

Odonata

Biology of Dragonflies



Dr. B.K. Tyagi

ODONATA

BIOLOGY OF DRAGONFLIES

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*This festschrift
is
fondly and respectfully dedicated to*



Professor Dr. Bastiaan Kiauta

Ph.D., D.Sc.

(Photographed soon after he was knighted by the Queen on 26th April, 2002)

The doyen of odonatology

&

The Patron of International Odonatological Foundation (SIO)

BEFORE AND AFTER 1971: A PERSONAL TRIBUTE TO BASTIAAN KIAUTA

I am old enough to have studied dragonflies for over thirty years before Bastiaan and his colleagues launched the Societas Internationalis Odonatologica (SIO) in 1971 and published the first volume of Odonatologica in 1972. I was interested in dragonflies as a boy but there was no popular book to help me to identify them. Cynthia Longfield's book "The Dragonflies of the British Isles" changed all that, and later she introduced me to the literature on dragonflies on a world scale. However I did not know personally any of those working on dragonflies outside the British Isles. Numerous other odonatologists in other countries were in a similar situation. The initiatives of Bastiaan and his colleagues opened up a new world. Not only was there now a new journal devoted entirely to dragonflies, but it provided a most useful literature abstraction service.

Yet perhaps the most important service that Bastiaan and his colleagues provided was the initiation of biennial International Symposia all over the world, with visits to wonderful dragonfly habitats where all of us lucky enough to attend could in addition enjoy dragonflies together in the field, and form friendships which stood the test of time. I for one will always be grateful to Bastiaan's leadership, so ably supported by Marianne and tirelessly assisted by Janny van Brink, for this enrichment of my life. Thank you, Bastiaan, for your pioneering work.

Best wishes for the future.

20th November, 2006

Prof. Dr. Norman Moore
Ex-Chairman
Odonata Specialist Group
Species Survival Commission (IUCN)

To
My Teacher and Guide
Professor Dr. B. Kiauta

FOREWORD

I am much honoured to write the Foreword to the Festschrift for Professor Dr. Bastiaan Kiauta on occasion of his seventieth birthday. He was born in Slovenia, and moved to the Netherlands, where he studied odonatology, especially as an expert in invertebrate cytology and cytogenetics. He engaged in research and education as a professor at the University of Utrecht.

The First Colloquium of Dutch Dragonfly Workers was held in Utrecht, the Netherlands in 1970 organized by Dr. Kiauta. This led to the venue of the First European Symposium of Odonatology in Ghent, Belgium, in 1971 on which occasion the first explicitly international association named *Societas Internationalis Odonatologica* (S.I.O.) started. He played the central role in the foundation of this long standing international society. He started the publication of the quarterly journal *ODONATOLOGICA*, Journal of the *Societas Internationalis Odonatologica* (S.I.O.) and its semiannual journal *NOTULAE ODONATOLOGICAE*. The punctuality of publication and the high quality of the published papers led the former journal to be indexed in Current Contents, Science Citation Index and Research Alert, and covered by most of the major abstracting services.

Dragonflies occur worldwide, and the odonatologists need to know their own odonate fauna as well as those of other areas. On this account the international communication and mutual help are indispensable. What Dr. Kiauta has done and continues to do is indispensable for the current and forthcoming research in odonatology alike.

He was knighted by the Queen of the Netherlands on 26th April 2002 in recognition of his remarkable management activities and his highly valued contributions to science. I think his knighthood award is an honour to all of us engaged in odonatological research.

On the occasion of the 1997 Symposium of Odonatology held in Maribor, Slovenia, S.I.O. was reorganized into the "International Odonatological Foundation S.I.O." The reorganization brought some difficulties into the management, but his enthusiasm and generosity opened the way for further development.

When we speak of his activity, we cannot forget to mention the devoted help of his lovely wife Mrs. Marianne Kiauta-Brink. She is always helping him or co-working with him in editorial and administrative matters. On Bastiaan's 70th birthday our heartfelt congratulations also go to her; and the odonatologists, his colleagues and friends, thank her for all she did for us through her help to him! She is also the author of many excellent poems, especially in the field of "haiku", a poetry form, in a pattern of approximately 5, 7 and 5 syllables with reference to the natural world.

Our friend Dr. Kiauta always calls his colleagues in odonatology a "family". We help any researchers, when asked, in the same way as if requested by our brothers and sisters. He is so to speak the "Father of the large family of odonatologists worldwide". We, as the members of this family, look forward to a continuation of our Father's valued contribution to odonatology in the years that lie ahead.

Last but not least, I should like to tender my cordial thanks to Dr. B.K. Tyagi for his initiative to publish this dedication book, and for his kindness to give me the opportunity to write the foreword. I admire his effort and talent which enabled him to publish such a great scientific book written by many authors worldwide.



Date: 10th December, 2006

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PREFACE

Dragonflies (Odonata) are unique insects. They are complex and intriguing creatures. Their life cycle is enigmatic, not least because of the remarkable development from water-dwelling larvae to the aerial life of adult – which necessitates a complete adjustment of the internal respiratory mechanism. With each generation, the dragonfly seems to retrace the evolutionary path that led some animals to leave aquatic life for good and adapt to land living. Quoting Professor Dr. B. Elwood Montgomery, the world famous American odonatologist, Professor Dr. B. Kiauta, Executive Editor of *ODONATOLOGICA*, and the former Director of the Netherlands Centre for Alpine Biological Research (N.C.A.B.R.), Utrecht, has justly given the brief and pointed characterization of the dragonflies, which, in my opinion, could not be styled more clearly and beautifully.

“In more than one feature they differ, at the very first glance, from all other insect superorders. The mayflies (Ephemeropteroidea) and dragonflies (Odonopteroidea) are the only members of the cohort (or pterygote subclass ?) of Paleoptera and were the first to split off from the pterygotan stock – an event that occurred probably as early as in the Lower Devonian. The two superorders are but very remotely allied, and do not at all show any structural affinities with the other pterygotan groups. Both superorders characterized by a number of extremely archaic features, have evolved but very little in the course of the past geological epochs, and are, therefore, justly considered as a kind of living fossils.”

Evolutionarily speaking dragonflies present a world of information on the pathways insects have gone along to metamorphose into their present form and shape. The living dragonflies, represented by over 6000 known species organized into 28 families under the three living suborders, represent but one order (Odonata) of a once flourishing group, the other order of which, Protodonata, became extinct already in the Upper Permian. In insect

phylogeny dragonflies also occupy a unique position. Since the Upper Paleozoic they have not changed essentially from the structural point of view and are considered as “living fossils” par excellence. In no other insect group is the paleontological evidence as complete as in dragonflies; therefore it is not surprising that the classification of the superorder is nearly entirely based on those morphological features that are liable to preservation in fossil material, most particularly on wing venation. Nothing is known on the direct ancestors and the earliest dragonfly history. In the Lower Carboniferous the two orders, Protodonata and Odonata, were already flourishing. While the former became extinct towards the end of the Paleozoic, three out of seven odonata suborders survived to the present time, viz., Zygoptera, Anisozygoptera and Anisoptera. Anisozygoptera were the dominant suborder of the Mesozoic era and are represented in the present day fauna only by two relic species, one of which is endemic in the Himalaya (both in Darjeeling, India and in Shivapuri Hills, Nepal). The Zygoptera and Anisoptera, on the other hand, are the dominant groups of our Kenozoic times.

The dragonflies comprise one of the most important groups of aquatic animals. The ecological significance of dragonflies and their importance in environmental monitoring have often been emphasized. Being voracious predators in both immature (aquatic) and adult (aerial) stages they are important elements of all, except the drier (or high alpine) environments in temperate and tropical regions, occupying a position at the apex of the food chain of invertebrate life. In addition to their biological importance in such environments, these relationships render them the ultimate accumulators of persistent compounds in polluted waters. They are thus ideal organisms to be used as indicators of water pollution and contamination. Many species serve as intermediate hosts of fluke parasites of birds, and thus are important in the transmission of parasitic diseases, especially of domestic poultry and wild ducks. Because of their unique morphology and physiology, dragonflies are used extensively in the study of many biological phenomena.

Dragonflies present manifold applications in biomedical sciences, too. They are a good biological control agent for several disease transmitting mosquitoes, especially *Aedes aegypti*, the vector for deadly dengue, yellow fever and chikungunya. Although distantly conjectured, yet these insects have lately been associated with the forensic science. In more recent times it has been realized to develop nano-technologically a highly sophisticated, effective and durable eye lens for human use on the basis of knowledge of the dragonfly's

magnificent compound eyes. Also, dragonflies veritably find a place in human social and cultural development. There are regions in some continents of the world where dragonflies are offered as a delicacy on the menu, while in others they are source of music composition, folk dance and folk tales. They are beauty *nonpaeil* and, therefore, dragonflies appear in print on textile and ornamental products of varying nature.

Dragonflies have attracted attention of some of the world's most celebrated entomologists, to mention a few, like Drs. R.J. Tillyard, P.P. Calvert, G.D.H. Carpenter, A.E. Gardner, C.H. Kennedy, E.B. Williamson, J.G. Needham, S. Asahina, R.M. Gambles, M.J. Westfall, C. Longfield, B.E. Montgomery, F.C. Fraser, M.A. Lieftinck, P.S. Corbet and, of course, B. Kiauta. Their attraction to these taxonomically and evolutionarily highly significant, yet absolutely harmless, creatures is a testimony of dragonflies' enormous value in our knowledge-based ecosystem. Prof. Bastiaan Kiauta, to whom this festschrift is being most fondly and respectfully dedicated, for his lifelong outstanding services to the science of odonatology, including dragonfly conservation and the S.I.O., unparalleled in the annals of dragonfly science, is one of those greatest ever scientists who by their energetic character not only practically educate the budding researchers in habits of industry, but by the example of diligence and perseverance which they set before them, largely influence the scientific activity in all directions and contribute in a great degree to form the national character. I hereby choose to record what many of his odonatological colleagues, friends and students across the world, with some of whom I had an opportunity to communicate recently, think of him: **Dr. Angelo B.M. Machado**, "*I am a very good friend of Bastiaan nobody has contributed so much for the development of the world odonatology than him.*"; **Dr. Milen Marinov**, "*I'm happy to have your Invitation and it will be an honour for me to write anything to celebrate Prof. Kiauta's birthday. In fact he is the one who supported me in the beginning of my researches with dragonflies and gave me every important advices and magazines as well.*"; **Dr. Theischinger Gunther**, "*Bastiaan has always been a very dear friend*"; **Dr. Jan von Tol**, "*Our good and esteemed colleague Professor Bastiaan Kiauta*"; **Dr. Robert Baker**, "*I am very appreciative of all that Professor Kiauta has done for Odonatology*"; **Dr. Gerhard Jurzitza**, "*His (Dr. Kiauta) 70th birthday will be in January 2007If I shall be able I shall send him a personal letter I would be glad to get a copy of the congratulation book.*"; **Dr. René Hoess**, "*Our honorable colleague Bastian Kiauta.*"; **Dr. Do Manh Cuong**, "*I would be very happy if I have published something in the festschrift in proud honor of*

Prof. Dr Bastian Kiauta.”; **Dr. León Andrés Pérez Gutiérrez**, “*Festschrift ...in proud honour of Prof. Dr Bastian Kiauta my paper.*” These are but a few of the scores of similar highly appreciative communications I have received, and all these show enormous respect and honour in the hearts of Dr. Kiauta’s thousands of young and old associates all over the world!

I hope that this book, written originally by as many as 23 specialist odonatologists from different countries in all continents of the world, covering a vast range of subjects as diversified as taxonomy, ecology, zoogeography, biology, cytogenetics and cytotaxonomy, ethnoentomology and many more, offer plenty of novelties in the ever growing science of odonatology and will serve a good purpose to expand knowledge globally by both the professional and amateur scientists and scholars alike.

Finally, writing this rare but most significant festschrift in the profound honour of 70th glorious birthday of Professor Dr. B. Kiauta has been a great and highly rewarding experience for me. The kind of help, support and encouragement showered on me in accomplishing this task on time by the numerous extremely busy and preoccupied odonatologist authors of this festschrift, at a very short notice, is a huge learning experience for me about the values of commitment, perseverance and punctuality. Without their, and very many others’, kind cooperation and attention an important responsibility like the preparation of this festschrift would have been almost impossible to be realized on time! My heartfelt thanks are always due to all of these dragonfly friends for everything they have done to the science of odonatology, to the festschrift of Dr. Kiauta and to keep the faith in the institution of “good odonatological family”, a thesis always so close to the heart of Prof. Kiauta. Indeed, we feel extremely obliged and blessed in dedicating this festschrift to Professor Dr. B. Kiauta – the doyen of odonatology.

Madurai

Dr. B.K. Tyagi

20th January, 2007

ACKNOWLEDGEMENT

Foremost I express my deepest sense of gratitude to the various authors who appreciated wholeheartedly this noble project of writing the festschrift in proud honour of the glorious 70th birthday of Prof. Dr. B. Kiauta, and instantaneously accepted to contribute highly valuable manuscripts even at a very short notice. This dream of offering a festschrift to Dr. Kiauta could become a reality largely due to their, and of scores of other odonatologists from all continents of the world, unparalleled sense of commitment, great camaraderie, unflinching cooperation and incessant encouragement. I wish to particularly thank Mrs. Marianne Kiauta for helping with the compilation of Prof. Kiauta's odonatological bibliography, one the most important compositions of the festschrift, and for kindly providing help with certain other details. My heartfelt thanks are also due to Dr. K. Inoue for his generous gift of Prof. Kiauta's knighthood photograph.

As ever in the past, my wife Ajita and daughters Anupama and Akansha were a great source of energy and determination in my undertaking the Festschrift project. They have been both my greatest critic and supporter.

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