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Co-authorship networks (and other contextual factors) behind the growth of taxonomy of South American Ephemeroptera: A scientometric approach

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Abstract

Science carried out in South America has experienced a major rise in the levels of productivity and impact during the last decade. The continuity of this process depends upon strong policy decisions of personnel training and of increasing investments. We study the effects of a new regional paradigm, specifically, an increasing international visibility through knowledge support, using the particular case of taxonomy of an ancient group of insects (Ephemeroptera) in South America. We tracked the number of new species described in scholarly papers along a period of two centuries. We have also mined patterns of connections from the respective co-authorship network. A quantitative framework to analyze historical sequences of scientific output is also proposed. Our results point out three stages of taxonomic development: (i) a pioneering stage (1800's–1970's) where foreign authors coming from Europe and North America account for almost the totality of described species, (ii) a transitional stage (1980's–1990's) where new species are described by both foreign and regional authors, and (iii) an autonomous stage (1999–present) where the bulk of scientific output is performed by regional authors. Remarkably, the transitional stage coincides with the advent of democracy in the region. We hypothesize that conjunction of funding and interactions between researchers act synergistically to foster an autochthonous taxonomy in South America.

Key words: network analysis, research and development, systematics, funding

Introduction

Taxonomy is the science concerned with the exploration, description and analysis of species and their phylogenetic relationships (Anonymous 1994a, 1994b). This discipline plays a central role in all branches of biological sciences because it delivers the basic and indispensable knowledge of the life on Earth. Since we still depend on our knowledge on the living world around us for increasing our chances of survival and welfare, the importance of taxonomy also radiates to different human activities. Taxonomy, although fundamental, is the hidden service behind activities ranging from biodiversity conservation to food security, human welfare, new industrial products, and eco-tourism (Smith *et al.* 2011). Despite its significance, taxonomy is often perceived as relevant only to specialists working at natural history museums and universities. Because there may be no clear economic benefit in the short to medium term, taxonomy has long suffered funding shortages. According to Wheeler (2004:571) “Taxonomy, already weakened by decades of neglect, now suffers the loss of positions and funding to studies that reconstruct phylogeny that improve neither formal classifications nor the application of scientific names”. Besides these problems, the formation of taxonomists requires long periods of training before they become productive. For this reason, the interruption of funding for even short periods affects severely this long term preparation because specialists must shift their activities and rarely return to taxonomy. Nevertheless, it appears that in South America there is a significant growth in taxonomic output in recent times. Then, a natural question arises: is this trend coupled with a process of monetary injection into the scientific system?

In Latin American countries, Science and Technology (S&T) research depends primarily on public funding (Hansen *et al.* 2002). Therefore, it is subjected to the economic fluctuations and political inconstancy that

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APPENDIX 1. List of valid species (updated 2012).

FAMILY AMELETOPSIDAE

- *Chaquihua bullocki* (Navás, 1930)
- *Chiloporter eatoni* Lestage, 1931

FAMILY BAETIDAE

- *Adebrotus amazonicus* Lugo-Ortiz & McCafferty, 1995
- *Adebrotus lugo* Salles, 2010
- *Americabaetis alphas* Lugo-Ortiz & McCafferty, 1996
- *Americabaetis bridarolli* (Navas, 1932)
- *Americabaetis jorgenseni* (Esben-Petersen, 1909)
- *Americabaetis labiosus* Lugo-Ortiz & McCafferty, 1996
- *Americabaetis longetron* Lugo-Ortiz & McCafferty, 1996
- *Americabaetis maxifolium* Lugo-Ortiz & McCafferty, 1996
- *Americabaetis mecistognathus* Salles & Raimundi, 2010
- *Americabaetis oldendorffi* (Weyenbergh, 1883)
- *Americabaetis peterseni* (Hubbard, 1974)
- *Americabaetis robacki* (Lugo-Ortiz & McCafferty, 1994)
- *Americabaetis titthion* Lugo-Ortiz & McCafferty, 1996
- *Americabaetis weiseri* (Navas, 1926)
- *Andesiops angolinus* (Navás, 1933)
- *Andesiops ardua* (Lugo-Ortiz & McCafferty, 1999)
- *Andesiops peruvianus* (Ulmer, 1920)
- *Andesiops torrens* (Lugo-Ortiz & McCafferty, 1999)
- *Apobaetis fuzai* Salles & Lugo-Ortiz 2002
- *Apobaetis hamadae* Cruz, Boldrini & Salles 2011
- *Apobaetis insolitus* Nieto, 2006
- *Apobaetis kallawaya* Nieto, 2006
- *Apobaetis niger* Nieto, 2006
- *Apobaetis signifer* Lugo-Ortiz & McCafferty, 1997
- *Aturbina beatrixae* Gillies, 2001
- *Aturbina georgei* Lugo-Ortiz & McCafferty, 1996
- *Aturbina maculata* Salles, Boldrini & Shimano, 2010
- *Aturbina nigra* Salles, Boldrini & Shimano, 2010
- *Baetodes andamagensis* Mayo, 1972
- *Baetodes arawak* (Traver, 1943)
- *Baetodes awa* Salinas, Dias, Salles & Bacca, 2011
- *Baetodes capixaba* de-Souza, Salles & Nessimian, 2011
- *Baetodes chilloni* Mayo, 1972
- *Baetodes cochunaensis* Nieto, 2004
- *Baetodes copiosus* Nieto, 2004
- *Baetodes diasae* Salinas, Dias, Salles & Bacca, 2011
- *Baetodes gibbus* Nieto, 2004
- *Baetodes huaico* Nieto, 2004
- *Baetodes itatiyanus* Demoulin, 1955
- *Baetodes iuaquita* de-Souza, Salles & Nessimian, 2011
- *Baetodes levis* Mayo, 1968
- *Baetodes liviae* Salles & Polegatto, 2008
- *Baetodes peniculus* Mayo, 1973
- *Baetodes pehuenche* Nieto, 2004
- *Baetodes proiectus* Mayo, 1973
- *Baetodes proscolus* de-Souza, Salles & Nessimian, 2011