Zootaxa 3572: 11–17 (2012)
www.mapress.com/zootaxa/

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

Article

urn:lsid:zoobank.org:pub:E778C562-7978-49A0-B57E-C2784A062E15

Transferability of genomes to the next generation: the fundamental criterion for the biological species

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Abstract

Biological species as the basic units in biodiversity unify organisms that are similar in structure, development and ecological demands. Since Darwin's work on the origin of species, intensive efforts have been mounted to find a criterion for biological species that is common to all organisms, prokaryotes as well as eukaryotes, making species natural units. This has led to numerous species concepts, but none have met the requirement of universal application. Additionally, many concepts are based on criteria that can be used only for recognizing species (operational criteria), not defining the 'being' or make-up of the species (explanatory criteria). The definition of a species concept proposed herein regards species as a pool of similar genotypes interconnected in successive generations. This pool can be homogeneous or be divided into sub-pools. Interconnectivity within such pools is given by transferability, which means the potential to transfer complete genomes or genome halves to the next generation, perpetuating transferability. A change in genotype frequencies over successive generations is caused by preferred or restricted genome transfer due to intrinsic and/or extrinsic factors. Speciation is defined as splitting up or splitting off a pool of genotypes into pools with differing genotype frequencies, in combination with a definite loss of transferability of genomes or genome halves between these pools.

Key words: Biological species, genotypes, genome transferability, speciation

Introduction

Biological species are taken to be real things in the world. The recognition of such entities and the information transfer of their existence to other persons are fundamental for humans, especially when these differences are important for nutrition (e.g. Wilkins 2010). This is also true for animals, which learn to discriminate between different species and generalize from this experience to all similar forms (Hohenegger 1992). The reality of such entities explains the correspondence between classification of organisms by natives and specialized taxonomists (Diamond 1966). It contradicts the 'nominalistic species concept', which negates such entities as constructs of the human mind (Bessey 1908).

Since the hierarchical classification of Linnaeus (1758), classes of the 'species' category were used to represent the diversity of organisms. Starting with Darwin (1859), the nature of the biological species has been a longstanding and important topic, becoming intensified with the introduction of the 'biological species concept' (Mayr 1942). The biological species concept fails to be universal in two ways. First, it cannot be applied to all organisms because it is restricted to sexual reproduction. Second, 'isolation' as the result of speciation does not explain the factors leading to isolation and can be used only to delimit species. Isolation is thus restricted to recent species, because it can be tested solely on living organisms. Therefore, those factors causing isolation must be regarded as the fundamental criteria for a biological species concept. Paterson (1985) introduced the 'recognition species concept', terming these factors a 'common fertilization system' (Paterson 1993). The recognition criterion is not operational and thus inapplicable for delimiting species. Moreover, it also fails to be universal by excluding all organisms without a mating system.

Several species concepts have been established since the introduction of the biological species concept. All attempt to provide a universal concept that is general, applicable and theoretically significant, but all failed (Hull 1997). Mayden (1997) categorized the 25 concepts developed until 1996 and arranged them in a hierarchical order (Mayden 1997: Fig. 19.1).

Accepted by M. Ebach: 7 Nov. 2012; published: 5 Dec. 2012