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TICK TAXONOMY: BIOLOGY *VERSUS* GENETICS

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Since Aristotele (384–322 BC) in his *Ton peri ta zoia historion* ("History of Animals") to present days, men have tried to classify life. This is what taxonomy is about: the art of naming, describing and classifying organisms. Although ticks had been known since ancient times, tick taxonomy is considered to be born in 1758, when C. Linnaeus published the 10th edition of *Systema Naturae*, even if Linnaeus's first attempt to systematize the knowledge of *Acarus* (which, at that time, included ticks) had been published before, in 1746, in his *Fauna Svecica*. Anyway, tick taxonomy remained, in a sense, obscure for years, until the illuminating works by C. L. Koch (19th century) and L. G. Neumann (late 19th-early 20th centuries), which represented the Aurora of modern tick taxonomy. During the last 260 years, tick taxonomy has evolved considerably, from refined morphological studies to modern phylogenetic analyses. While the morphological species concept is still the most widely used in tick taxonomy, it became clear that morphology, alone, is not enough to uncover the global diversity of ticks. Combined approaches have unveiled the existence of cryptic tick species within the so-called species complexes. The biological and genetic species concepts are becoming more popular in modern tick taxonomy, shedding new light into old taxonomic issues, but also uncovering new problems to be fixed. Evidence of natural hybridization has been provided for different tick species; thus, successful hybridization does not necessarily confirm conspecificity. Genetic differences reflect time of divergence but may not necessarily indicate reproductive isolation or morphological divergence. Integrative approaches should be employed to assess the existence of cryptic species, but their results should be interpreted with caution. For instance, crossbreeding experiments may not be enough to assess conspecificity, as different species may not be reproductively isolated. Moreover, data from mitochondrial DNA should be interpreted with prudence as well, as paternal inheritance of mitochondrial DNA and mitochondrial heteroplasmy has recently been suggested in ticks. The creation of a "Non-Exclusive, Collusive Species Concept" would be desirable to enhance our understanding of biodiversity and speciation in ticks. This concept would recognize a species as a group of organisms, whether living or extinct, that can be unequivocally distinguished from their congeners, whether by morphological, biological, ecological and/or genetic traits. Indeed, a consensual species concept would be highly desirable, also to avoid future instabilities in tick taxonomy.

Keywords: Ixodida, species definition, population genetics, interbreeding, DNA inheritance.