PART A

# MICROTAXONOMY

The first and most basic task of the taxonomist is to sort the bewildering diversity of individuals found in nature into species. It is impossible to construct a classification until the several species that are to be ordered are correctly discriminated. The activities by which this is achieved constitute *microtaxonomy*.

From the beginning there has been controversy about how species should be discriminated; these arguments are usually referred to as the *species problem*. Evidently, the recognition of species is not an easy matter. There are difficulties at several levels. First, there are semantic confusions that involve the concepts underlying the terms *phenon*, *taxon*, and *category* (see below). A more profound problem is caused by the fact that the visible diversity of nature among whole organisms includes two levels of discontinuity that are of special importance to the taxonomist: individuals and reproductively isolated populations. Taxonomists must adopt criteria that permit them to distinguish between these two levels and must learn how to apply these criteria properly. Finally, insoluble problems are posed by incipient species, that is, populations that have some of the properties of species but lack others.

Since much of the confusion in the taxonomic literature is due to a misunderstanding and the consequent erroneous application of certain terms, we begin by offering definitions of a number of terms that are commonly used in this textbook.

## PHENON

This is a convenient term for the different forms or phenotypes that may occur within a single population. It includes many of the "varieties" of the older literature, the sexes (when there is sexual dimorphism), age stages, seasonal varieties, and morphs (individual variants). The term *morphospecies* has sometimes been applied confusingly to what is designated here as a phenon. Recognition of a technical term for a phenotypically uniform sample greatly facilitates the description of the taxonomic procedure. The term *phenon* was introduced by Camp and Gilly (1943) to describe phenotypically homogeneous samples at the species level. It was later used in a very different sense by Sneath and Sokal (1973). Chapter 3 deals with the taxonomic treatment of phena.

## TAXON

The words *bluebirds, thrushes, songbirds,* and *vertebrates* refer to groups of organisms. Such concrete objects of zoological classification are taxa. A taxon is defined by Simpson (1961:19) as "a group of real organisms recognized as a formal unit at any level of a hierarchic classification." The same thought can be expressed as follows: *A taxon is a named taxonomic group of any rank that is considered sufficiently distinct by taxonomists to be formally recognized and assigned to a definite category.* This definition calls attention to the fact that the delimitation of a taxon against other taxa of the same rank is usually subject to the judgment of the taxonomist.

Two aspects must be stressed. The term *taxon* always refers to concrete zoological objects. Thus the species is not a taxon but a category; for example, the robin (*Turdus migratorius*) is a taxon. Second, the taxon must be formally recognized by the taxonomist. Within any large genus, groupings of species can be recognized. They are taxa only if and when they are formally distinguished and named, for instance, by being recognized as separate subgenera. Similarly, demes and geographic isolates within a species become taxa only when they are formally recognized as subspecies.

Taxa are not classes but what philosophers call individuals or particulars. This includes all biopopulations (sensu stricto). They are characterized by internal cohesion and other aspects of the ontology of species discussed in Chapter 2. Since higher taxa lack the degree of cohesion shown by species, they are best referred to as *historical groups* (Wiley 1981), yet they are clearly individuallike and are definitely not classes.

We speak of higher taxa, such as thrushes, birds, and vertebrates, and lower taxa, such as bluebirds and robins. The taxonomist ordinarily classifies taxa of species rank, yet there is a great deal of variation within most taxa, as will be discussed in later chapters. The recognition of what belongs to a given taxon of species rank is often the most difficult step in classification owing to individual variation (existence of highly different phena) or extreme similarity of individuals in different species (sibling species).



## CATEGORY

A *category* designates rank or level in a hierarchic classification. *It is a class whose members are all the taxa that are assigned a given rank.* For instance, the species category is a class whose members are the species taxa.

A full understanding of the meaning of *category* depends on an understanding of hierarchical classification, which is discussed in Chapter 6. Terms such as *species, genus, family,* and *order* designate categories. A category is thus an abstract term, a class name, while the taxa placed in categories are concrete zoological objects. Until the word *taxon* was introduced into the literature, the term *category* was often confusingly used both for group and for rank, just as the word *character* is often still confusingly used to mean both character in the original sense (a specific feature) and variable (a feature that varies from taxon to taxon) (Chapter 6).

The 20 or more categories that the taxonomist uses in classification are of unequal value and different significance. They fall naturally into three groups:

1 The species category (Chapter 2)

2 Categories for distinguishable populations within species (*infraspecific* categories) (Chapter 3)

3 Categories for taxa above the species level, that is, higher taxa (collective categories are higher categories) (Chapter 6)

In a number of different ways the species occupies a unique position in the taxonomic hierarchy.

## SPECIES AND CLASSIFICATION

What is the relationship between classification and the study of species? Every phyletic line and every higher taxon originated through a speciation event. Speciation and macroevolution thus are part of a single continuum. However, in the everyday practice of the taxonomist, the study of species and the operation of classifying are remarkably independent. When one proposes a new classification, one does not have to ask

whether the species one is arranging originated by peripatric, parapatric, stasipatric, or sympatric separation. Indeed, we are not aware of any case where a difference in the origin of a species would have affected the proposal of a classification (except possibly in cases of hybridization).

It is evident, then, that taxonomic research at the species level—*microtaxonomy*—is rather different from the process of classifying genera and higher taxa—macrotaxonomy. This conclusion is supported by the recent history of taxonomy. For instance, the new systematics of the 1930s and 1940s involved the species level almost exclusively. Geographic variation, the recognition of polytypic species, the definition of subspecies and species, the taxonomic status of incipient species, and the role of nonmorphological characters in the delimitation of species were the principal concerns of the new systematics. Authors such as Mayr who were active in the new systematics usually did not make a substantial contribution to the classification of higher taxa. By contrast, most authors who have been most active during the flowering of macrotaxonomy from the 1960s on have made few, if any, contributions to species-level taxonomy. This statement cannot be interpreted to mean that there is no connection between the two levels. Obviously, species are the vehicle of all macroevolution. As Mayr (1963:621) stated,

> The evolutionary significance of species is quite clear: Although the evolutionist may speak of broad phenomena, such as trends, adaptations, specializations, and regressions, they are really not separable from the progression of the entities that display these trends, the species. The species are the real units of evolution, as the temporary incarnation of harmonious, well-integrated gene complexes. . . . The species, then, is the keystone of evolution.

The delimitation and proper ranking of species populations and the sorting and evaluation of characters during the construction of classifications are two very different activities. This difference is acknowledged in the recognition of two remarkably independent domains of taxonomy: microtaxonomy and macrotaxonomy. Chapters 2 through 5 are devoted to various aspects of microtaxonomy; Chapters 6 through 11, to aspects of macrotaxonomy.