PROBLEM OF ESTABLISHMENT OF TAXA AT THE GENERIC LEVEL

(Permasalahan Penempatan Taxa pada Tingkat Genus)

By: Bambang Agus Saripto

Abstract

Classification of taxa at the generic level is determined by application of a generic definition derived from an accepted generic concept. There have been attempts to define the generic concept from Aristotle's time up to now, when most biologists except from the evolutionary theory, but in fact there is still no universally accepted generic definition. The establishment of intra- and inter-generic relationships should be one of the most important aspects of pure taxonomic systematic methodologies, but in reality this not necessarily the case.

Keywords: genus, taxa

Abstrak

INTRODUCTION

The answer to the question, "What is a genus?" is as elusive today as was in the time of Linnaeus. The genus is the next major taxonomic category above the species level in hierarchical biological classification proposed by C. Linnaeus (1754). Originally, the hierarchy was composed of species, genera, orders, and classes. Since then, several additional categories have been interpolated between them. Theoretically there is no limit to the number of levels contained in a hierarchy, but the International Code of Botanical Nomenclature (which is also the code used for fungal nomenclature) recognizes twelve main categories. The International Code of Zoological Nomenclature recognizes only seven main categories. A logical progression of taxa as those in each category is combined into a single taxon at the next higher level are found in Buck and Hull (1966) and Stace (1989).

The realization of a generic concept is not new at all. It did not originate with Linnaeus or his great predecessor, Tournefort, but existed in folk science (Bartlett, 1940).

I. The Importance of Taxa at the Generic Level

Perhaps the importance people place on "the genus" is a reflection of its importance in biological classification itself. The original purpose of classification was to identify and to infer to certain organisms when people communicate with each other, because people wished to satisfy their "curiosity" as well as to take advantage of the diversity of life for their needs. The degree of curiosity among people varies. Lay people will probably be satisfied if they can identify the more common plants and animals in their local area, but modern systematists wish to know every single type organism of a particular group in the world. The need for systematics also varies; say people want to take advantage of the diversity of local plants and animals for their basic needs directly, but modern systematists want to take advantage of the diversity of organisms on the earth for need of human beings both directly and indirectly. Sometimes the wish to understand organisms, their relationship and their distribution is the overriding motivation. Therefore, in post-Darwinian classification, systematists do not wish to provide a classification only as a device for the storage and retrieval information on the diversity of life, but also to express the relationships among organisms, both extant and extinct. Fortunately, the Linnaean categories at any levels can provide an expression of relationship among organisms.

Perhaps the species category is the most important for biologists who wish to study physiology, ecology, or behaviour. The higher categories of Class and Phylum or Division are important only for those who ask phylogenetic questions, or who are concerned with macromolecules or organ systems (Mayr, 1969). On the other hand, palaeontologists and those who study biogeography may consider that the genus category is more important than any other category.

Simpson (1961) has said that genus has a species status, not only for traditional and nomenclatural reasons, but also for its application in biological study. He suggested that the genus is somehow a more usable and reliable unit for classification than any other category. There are some tendencies (specialty among palaeontologists) to consider the genus, rather than, or in addition to, the species as a fundamental unit. Genus are frequently more appropriate or useful units than species, not only in space but also in time. Furthermore, genera are more conveniently localized and less widespread than families. Simpson mentioned that in stratigraphic palaeontology, species permit more precise local correlations, but genera are much more useful in long range considerations, especially those between continents.

II. The Problems of Establishment of Taxa at the Generic Level

Biological classification is delimitation, ordering, and ranking of taxa (Mayr, 1969). The purpose of classification for some systematists is merely "convenience", but for others it should also attempt to express relationships. How to establish the ideal genus is precisely the problem of systematics as a whole. The procedure of delimiting taxa at generic level is summarized in Figure 1.
The problems of delimiting genera exist at every step in Figure 1. Although most systematists now accept evolutionary theory, some of them do not agree that purpose of classification should be to reflect the relationships among taxa. When systematists agree on the basic purpose, they may not agree on the generic definition, they may not agree on the methodical methods to be used.

The generic definition is neither static, nor independent of theory, but strongly influenced by other theories, viz. "essentialism", and "evolutionary theory", and also non theory (="intuitive") (Mayr, 1969). Although we find many generic definitions, basically these can be summarized in only three definitions (outlined in Table 1) that have been broadly used in systematic studies.

### Table 1: The analysis of the generic concept

<table>
<thead>
<tr>
<th>Definition of genus</th>
<th>Field of Studies</th>
<th>Basic of Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A group of species in which every member has at least one character</td>
<td>Morphology/ similarity</td>
<td>Logic (structural)</td>
</tr>
<tr>
<td>2. A group of species that are arranged on a basis of &quot;morphological&quot; similarity</td>
<td>Systematics (i)</td>
<td>Practical</td>
</tr>
<tr>
<td>3. A group of closely related species</td>
<td>Systematic - evolution (ii)</td>
<td>Theoretical: evolutionary theory</td>
</tr>
</tbody>
</table>

Note: i = Traditional Taxonomy; ii = Phylogenetics, Evolutionary systematics, Traditional phylogenetic systematics.

In the first definition, a genus is a group of species in which every member has at least one character in common (Daly, 1961). The basic of this definition is the Aristotelian logic version of essentialism. The method
of establishing genera based on this definition is called typology. The
definition was developed along with the historical development of
biological classification as a part of systematic studies.

In biological classification, an organism is placed within a system,
called the "Linnaean categorical system". The Linnaean categories are
concepts derived from the Aristotelian version of essentialism, in which
primary substance (individuals) embody within themselves the essences of
a hierarchy of secondary substances (universals). In this sense biological
classification means an arrangement of organisms in scala naturae
according to their degree of "perfection" (Mayr, 1969). Aristotle devised
the secondary substances into species (cides), the lowest classes of
individuals in the hierarchy. Linnaeus did not innovate conceptually, but
merely proposed the additional names "order" and "class" for higher
levels in the hierarchy of Aristotelian genera. Additional names were later
coined by authors of the International Codes of Nomenclature (Griffith,
1976).

In the second definition, a genus is a group of species arranged on
the basis of "morphological" similarity. The basis of this definition is both
practical and logical, but it has no established theoretical basis. The
method by which genera are established using this definition may be
called "morpho"-systematics, or oninspective systematic sensu

In the last definition, a genus is a group of closely related species.
This definition is derived from the evolutionary theory presented by
Darwin (1859). The method by which genera are established using this
definition is called "phylogenetic" systematics. At the basic-process-step
(Fig. 1), cladistics and "phylogenetic" systematics treat a genus as a
synthetic group. However, other systematic methods treat a genus as
either a synthetic or an analytic group. In fact, these two processes for
constructing a genus, analytic and synthetic, have been in operation since
ancient times in folk science.

With increasing experience, people make finer distinctions, and
need different names for newly distinguished entities which have
previously been called by the same original name. The original name
becomes generic in its application and, variably qualified, it provides
the basis for specific names. Such genera are established by analysis.
Alternatively, as language becomes cumbersome rich in separate names
for closely similar things, there is a tendency toward grouping or
classification under the same name on the basis of newly perceived
similarities. Thus, genera are established by synthesis (Bartlett, 1940).

Some modern systematists adopt the first process, others the second
process, while still others sometimes adopt the first and sometimes the
second. For example, Linnaeus was not consistent on this issue. He
adopted the analytic approach for his 1735 book, but adopted the synthetic
approach for his "Systema Naturae" (1740) (Cronshaw, 1970). On the other
hand Inger (1958) suggested that "Essentially the species is an analytic
category whereas the genus is a synthetic one". According to Cronshaw
(1970) artificial classifications of library books, etc. are essentially
analytical, while natural classifications are essentially synthetic.

At the analytic-character-step (Fig. 1), one may face other
problems. Since no generic characters exist, one can either analyze
characters using an unweighted (or defined as similarly weighted), a
weighted approach, or neither (simple). The two terms, unweighted and
weighted, may look very simple and concepts, but their applications
are very plastic. The selection of characters is also another problem in
defining a genus.

Some systematists may agree with Mayr (1943) who said "...nobody has ever found an objective criterion of the genus...how the
should be delimited from other genera are matters of convenience left to
the judgement of the individual systematists. Taxonomic characters that
prove generic distinctness do not exist". Or they agree with Simpson
(1943) when he said "...the distinction of one member of the hierarchy as a
genus requires art as well as science".

Nevertheless, others have suggested that the delimitation of genus
should be as objective as possible, and we should reduce the art in it as
much possible. A few systematists have attempted promote such objective
generic criteria. For example, Inger (1958) proposed an adaptive character
as an ideal criterion to delimit a genus, while Dubois (1982) proposed the
use of interbreeding as a criterion.

A problem still remains in the interpretation of the resulting genus.
Systematists, whatever systematic methods they use, expect to produce a
"good" and "natural" genus. The problem is that the definition of a "good"
genus is itself uncertain. Plannick and Nelson (1978) noted that the
resulting ideal genus should be maximally stable, useful, informative,
testable, refutable, predictive, etc. The meaning of "natural genus" varies, e.g., a genus that accurately reflects the evolutionary history of the organism concerned, or a genus that reflects patterns of "affinities" of a God creation (Briggs & Walter, 1984). Other meanings of "natural genus" are a genus that is established using numerous characters or a genus that expresses or embodies a phylogenetic relationship.

So it is not surprising if a genus is considered a "good" and "natural" genus by some systematists, but at the same "bad" and "unnatural" by others. In the latter case, there is a high possibility that either the same or a different person will establish another new genus or will revise the "old" genus (including downgrade and upgrade) using either the same or different methods.

**CONCLUSION**

When the generic concept began to exist in the minds of human beings, nobody knows. Clearly, the "generic" concept exists in almost every culture. Aristotle merely formalized the concept. Linnaeus merely internationalized the concept. They did not invent it. In biological science, but in fact there is no universally acceptable generic definition.

The theory to give "meaning" to the generic definition comes and goes through time, but in fact there is no universally acceptable meaning. Even now, when most biologists accept a single theory, the evolutionary theory, and a single definition of the genus group of closely related species, there is no universally acceptable systematic method to contruct the genus. Moreover, even if biologists accept a single systematic method, there is no guarantee that they will set the same boundaries to delimit a genus.

**REFERENCES**


