This is far from the reality, as it has been experienced by most authors working on the Catalogue, and probably by others involved in alpha-taxonomy of Coleoptera and other mega-diverse groups of animals. These mega-diverse groups include the world's bulk of still unknown species. According to recent estimates, only about one tenth (or one fifth, or even one fiftieth!) of extant terrestrial species is actually "known", i.e., is mentioned in publication. In addition, a high proportion of the so-called "known" species are inadequately defined: in many cases the "known" consists of nothing more than a published name, and subsequent studies are needed to clarify their state. Thus, the numbers of "known" species currently given for many parts of the world are rather meaningless, at least as far as Coleoptera are concerned.

Alpha-taxonomy faces antagonistic paradigms, and its support is too often limited to verbalism. Global, nicely sounding projects producing countless reports, workshops, and pleasant web pages are favoured, while the laborious study of concrete taxa is disadvantaged.

In particular, the study of mega-diverse groups of insects is impeded by imposed restrictions concerning the following areas:

1) **Extensive sampling in poorly-explored areas with presumed high diversity of life**. As native taxonomists are usually not available or under-represented in such areas, actual field-work is often done by foreign researchers. In addition to being exposed to health and other risks, they face administrative restrictions, resulting in increased expenses and reduced effectiveness of work. Access to sites is often even prohibited. Thus, the restrictive legislation in many countries prevents research instead of preventing destruction of habitats. It is an international problem, induced commonly by managers with little or no knowledge of biology, who are unaware of the fact that responsible insect sampling has no or only ephemeral impact on respective communities. In Europe, bats consume more insects in a single year than can ever be sampled by humans worldwide. For

legislation, the impact of bats on environment is luckily not considered injurious, while sampling by researchers may be declared illegal and punishable. In general, legislators seem to avoid or ignore real factors that depauperate the biosphere. Here just one of numberless examples: according to studies realized in the 1970ies, 14 million billions of insects were killed by cars in a single small country, Austria, in a single year. The number exceeds by about 14 million times the estimated number of insects ever sampled for scientific purposes.

As a result, field research is often abandoned or strongly restricted, while the habitats with the most diverse and poorly known communities suffer continuously under anthropic pressure and may disappear before being catalogued and described. The situation is rampant as illustrated by one example regarding the weevil family Curculionidae (minus Scolytinae) with a worldwide distribution. It was adequately studied in Switzerland, which traditionally has a non-restrictive insect sampling policy. According to data from 2012, 470 species were reported from the moderately diverse and densely populated Geneva Canton with a surface of 282 km^2. Compare this with Sikkim which, with a surface of 7096 km^2, is 25 times larger, with highly diverse ecosystems and moderately populated. Yet, according to our 2003 data, only 28 curculionid species are known to occur in this region of India. For a skilled collector, one could imagine that 28 species would be collected there within a single day! This small number of species represents a minute fraction of expected species, and yet, restrictions and regulations deter experts who focus on other faunas where field work and effective collaboration are tolerated or even encouraged.

2) **Study of sampled collections**. Collections are housed in museums, universities, and private homes (eventually transferred to museums). While collections in museums of natural history continuously increase globally, the number of curators and technical staff decreases, or at best, stagnates. In addition, priorities in museums are frequently switched away from alpha-taxonomy to beta-taxonomy although the latter depends less on extensive comparative collections, or to popular science. Collected material has to be adequately treated, including time-consuming mounting and sorting to small taxonomic subunits. Otherwise it cannot be made available to potential experts. Considering the lack of skilled staff having both time and opportunity to take adequate care of collections, workers often reduce their activity to sampling groups that have the potential of being studied in the near future. Major expeditions produce extensive collections that may remain "provisionally" stored, in a utopian hope for a better future, but that risk the same fate as many samples made for countless ecological studies: they end up trashed.

A particular problem arises from the fact that the value of scientific collections is not intrinsic, as that of artifacts, but extrinsic. This is usually ignored by decision makers who impose the same administrative regulations for both types of collections, regardless of the impact on work efficacy. Thus, administration is actually one of the factors that slows down studies and impede the increase of biodiversity knowledge.

3) **Alpha-taxonomy reveals what kind of life exists, locally and globally, and provides means for identification.** An effort to distinguish kinds of organisms precedes de Candolle's term taxonomy. In fact, it is linked to interest in our environment, and is obviously an integral part of culture, irrespective of applications. In the past, the role of alpha-taxonomy was therefore widely acknowledged and taxonomy was one of the main fields in biology. A major potential of new sources of information arose more recently with the refined development of molecular technologies. Genes provide data useful for taxonomy, such as identification of fragments of organisms, resolving identity of specimens in polymorphic species, identification of taxa lacking discrete morphological characters (i.e., cryptic species) and also study of relationships, although the phenetic methods eventually applied may be problematic. With the generalized use of these technologies one would expect great advances in taxonomy, yet the opposite is happening.

We are not going to discuss over-simplified approaches, such as barcoding, that consume resources and are not popular among many alpha-taxonomists because barcodes are practically useless in mega-diverse groups in

which most members are first to be redefined or defined by experts. However, we believe that the most serious negative impact on study of diversity of life is related to the evaluation and justification of scientific work. The technocratic, almost pandemic, and seemingly objective *impact factor* and *citation index* used to categorize published papers induce a process that may be considered as the "programmed death of alpha-taxonomy".

Professional success and support is usually the reward for papers published in journals that are assigned a high impact factor. Works using modern, fashionable technology, providing detailed descriptions of methodology, including phylogenies based also on molecular data and well readable discussions, are appreciated and easier to place in such journals. The less impressive definitions of numerous and similar species, accompanied by detailed lists of locality data and identification keys, risk rejection. The imposed need of being scientifically successful and highly cited results in focusing on popular questions usually on groups that have been already studied by others while unstudied groups are often left abandoned. The presently wide-spread system to have records with successful grants and visible publications in museums and universities amplifies the loss of taxonomic expertise.

As a consequence, graduate zoologists often have inadequate knowledge of animals which is passed over to teachers and scholars, resulting in general public missing elementary information about the diversity of life.

The urgently needed long-term studies leading to revisions of large sets of taxa, based on extensive collections, are increasingly produced by enthusiastic non-professionals and retired professionals. Unfortunately, non-professional taxonomists are active in some countries only, and their average age increases. As evaluations based on impact factor are not yet generalized, professionals in some parts of the world still contribute in a relevant way towards promoting taxonomic knowledge of Coleoptera and other groups. Several of our collaborators and colleagues privately admit to use fashionable methods in taxonomy while preferring morphology, only because they submit to pressure. The examples of Volker Puthz and Volker Assing, two non-professional German taxonomists, working in their free time without grants or other official support, are symptomatic of the current academic climate. They are prolific workers who base their studies on morphological characters, and do not pay attention to impact factors of journals in which they publish. Each of them contributed more to the assessment of diversity of Coleoptera in any given time span than the combined effort workers who based their study on molecular data, and who enjoyed considerable credits and ample support.

To conclude our plea, let us quote Q. D. Wheeler (2004, Philosophical Transactions of the Royal Society of London, B 359: 575): "Taxonomy, far from a merely descriptive science, is packed with intellectual content and societal relevance. Taxonomists synthetize and interpret billions of facts about millions of species, make those species identifiable, provide the vocabulary to talk about them, critically test the evolutionary units of biological diversity, and make accessible and predictable all that we know of life on Earth. It has a rich and proven epistemic basis that makes its hypotheses testable and its results as rigorously scientific as any".

Taxonomy was and should remain the essential tool for recording and enlarging the knowledge on biodiversity. It is also essential for any subsequent disciplines and ignoring, or even underestimating it, would be as if one wanted to write poetry without knowing all letters of the alphabet.