

## ***In Memoriam: Ignacio Ribera Galán (1963-2020)***

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On April 15th 2020, our colleague and dear friend, Ignacio Ribera, passed away. His work on faunistic, systematic, taxonomy, evolution, biogeography and conservation of water beetles has contributed enormously to the growth of the “Iberian Limnology”.

Ignacio was born in Martorell on 9th March 1963 and since childhood he was fascinated by insects in general and beetles in particular. He completed a degree in Biology at the University of Barcelona, being awarded as one of the best students. Shortly later, he began his PhD in the Development and

Research Centre (CSIC) in Barcelona, granted by a fellowship from the Spanish Government, and concluded it in 1992 with outstanding marks. In 1995, he moved to the Scottish Agricultural Center in Auchincruive under the supervision of Garth Foster, one of the main specialists in water beetles worldwide. Then, he worked at the University of Murcia (Spain) as “Associate Professor” (1997), consolidating the collaboration with Andrés Millán. After that, he moved to London to work as a postdoctoral researcher in the Imperial College and Natural History Museum supported by both Marie Curie and Leverhulme Special Research fellowships. During this fruitful period, Ignacio worked closely with Alfried Vogler, one of the most recognised researchers on molecular systematics and evolution of insects. He returned to Spain in 2004 awarded with a “Ramón y Cajal” contract to work in Madrid at the National Museum of Natural Sciences (CSIC), where he reached a permanent position in 2005. Finally, in 2008 he moved to the Institute of Evolutionary Biology (UPF-CSIC) in Barcelona.

He published close to 300 scientific documents, including articles, books, book chapters and other outreach works. More than 160 of such papers were published in SCI-indexed journals (citations: 4487, h index: 37). He described 97 new species for science, 16 genera and even a new family of water beetles (Ribera *et al.*, 2002). Besides, he published the first comprehensive checklist of aquatic and semiaquatic Coleoptera for the Iberian Peninsula (Ribera *et al.*, 1999) and was the senior author of the book “Atlas of aquatic Coleoptera from mainland Spain” (Millán *et al.*, 2014).

Ignacio was primarily an evolutionary biologist, who actively worked on the phylogeny and evolution of water and cave beetles, with a particular emphasis on the Western Palaearctic. Early in his career, Ignacio found in molecular phylogenies a promising and powerful tool for addressing many of the questions that he wished to answer about beetle taxonomy, evolution, biogeography and conservation. An important part of Ignacio’s research focused on the phylogenetic systematics of aquatic Coleoptera, a field in which he became an internationally recognised authority. His research in this field contributed to the classification and reconstruction of the evolutionary history of different water beetle lineages, both small clades and entire families, therefore making aquatic coleopterans one of the few hyperdiverse insect groups with well-resolved phylogenies (Bilton *et al.*, 2019). In the early 2000s, and in collaboration with the mentioned Prof. Vogler, he started the study of the evolutionary relationships of diving beetles (Dytiscidae) and other aquatic Adephaga groups (Ribera *et al.*, 2002; 2004; 2008), a research line that continued until his last days (e.g. Beutel *et al.*, 2008; Ribera & Faille 2010; Abellán *et al.*, 2013; García-Vázquez *et al.*, 2016; Fery & Ribera, 2018). An important contribution associated with his stay in London was the study of phylogenetic relationships of the whole Coleoptera (Hunt *et al.*, 2007), an overwhelming order-level phylogeny where the multiple transitions to the aquatic realm were for the first time located and dated. Over the years, he enlarged the scope of his research to other water beetle groups, with a special focus on Hydraenidae (Ribera *et al.*, 2010; 2011; Abellán & Ribera, 2011; Trizzino *et al.*, 2011; Villastrigo *et al.*, 2019). Beyond his work with species-level phylogenies, Ignacio made also a substantial contribution in the field of phylogeography and historical biogeography, leading to elucidate the evolutionary history of populations, subspecies and species of water beetles (e.g. Ribera *et al.*, 2003a; Abellán *et al.*, 2009). Among other achievements, his research provided an outstanding contribution to understanding the role of Pleistocene climatic changes promoting water beetles diversification and speciation in Mediterranean refugia (Ribera & Vogler, 2004; Ribera *et al.*, 2011; García-Vázquez *et al.*, 2017; Abellán & Ribera, 2017). Additionally, he also became an expert in cave and soil beetles beyond those those linked with groundwater (e.g. Faille *et al.*, 2013; Cieslak *et al.*, 2014; Andújar *et al.*, 2017).

Apart from strict phylogenetic and systematic studies, Ignacio used species-level phylogenies to address a number of transversal questions in ecology and evolutionary research, such as: What determines species geographical range size? What mechanisms shape speciation and adaptive divergence? Which are the evolutionary consequences of specialisation? His researches in these diverse areas are well characterised by the use of information from multiple methodological approaches (including ecological modelling, thermal and osmotic physiology, microscopy or morphometrics) integrated within

a robust phylogenetic frame of hypothesis testing. An important part of his research concentrated on the effect of habitat constraints in the genetic structure, macroecology and macroevolution of freshwater invertebrates. In this field, he studied the evolutionary consequences of one of the main habitat constraints in aquatic ecosystems: the division between standing (lentic) and running (lotic) waters. It has been hypothesised that the contrasting ecological stability of these two habitat types has profound implications on the species inhabiting them, driving disparities between specialists from both habitats ranging from dispersal abilities to macroevolutionary patterns (revised in Ribera 2008). Thus, he was a pioneer in reporting range size differences and distinct latitudinal diversity gradients between lotic and lentic specialists (Ribera & Vogler, 2000; Ribera *et al.*, 2003b). These results were linked to the constraints that the long-term persistence of habitats imposes on species dispersal ability and supposed the starting point for subsequent studies, which supported this hypothesis. Later, Ignacio *et al.* demonstrated that restricted lotic specialists show higher genetic diversity than their widespread sibling species from lentic habitats (Abellán *et al.*, 2009), that lentic specialists have experienced higher range shifts throughout the Quaternary period (Abellán *et al.*, 2011) and that species range size is related to geographic location and phylogeny (Abellán & Ribera, 2011). Further research also supported previous work in this line by reporting a higher degree of equilibrium with the climate in lentic specialists as a consequence of profuse postglacial recolonisation (Sánchez-Fernández *et al.*, 2012). These disparities between lotic and lentic sister species were later demonstrated to be caused by differences in dispersal capacity and not in establishment abilities (Arribas *et al.*, 2012). The most recent large-scale research done by Ignacio dealt with the contrasting geographical range conservation between lotic and lentic specialists (Abellán & Ribera, 2017), the range expansion from glacial refugia after the last glacial maximum (García-Vázquez *et al.*, 2017) as well as the relationship between body size and latitude (Pallarés *et al.*, 2019).

During the last years, Ignacio raised other questions, such as: What is the origin, and what are the evolutionary consequences of novel traits? What is the influence of these novel traits in species diversification? How these traits appeared and evolved in independent lineages? Thus, he led different studies focused on water salinity, which constitutes another strong evolutionary pressure for freshwater species, by addressing the evolution of salinity tolerance in different lineages of water beetles (Arribas *et al.*, 2014; Pallarés *et al.*, 2017; Villastrigo *et al.*, 2018). More recently, an important part of his research aimed to understand the origin and evolutionary consequences of habitat transitions between running and standing waters in aquatic macroinvertebrates and the development of tolerance to salinity. His recent research also contributed to understand the evolution of several key traits of water beetles. For example, he led studies exploring the evolution of physiological changes in thermal tolerance and its association with diversification, range expansion and speciation (Hidalgo-Galiana *et al.*, 2014; 2016) or aimed at disentangling the evolutionary origin of complex patterns in the morphology and diversity of coleopterans' genital structures (Rudoy & Ribera, 201a; Rudoy *et al.*, 2016).

An important part of Ignacio's research has been also focused on conservation of freshwater biodiversity. This research has developed different approaches and strategies from the double perspective of setting conservation priorities for species and areas. Indeed, he was a pioneer in identifying Iberian water beetles which could be the target of conservation efforts, firstly revising the status of the species included in the IUCN red list (Ribera, 2000) and, more recently, identifying endemic threatened species (Sánchez-Fernández *et al.*, 2008). He was also actively involved in studies focussed on the assessment of the effectiveness of protected areas in terms of conserving taxonomic (Sánchez-Fernández *et al.*, 2008, 2011) and phylogenetic diversity (Abellán *et al.*, 2013) as well as some specific niche features and their response under future climate scenarios (Sánchez-Fernández *et al.*, 2013).

He supervised 6 PhD (+ 2 on going), and advised a number of postdocs and researchers from anywhere in the world, being one of most demanded mentors in evolution of aquatic insects. He was an exceptional "field worker", spending a lot of time traveling and sampling in all possible water bodies around the world, usually accompanied by PhD students and colleagues. The suggestions of key ques-

tions and how to test them, and his brilliant research advice whenever it was needed were essentials to successfully guide students under his supervision. Ignacio was a true team player, who generously inspired so many researchers around him. Wisdom, humanity and calm were his main personal features. Undoubtedly, aquatic ecologists and evolutionary biologists have lost one of their reference figures. He was the star, which was shining without wishing so, and likely, the most humble genius we ever met. We'll never forget him.

A full list of Ignacio's publications together with the species new for the science described by him and collaborators can be found at: <https://www.um.es/ecoaqua/index.php/external-collaborators>.

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