

Alkaloids, Plants and Butterflies: a Farewell to José Roberto Trigo (1956–2017)

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During the night of 28th–29th November 2017 José Roberto Trigo, professor of Chemical Ecology at the Universidade Estadual de Campinas (UNICAMP), died unexpectedly at the age of 61 at his home in Paulínia, São Paulo. Trigo, as he was known, will be remembered as a multitasked chemical ecologist and a passionate educator. His passing is an enormous loss for Brazilian ecology, and in particular for Neotropical Entomology, where he served for 10 years (2005–2014) as part of the editorial board in the Ecology, Behavior and Bionomics section.

Trigo grew up in São Paulo city under difficult circumstances, something which profoundly shaped the way he viewed life and academic work. In 1979 he entered the biological sciences programme at the Universidade de São Paulo (USP), Ribeirão Preto Campus, and received his degree in 1982. He then approached Keith S. Brown Jr. at UNICAMP, and between 1984 and 1988 under Keith's supervision, he carried out his Master's degree in Ecology studying sequestration of plant metabolites by Ithomiine butterflies. This experience would open the door to what would become Trigo's major contribution to chemical ecology: the interaction between plant secondary metabolites, insect defence and insect pheromonal communication. After completing his Master's, Trigo realised that, in order to answer the

ecological questions that interested him, he needed a deeper knowledge of chemistry, and decided to carry out his doctoral studies in Chemistry at UNICAMP under the supervision of Lauro E. Soares Barata, in collaboration with Keith Brown. This decision to study chemistry in depth would give Trigo a unique professional profile, at least in Brazil: an ecologist who thoroughly understood chemistry and therefore had the chemical tools to rigorously test ecological hypotheses.

After a postdoctoral placement in Thomas Hartmann's laboratory at the Technische Universität Braunschweig, Germany, in 1997 he became a lecturer in Animal Ecology, and leader of the Chemical Ecology laboratory at UNICAMP, following Keith Brown's retirement. At the undergraduate level he lectured mainly in general ecology and was known for his passionate and rigorous approach to teaching. Over the many generations of students that passed through his courses, his uncompromising approach led to most students recognising that few people in academic life cared more about students understanding the fundamental concepts of the field. At the postgraduate level he supervised or co-supervised over 30 Master's and doctoral students. His wide-ranging skills allowed him to supervise students in the Ecology, Plant Biology, Animal Biology and Molecular and Functional Biology programmes at UNICAMP. His laboratory was therefore a hub of interactions of students of different academic backgrounds. Trigo also chaired the postgraduate programme in Ecology at UNICAMP for four years, during which he began a process that later led the programme to become Brazil's first top-rated postgraduate programme in Biodiversity research.

In the field of chemical ecology, Trigo's early work alongside Keith Brown contributed publications that have become essential reading in the study of insect defence and sequestration of plant metabolites. He helped to understand the chemical mechanisms and evolutionary origin of sequestration of plant metabolites by butterflies, and how sequestration relates to defence conferred to insects as well as use as courtship pheromones by males. He initially focussed on Ithomiinae feeding on Solanaceae, but gradually expanded

his study systems to include Nymphalidae in general and later alkaloid-sequestering moths, in particular Arctiinae. More recently he became interested in other types of interaction between plant chemistry and insect defence, such as chemical camouflage.

Through his work on how insects use plant metabolites for their own defence Trigo developed an interest in plant defence theory, and during the last 15 years, this became a major line of research in his laboratory. With this work he was leading the way in the research on plant defence in native neotropical systems, for which we still have amazingly little information. He was interested in ideas such as the

selective pressures on defence exerted by specialist and generalist herbivores. This led him to consider defences in a broader context, and he began to intensively research the relative defence conferred by plant chemistry and extrafloral nectaries against specialist and generalist herbivores. This was a budding line of research, and Trigo was very enthusiastic as to where it would lead.

Brazilian chemical ecology has lost one of its leading lights and UNICAMP has lost a formidable lecturer and faculty member. We will remember Trigo as a unique chemical ecologist, a tireless contributor to many postgraduate programmes and a passionate educator.