

Species Concept

The taxonomic literature reports innumerable species concepts, but they fall into four groups such as typological species concept, nominalistic species concept, biological species concept and evolutionary species concept. The first two have mainly historical significance, but are still upheld by a few contemporary authors.

1. Typological Species Concept / Morphological Species Concept / Essentialist Species Concept

This species concept, going back to the philosophies of Plato and Aristotle, was the species concept of Linnaeus and his followers. This school of philosophy is now usually referred to as essentialism and thus this concept is also called essentialist species concept.

Statement:

According to this concept the morphologically distinct organisms constitute a species. So according to morphological species concept, species is the group of individuals that resemble each other in most of their visible or morphological characters and the adjacent local population within the group differs only in variable characters that integrate marginally. It included the acceptance of four postulates-

- i. Species consist of similar individuals sharing the same essence.
- ii. Each species is separated from all others by a sharp discontinuity.
- iii. Each species is completely constant through time.
- iv. There are strict limits to the possible variation within any one group.

Criticism:

This concept has been universally rejected due to two practical reasons-

- i. Individuals are frequently found in nature that are clearly conspecific with other individuals in spite of striking differences resulting from sexual dimorphism, age differences, polymorphism and other forms of individual variation.
- ii. It is equally helpless in sibling species – which differ hardly at all morphologically yet are good biological species.

Therefore, degree of morphological differences should not be a decisive criterion in defining species.

2. Nominalistic Species Concept

This concept is of Occam and his followers who believed that only individuals exist, while species are man's own creation. This concept was popular in France in the 18th century but surprisingly it is still used (though very rarely) by some, especially botanists.

Statement:

Bessey (1908) expressed that 'nature produces individuals & nothing more..... species have no actual existence in nature. They are mental concepts & nothing more Species have been invented in order that we may refer to great numbers of individuals collectively.

Criticism:

No biologist can agree with the idea that the species are man made when it is now an established fact that they are the products of evolution.

3. Biological Species Concept

Biological species concept was introduced by Ernst Mayr (1942).

Statement:

According to this concept 'species are groups of actually or potentially interbreeding natural populations that are reproductively isolated from other such groups'. Biological species concept has clearly postulated that species is a relational term: when X is reproductively isolated from Y and Z, it is a species in relation to Y and Z. This species concept has three distinct functions-

- i. **It forms a reproductive community** i.e., the individuals of an animal species recognize each other as potential mates and seek each other for the purpose of reproduction.
- ii. **It is an ecological unit** regardless of the individuals that constitute it. Individuals of one species interact as one unit with other individuals of other species with which it shares its environment.
- iii. **It is also a genetic unit** consisting of a large intercommunicating gene pool. Individuals of a species share one gene pool.

Criticism:

- i. It is limited to sexually reproducing individuals and can not be applied to agamospecies.
- ii. It is not applicable to museum and fossil specimen because the criteria of cross fertilization can not be tested.
- iii. It can not be applicable to the animals which distributed in time and space in the past.
- iv. It is easy to test the reproductive barriers between populations found in the same locality (sympatric population) but not so in case of geographically isolated populations (allopatric population).
- v. The most serious difficulties in the application of the biological species concept are those caused by-
 - a. Insufficient information.
 - b. Uniparental reproduction.
 - c. Evolutionary intermediacy

4. Evolutionary Species Concept

The paleontologist G. G. Simpson proposed the evolutionary species concept. In this concept, a species is defined not in term of sexual isolation but in terms of evolutionary isolation in which sexual isolation is one aspect. Ideally, ESC utilizes morphological, genetic, behavioural and ecological variables.

Statement:

According to this concept, 'a species is a single lineage (an ancestral descendant sequence of population) evolving separately from others and with its own unitary evolutionary role and tendencies' (Simpson, 1961).

Criticism:

The main weakness of evolutionary species concept are-

- i. It can not clearly say what the unitary role of a species is.
- ii. There is no view as to why phyletic lines do not interbreed with each other.
- iii. The view ignores the causes, which result in and maintain discontinuities between contemporary species.
- iv. It may be difficult to apply in practice.

Conclusion

These four species concepts considerably overlap each other. For some organisms one definition is more suitable than another and for some the definitions will coincide. It becomes even more difficult to estimate the populations of species in the living world or in special group of organisms to which any two, three, or all species definitions apply. In any case biological distinctness is primary and the morphological difference secondary.

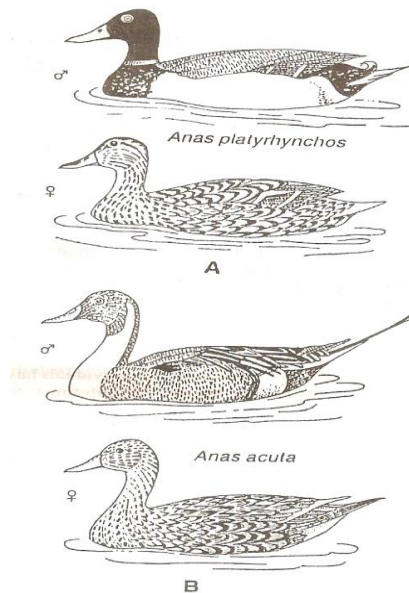
Advantage of Biological species concept

The advantage of biological species concept is that it can be tested objectively. If two populations in same locality do not fertile each other and if cross fertilization occur but hybrids are not viable and fertile, then two populations tested can be considered as two separate species.

Disadvantage of Biological species concept

1. **Apomictic or asexual group:** It can not be applied to entirely asexual organism because the asexually reproducing forms do not fulfill the criteria of interbreeding which is foremost characteristic of biological species concept.
2. Mayr's definition is expressed in terms of populations, not individual organisms. Two individuals might be incapable of interbreeding (e.g., two males or a Great Dane and a Chihuahua among dogs) but yet be members of a single reproductive community, or gene pool.
3. In Mayr's definition of species, the main criterion is **interbreeding**, i.e., gene exchange, among populations in nature, not fertility or sterility. To be sure, many of the mating that can be induced between different species yield sterile offspring (such as the **mule**, a hybrid between horse and ass), or no offspring at all.

However, there exist many cases in which different species, induced or forced to mate in a zoo, garden or laboratory, yield partly or fully fertile offspring, yet never hybridize in their natural environment, because they simply mate with other species in nature (e.g., mallard and northern pintail).



Despite the conspicuous differences between the mallard (A, *Anas platyrhynchos*), and the northern pintail (B, *Anas acuta*), these species can be hybridized. However, they very seldom do so in nature.

4. ***Insufficient Information:*** Individual variation in all its forms often raises doubt about whether a certain morphotype is a separate species or only a phenon within a variable population. Sexual dimorphism, age differences, polymorphism and other types of variation can be unmasked as individual variations through a study of life histories and through population analysis.
5. ***Uniparental Reproduction:*** BSC is not applicable to those animals where asexual reproduction and uniparental reproduction occurs. Because in these animals no exchange of gene is not possible like sexual reproduction. Uniparental reproduction may take place in different way like self-fertilization, vegetative reproduction, parthenogenesis, automixis etc.
6. ***Evolutionary Intermediacy:*** In nature, some animal groups are found that can not be recognized as species through there have clear reproductive isolation. The various difficulties for the taxonomist that may result from evolutionary intermediacy can be summarized as follows.

- i. ***Acquisition of reproductive isolation without equivalent/sufficient morphological changes.***

In nature those individuals are formed whose morphological difference with very slight or almost absent. But they are reproductively isolated. These individuals are called sibling species. It is very difficult for the taxonomist to animal groups into species if the reproductive isolation and morphological differences are not occurred same time.

- ii. ***Acquisition of strong morphological difference without reproductive isolation.***

In nature, a number of genera of animals and plants are known in which morphologically very different populations interbreed at random whenever they come in contact.

7. ***Semi species.***

Geographic isolation occasionally has an intermediate status between sub species and species. On the basis of some criteria they would be considered species and on the basis of others they would not. It is usually more convenient for the taxonomist to attach such doubtful population to the species which they are most nearly allied.

What is species?

A species is a group of interbreeding natural populations that is reproductively isolated from other such groups.

Different kinds of species

- 1. Sibling species.**
These are reproductively isolated species that are morphologically similar.
- 2. Sympatric species.**
The species / populations occupy the same geographical locality so that the opportunity to interbreed is presented.
- 3. Allopatric species.**
The species or populations occupy the same geographical region different that of another population or species.
- 4. Parapatric species.**
The species or populations which are partially separated from each other.
- 5. Continental species.**
These are those species which live on the large land masses.
- 6. Insular species.**
These are those species which live on isolated islands.
- 7. Cosmopolitan species.**
These are widely distributed species over the earth.
- 8. Tropicopolitan species.**
These are species found throughout the tropics.
- 9. Montane species.**

These are those species which occur at high elevations on mountain ranges.

10. Agamospecies.

Those species which consists of uniparental organisms i.e., all those animal species which reproduce parthenogenetically.

11. Panmictic species.

Species in which each sex is produced by a different individual (diocious) or species in which the two sexes are produced by the same individual (monocious) are panmictic if some of the progeny are the results of cross fertilization between different individuals.

12. Apomictic species.

These are those species in which there is no mixing of gametes between different individuals; mostly unisexual, i.e., producing only ova; others reproduce completely asexually by budding or fusion and have no functional sexual stage in any part of the life history.

13. Monotypic species.

Species with one subspecies.

14. Polytypic species / Ressenkries.

Species with two or more subspecies.

15. Paraspecies.

In palaeontology, isolated parts of animals or fragments when named equally as species or other taxa.

16. Semispecies.

A taxonomic group intermediate between a species and subspecies especially as a result of geographical isolation.

17. Superspecies / Artenkreis.

Aggregate of a group of semispecies.

18. Species of Ray and Linnaeus.

Species of Ray and Linnaeus was typological species. it was a fixed or static taxonomic unit which did not change and as such existed permanently and forever.

19. Subspecies.

A subspecies is an aggregate of local populations of a species inhabiting a geographic subdivision of the range of the species & differing taxonomically from other populations of the species. Species of Ray and Linnaeus was typological species. it was a fixed or static taxonomic unit which did not change and as such existed permanently and forever.

