

Systematics, bionomy, and metamorphosis of Coleoptera (Insecta): Papers celebrating the 80th birthday of Cleide Costa

Foreword from the editors

Sônia A. Casari^{1,2} & Gabriel Biffi^{1,3}

¹ Universidade de São Paulo (USP), Museu de Zoologia (MZUSP). São Paulo, SP, Brasil.

² ORCID: <http://orcid.org/0000-0003-4895-6709>. E-mail: casari@usp.br

³ ORCID: <http://orcid.org/0000-0001-7532-3822>. E-mail: biffigabriel@gmail.com

Abstract. We present a brief biography of Dr. Cleide Costa, eminent entomologist from Museu de Zoologia da Universidade de São Paulo (MZUSP). She has been dedicating the last six decades to the study of adults and immatures of Coleoptera. Dr. Costa is the pioneer in collecting and rearing immature beetles in Brazil, being responsible for establishing the most extensive Latin American collection of reared immatures Coleoptera. We discuss central aspects of her personal history, as well as career landmarks and achievements. A compilation of taxa introduced to science by her, taxa named in her honor, and a full list of her scientific, educational and cultural production are provided in chronological order. More than a biographical account, this publication is an acknowledgment of Dr. Cleide Costa's legacy to entomology.

Key-Words. Biography, Festschrift, Publications, Tribute.

Cleide Costa: a pioneer in Brazilian coleopterology

This special volume of *Papéis Avulsos de Zoologia* (PAZ) is dedicated to Dr. Cleide Costa, a highly prolific beetle taxonomist from the Museu de Zoologia da Universidade de São Paulo (MZUSP). Her list of contributions comprises over 166 publications, including peer-reviewed manuscripts, books, book chapters, and science outreach articles. Dr. Costa's comprehensive work encompasses diverse fields of biology such as natural history, comparative morphology of adults and immatures, phylogenetics, and taxonomy in several groups of insects, most notably Coleoptera. She pioneered the study of immature insects in Brazil. A highlight of her career is a volume on the beetle larvae from Brazil ("Larvas de Coleoptera do Brasil"), considered amongst the most relevant publications in Brazilian entomology.

Dr. Costa described over one hundred new taxa across different taxonomic ranks, from species to family-level. She contributed to her home institution in several academic and administrative roles, including student mentoring, teaching, and erecting a world-class collection of immature beetles.

This editorial provides an overview of Dr. Costa's academic trajectory, starting from her early career as an entomology student to some of her most significant achievements and discoveries as a researcher. We also emphasize the pivotal relationship with close colleagues whose collaborative ties contributed to her outstanding accomplishments.

On the occasion of her 80th birthday, and in recognition of her exceptional career, we dedicate this volume to Dr. Costa, which introduces 35 original papers in 25 Coleoptera families. These manuscripts encompass most of the subjects and fields of study Dr. Costa has comprehensively explored in her career, featuring 53 new taxa, most of which are named in her honor. The distinguished team of experts who contributed with high-quality papers is a testimonial of her legacy and the esteem that her colleagues afford her.

This publication is part of the academic activities circumscribed to the "VI Simpósio de Coleoptera" occurring in the "XXXIII Congresso Brasileiro de Zoologia", which will be held in Águas de Lindóia, São Paulo, Brazil, March 2nd-6th, 2020. On this occasion, part of the Brazilian scientific community will acknowledge Dr. Costa in person for her contributions to our field.

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Early career and the academic trajectory of Cleide Costa in the Museu de Zoologia da Universidade de São Paulo

Cleide Costa (Fig. 1) was born on the 22nd of October, 1940, in São José do Rio Preto, a city in the countryside of the state of São Paulo, Brazil. From 1960 to 1963 she attended university, graduating in the subject of Natural History at the “Faculdade de Filosofia, Ciências e Letras de São José do Rio Preto” (currently “Universidade Estadual Paulista Júlio de Mesquita Filho” – UNESP), in her hometown.

Her interest in entomology arose early as an undergraduate. Under the supervision of Zoology Professor Luiz Dino Vizotto, Cleide conducted a project on rearing grylinid beetles in the laboratory. Such a study would re-

quire the further assistance of a coleopterist with taxonomic knowledge. Seeking to learn more about her subject, Cleide started a close correspondence with eminent entomologist Dr. Ubirajara Ribeiro Martins, who advised her on the fundamentals of taxonomy and beetle identification (Fig. 2). The growing experience in Coleoptera and the new challenges stemming from these studies prompted her to seek closer guidance from a specialist, and thus Cleide would attend the DZ quite often, to work with Dr. Martins. These early visits were the beginning of a long and prolific career at MZUSP, which strongly influenced the field of entomology in Brazil.

One year after initiating the internship at DZ, Cleide’s unique talent for beetle systematics earned her a position of curator of the entomology collection. After she became a staff member, Cleide started her graduate



Figure 1. Cleide Costa working at the Museu de Zoologia da Universidade de São Paulo. (A) Dr. Cleide Costa; (B) Cleide working on the Elateridae collection, June 1972; (C) Cleide working with Wanessa Zorzan, 1980; (D) Cleide and Sergio Vanin, May 1993; (E) Cleide and the MZUSP team at the inauguration of the new facilities of Boracéia Biological Station, August, 1996; (F) Cleide, currently working at the MZUSP; (G) Tribute from the MZUSP for Cleide’s “50 years of outstanding performance, dedication, ethics and love for the research and teaching”, Marcos Tavares, Cleide Costa, Sônia Casari, Sergio Vanin and Simone Rosa.

studies with renowned Brazilian zoologist Dr. Paulo Emilio Vanzolini, on a new line of research in Brazil: the systematics of luminescent elaterid beetles.

Influenced by her early studies on the life cycle of insects, and concerned about the scarcity of data on beetle immatures, especially from the Neotropics, Cleide set out an ambitious goal: to study the morphology, bi-

ology, and metamorphosis of Coleoptera. Under Cleide's leadership, in countless collecting trips and fieldwork, immatures samples were collected by herself and her students, colleagues, and collaborators. As a result of a long-lasting routine of collecting and rearing, Cleide assembled the most extensive Latin American collection of laboratory-reared immatures of Coleoptera, which is

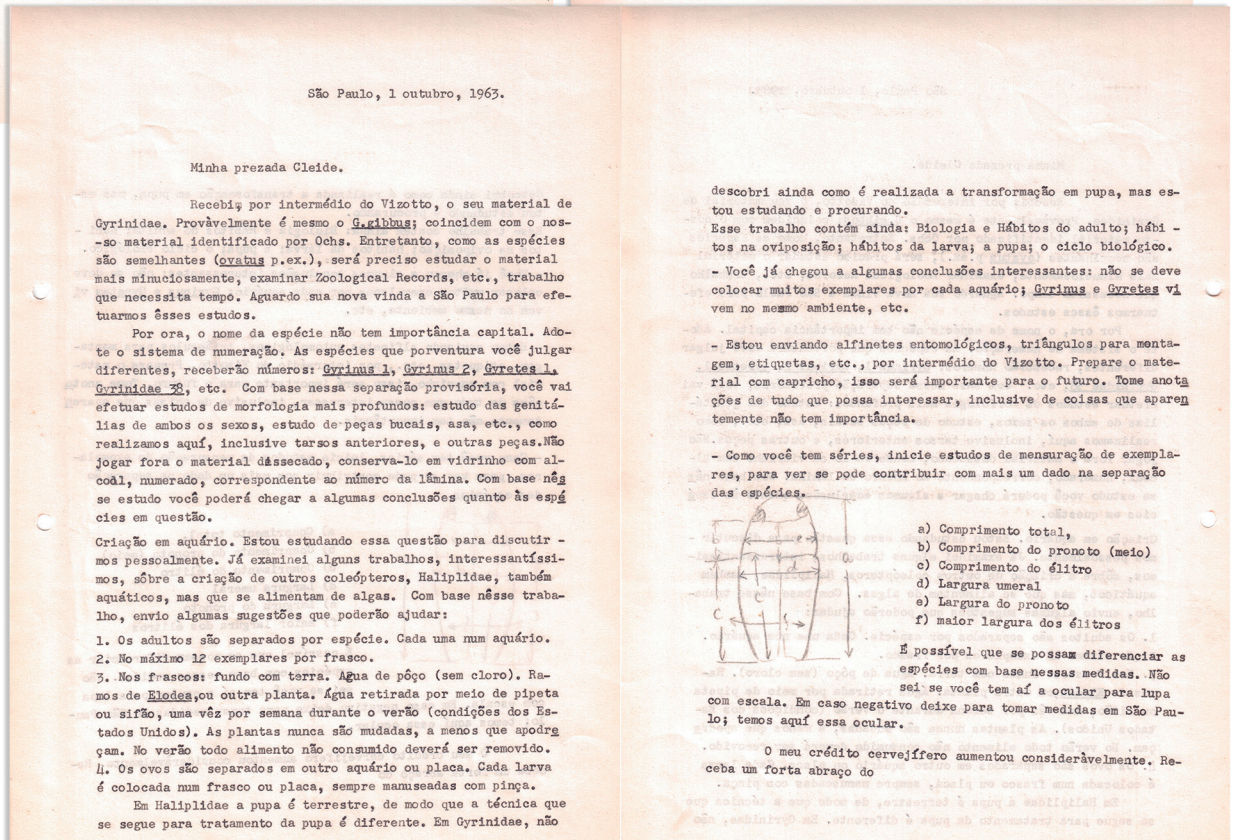
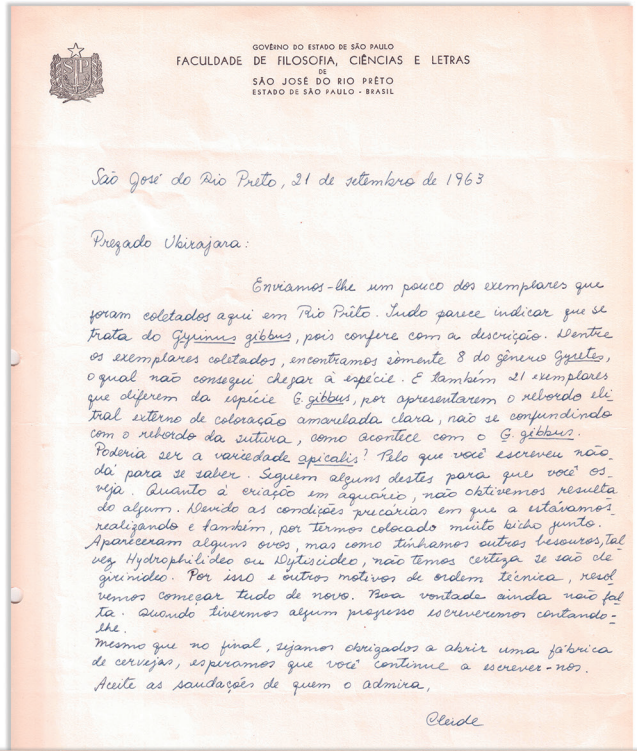
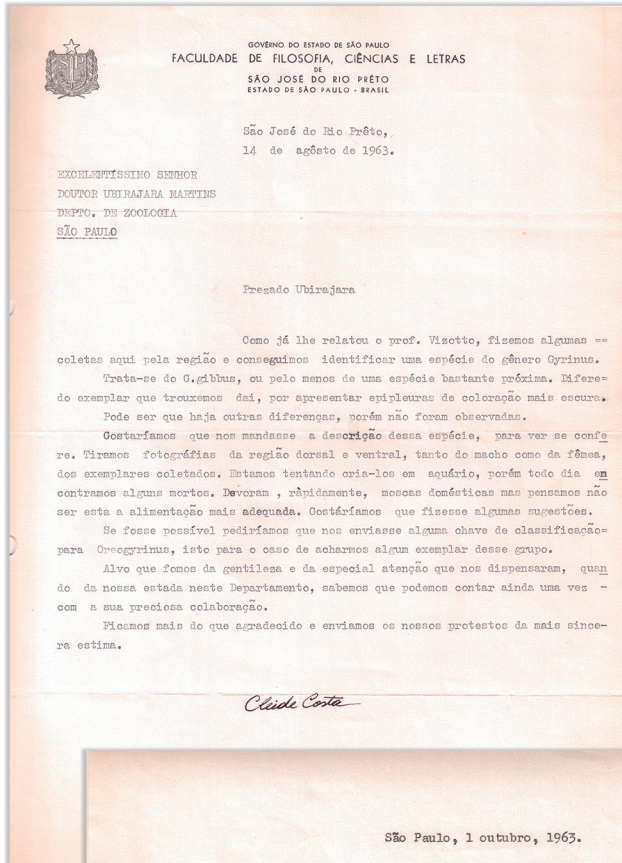


Figure 2. Correspondences between Dr. Cleide Costa and Dr. Ubirajara Martins during her first studies of beetles. These letters were the beginning of their contributions.

also one of the world's most important holdings of its kind. Such endeavor generated an outstanding and innovative series of papers and books on immature beetles (series named "*Larvas de Coleoptera Neotropicais*", or "*Larvae of Neotropical Coleoptera*"). Early on this project, Costa advised on the importance of immature traits to systematics, therefore teaching how to collect and rear beetle larvae in the laboratory efficiently. Her efforts came to fruition, as most of her students continued to pursue this subject, which in turn influenced new generations of entomologists. In Brazil, the study of immature morphology and development is increasingly popular and appreciated among contemporary experts.

Apart from research and curation, part of her professional attributions at MZUSP included advising graduate and undergraduate students, and teaching entomology classes for undergraduate and graduate courses at the Universidade de São Paulo (USP) and other Brazilian and international institutions. Cleide's professional activities extend beyond the real of Brazilian academia. She consistently traveled abroad to teach, participate in congresses, and scientific exchange events. Her tight relationship with foreign colleagues resulted in a vast network of external contributors, which helped introduce novel techniques and experimental methods to Brazilian academia, and draw the attention of the international community to Brazilian research.

Cleide was also very active in the administration and discussions about the future of her home institution. In 1969, the Museu de Zoologia da Universidade de São Paulo was then called "Departamento de Zoologia" ("Department of Zoology"), a branch of the State of São Paulo Secretariat of Agriculture, Industry, and Commerce. In 1969, this section of the Secretariat became an Institute within the State University and was renamed "Museu de Zoologia da Universidade de São Paulo" (MZUSP) (Nearn *et al.*, 2019). Cleide was the head of the Entomology section from 1974 to 1977, and from 1993 to 1999. Notoriously determined, she obtained funds to implement simple changes that have drastically improved the section facilities as well as the conservation of the collection, like the transfer of all insect specimens from drawers with fixed cork bottoms to drawers with unit trays. She also brought innovation to the Coleoptera collections storage system by implementing sliding compact cabinets, which allowed the optimization of space and improved safety for the beetles. For several years Cleide was the head of the "Estação Biológica de Boracéia" ("Boracéia Biological station"), a conservation unit located in the Atlantic Forest managed by the MZUSP, to serve as a center for biological research and student training in fieldwork. In 1996, during the last period under her responsibility, she fully renovated all the buildings, rebuilding the accommodations for researchers and constructing a laboratory and classrooms.

Cleide was an active member in the discussions about the future of the MZUSP and the career path of the museum's members. Until 1986, the position of "Biologist" of the majority of the researchers of the

MZUSP was assigned a salary and status that was largely incompatible with the activities developed by these professionals. Unlike researchers and professors from other University departments, apart from doing research and teaching, the biologists were also in charge of curatorial and other technical work activities. Despite the numerous attributions and requirements imposed on the biologists, the recognition of their importance and salaries were much lower than those of their colleagues from other departments. MZUSP researchers protested, then, for parity of career status and wage. Thanks to Cleide's scientific recognition and political influence, this issue was partially solved in 1986, when she convinced the influent USP Professor Fernando Henrique Cardoso (at that time a Senator of Republic who would later be elected President of Brazil), to transmit her appeals to the University President, Professor José Goldemberg. The salary disparity issue plaguing MZUSP researchers was finally solved. However, their career status situation was still not settled before Cleide's official retirement, when the MZUSP researchers achieved the recognition of equivalent career to those of other researchers and professors from USP. From 1988 to 1995, the University of São Paulo was undergoing a reorganization of their institutes, and the status of the University museums (including MZUSP, as well as history and art museums) was intricate. The University Rectory then appointed Cleide as a representative of the MZUSP community in the discussions about the integration of the museum to the Instituto de Biociências (IBUSP) (see Costa, 1987; Brandão & Costa, 2007).

Cleide was included in the active researcher team of MZUSP until 1999 when she officially retired. Even after retirement, she keeps working as a Senior Professor at the MZUSP, where she still conducts research, advises students, and teaches graduate-level classes.

Cleide as Coleoptera researcher

Cleide's scientific career has followed three overlapping lines of research: systematics, phylogeny and biology of Elateroidea, with an emphasis in Elateridae; study of Coleoptera larvae from Neotropical Region; and systematics, bionomy, and metamorphosis of Coleoptera (see publications below, chronologically listed). Early on, Cleide demonstrated a high amount of carefulness in her papers, which is evident from their high scientific quality and fantastic detail in her illustrations (Fig. 3). In her first published paper (Costa, 1966), she presented illustrations of the male genitalia, mouthparts, antennae, and tarsi, as line drawings covered with Nankin ink. Mr. Giro Pastore took most of the photographs of luminescent elaterids from live specimens. This high standard persisted during all her career, and the quality of the illustrations improved over time. Every time that a novice student arrived in her laboratory, their first task was to learn how to draw. It is a tradition in Cleide's laboratory, followed by her disciples, that every student should illustrate their papers adequately.

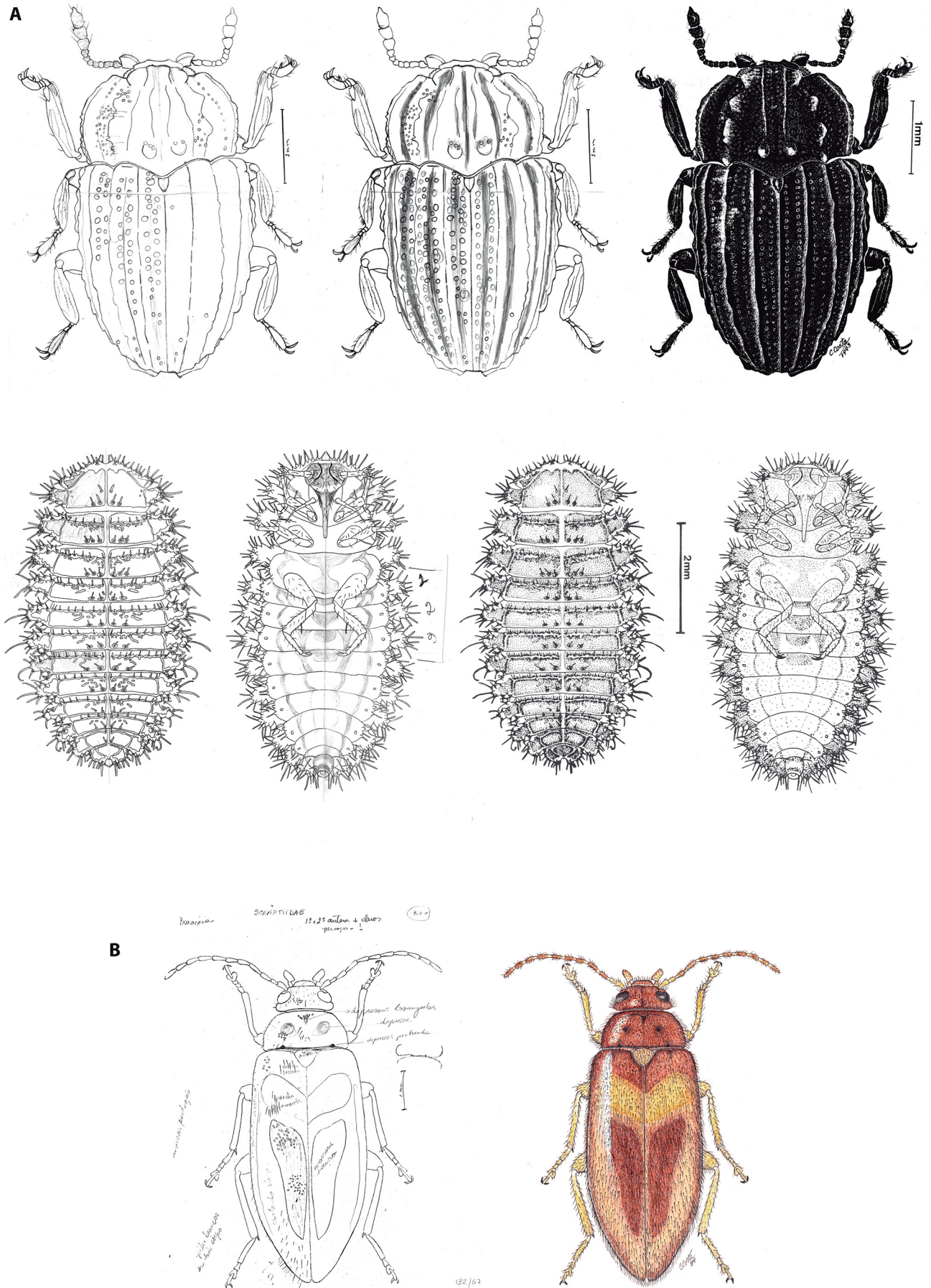


Figure 3. Cleide Costa's drawing process. (A) Drafts to final art of adult and larva of *Glyptolopus quadricostatus* Heinze, 1944 (Cerylonidae), from Costa *et al.*, 1996. (B) Pencil draft and final art of *Scaptia triangularis* Champion, 1916 (Scaptiidae), from Vanin *et al.*, 1996.

Costa's early research efforts were related to luminescent elaterids, especially concerning *Pyrophorus* (e.g., Costa, 1968b, 1969, 1970, 1971a, b, c, 1972a) and related genera (Costa, 1975a, b, c, 1976, 1977a). Her doctoral thesis developed the project "Systematics and evolution of bioluminescent Pyrophorinae of New World (Coleoptera, Elateridae)", concluded in 1972. Many new species were described in the subsequent works, and a new classification for the then subfamily Pyrophorinae was established.

During this period of intense taxonomic works in luminescent elaterids, Cleide has caught attention due to her knowledge and descriptions of their immature forms and natural history (Costa, 1970, 1971a, 1972b). This particular interest gave rise to her second and successful line of research: the study of the immature forms of Neotropical Coleoptera. To accomplish this ambitious project, she missed no opportunity to collect beetle larvae and, in 1980, together with contributors, started intensive larvae collections and laboratory rearing of beetles. For over a decade, her works were primarily focused on beetle larvae. As a result of this inaugural project, the knowledge of Coleoptera larvae was greatly intensified, with the publication of dozens of papers, in a series called "Larvae of Neotropical Coleoptera" and one textbook with the state of art of immature beetles from Brazil (Costa *et al.*, 1988). One essential aspect of Cleide's papers is that, whenever possible, she introduced the pupae in the descriptions and illustrations. It is common for papers dealing with immatures forms to omit or only briefly describe the pupae. On some occasions, she investigated the possible roles and evolution of pupae and prepupae in Endopterygota (Costa, 1984c; Costa & Vanin, 1985b). Cleide's pioneering in the study of immature beetles, always evidencing the importance of the associated knowledge to the study of systematics, has and still inspires many researchers and students around the world. The book "Larvas de Coleoptera do Brasil" (Costa *et al.*, 1988), has been a fundamental reference for larval studies worldwide. Some of the descriptions and figures of larvae and pupae introduced therein or in her series of papers are the single references for many groups and are frequently reproduced in subsequent textbooks and manual of coleopteran larvae (e.g., Booth *et al.*, 1990; Beutel & Leschen, 2005; Lawrence *et al.*, 2000; Leschen & Beutel, 2014; Leschen *et al.*, 2010).

The third line of research pursued by Costa essentially merges the precedent lines, comprehensively applying the immatures features sampled in broad systematic works, mostly focused on the superfamily Elateroidea. According to Costa (1971a), larval characters of species of *Semiotus* Eschscholtz, could be useful to establish a new subfamily for this genus. The subfamily Semiotinae was almost simultaneously erected by Golbach (1970), based on adult features (Costa, 1972b). Even though this subfamily is no longer valid, the monophyletic group that it represents is consistently recovered in different phylogenetic approaches (e.g., Kundrata & Bocak, 2011; Kundrata *et al.*, 2018). If larval characters are robust enough to support generic and subfamilial ranks, they might be in-

formative and useful in higher coleopteran ranks. Thus, starting in the 1990s, besides continuing the immatures studies, she also dedicated herself to the systematics of Elateriformia, whenever possible, combining data of immatures and adults. As a result, highly relevant systematics works and major taxonomic revisions were concluded in several groups, such as elaterid tribe Tetralobiini (Costa *et al.*, 1994), the superfamily Byrrhoidea (Costa *et al.*, 1999b), and the family Brachypsectridae (Costa *et al.*, 2006i).

More recently, Cleide has been successfully transitioning to modern methodological approaches, combining detailed morphological studies with molecular phylogenetics. In her most recent paper, a comprehensive survey of immature forms and adults, combined with a molecular phylogeny, resulted in the discovery of a new family of Coleoptera within Elateroidea (Rosa *et al.*, 2020a, b).

Cleide has repeatedly benefited from career grants and has recently been awarded renewals for her research grants to work on new projects and to conclude her upcoming book on the "Neotropical Immature Beetles".

Collecting and rearing beetles in the laboratory – the rise of the Immature Beetles Collection (CIC-MZUSP)

Cleide started collecting and rearing beetle larvae in 1965. At that time, the immature forms of Neotropical beetles were mostly unknown, and even primary literature was unavailable. Thus, rearing beetles in laboratory conditions was an experiential activity. The only proper process to have larvae determined to family level was to obtain adults that would then produce immatures, so that the developmental stages could be reliably associated. Considering that larvae collected without their adult counterparts were not yet identified to family, their behaviors and feeding habits had also to be discovered by trial and error. There was a great effort in keeping all the collected specimens alive, either to allow the larvae to reach full development to adults, or to obtain eggs and larvae from the adults. While rearing in the laboratory, every relevant information regarding their natural history, behavior, molting, and feeding habits was recorded (Fig. 4).

This project to understand and describe the immatures of Neotropical Coleoptera would require intensive fieldwork and daily devotion in the laboratory. In the beginning, Cleide frequently collected at the "Mata do Instituto Botânico", in São Paulo, a vegetation patch that is not far from the MZUSP, accompanied by the museum technician Lázaro Ribeiro Silva. In addition to the material collected by herself, she also received specimen donations, especially bioluminescent larvae and adults, from fellow zoologists such as F. Lane, L. Alonso, B.N. Dias, P. Biasi, P.E. Vanzolini, D.L. Tiemann, J. Bojard, and L. Otero.

She was accompanied in two collecting trips in 1969 by D.L. Tiemann, an amateur entomologist and engineering technician for the United States Navy, who contributed with his knowledge in finding luminescent larvae and females of Phengodidae (railroad worms). Tiemann

With plans of increasing her commitment to the study of larvae and developing a project on immature beetles, from 1977 on, she had an active collaboration with Dr. Sergio A. Vanin (IBUSP), to work in the collecting and also in the publication of data on immature forms. In 1980, she obtained funding from the Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) ("São Paulo Research Foundation") to initiate an intensive work of larvae collecting and laboratory rearing. This endeavor counted with the constant contribution of dedicated colleagues that were zoologists, botanists, entomologists, technicians, field assistants, and drivers, like Sônia A. Casari, Sergio A. Vanin, Wanessa Zorzan, Emilia Arasaki, Édson P. Teixeira, Lázaro Ribeiro Silva, Sergio Ide, João Rossi, and Francisco de Abreu. Also participated sporadically, Maria Eulina Jorge, Luiz Roberto Fontes, Carlos Campaner, Lea Rosa Mourgues Schurter, Dalton de Souza Amorim, Alcebiades Custódio Filho, Denise Pagni, Ana Maria Vasques, Claudia M. Resende, Vadim Viviani, Selma Bellusci, Manoel Dias, Roberta de Melo Valente, Pedro Gnaspini, Nilza Godoy, Carlos F. da Rocha, Maria José de Souza Coelho, Norton Giannuca, Fátima Kakuta, Eliana Marques Canello, Marcia Cintra Albertoni, Claudio Ruy V. Fonseca, Paulo Kofuji, Vera Regina Naliato, José Carlos Costa, Marco Antonio Joaquim Pereira, Vera Cristina Amorim, Inocência S. Goryayeb and Marcelo Christoff, among others. The immeasurable contribution of such constant collaborators has continuously been acknowledged. Some of MZUSP's foreign visitors took the advantage of participating of collecting trips with Cleide, such Martha G. de Tomé, Suzana Aranda and Lucia Claps (Instituto Miguel Lillo, Argentina), Erik Arndt and Helke Gruger (University of Leipzig, Germany), Norman Johnson and Peter Kovarik (Ohio State University), among others. Likewise, Cleide learned and implemented new techniques taught by her guests. Along with her collaborators, Cleide participated in more than seventy expeditions to collect scientific material in various Brazilian ecosystems (Fig. 5).

In 1982 a partnership was commenced between Cleide and the chemist Prof. Dr. Etelvino Bechara (Instituto de Química, IQUSP), a joint project aiming to study the phenomenon of bioluminescence. Together they headed on several journeys to central Brazil, notably to Parque Nacional das Emas (Goiás), frequently accompanied by the driver and excellent field assistant Mr. José Sanches (IQUSP). Their main objective was to massively collect larvae occurring in termite mounds, primarily the luminescent specimens, which would then be used in chemical, biological, morphological, and systematic studies. The hundreds of bioluminescent larvae collected in those expeditions were kept in the laboratory housed in the MZUSP, under Cleide's supervision, and with the close assistance of three technicians, Maria Ines Migliaccio, in charge of the general Coleoptera, and Emília Arasaki and Adriana Pires, who cared for the bioluminescents.

With the growing relevance of her works, Cleide received exceptional support from world specialists in immature beetles, such as Roy A. Crowson and John F. Lawrence, and from specialists in several families, who

joined her in her projects and became coauthors in her articles (Fig. 6).

The diaries and notes taken by Cleide in the laboratory and during fieldworks since 1965 are quite descriptive, detailed, and informative. In 1969, during fieldwork in Estação Biológica de Boracéia (EBB), she recorded in her field book the observation of a luminescent larva of Staphylinidae. This would be the first record of light emission in Staphylinidae and the first record in a non-Elateroidea beetle. She knew that this would represent an extremely crucial discovery, in particular for those interested in bioluminescence. Unfortunately, at that time, the larva died amidst molting, and the dissemination of that important record would have to be postponed. Countless other surveys were conducted in the EBB for 13 consecutive years. In 1983 and 1984, 14 years after the first observation, Cleide found that mysterious luminescent staphylinid species at the same spot where it had been before. This time, another four specimens were found and reared in the laboratory for several days, and the same light emission was observed. The staphylinid larva was tentatively identified as a species of *Xantholinus* Dejean, and this record was finally published, along with a morphological description of the larva (Costa *et al.*, 1986b). The occurrence of luminescence in *Xantholinus* larva was later confirmed by Rosa (2010) from specimens from Mato Grosso state, Brazil.

Finding and collecting larvae can be easy if one knows their habits and natural history, although, for certain groups with completely unknown larvae, the chase may be a puzzle. Cleide's surveys for immatures collection were strictly planned, with the techniques and collecting methods carefully designed to catch target groups or to investigate the determined area, micro ambient, hosts, etc. However, occasionally some of the most pleasing surprises and important discoveries occur by chance when no one is expecting them.

During one call for inspection to investigate why the *Casuarina* sp. trees in São Paulo were dying, Édson P. Teixeira, an Agricultural Engineer from the Instituto Florestal de São Paulo, along with Cleide, found adults and larvae of *Nosodendron angelus* Reichardt, 1973 (Nosodendridae) in the exudate present on the tree's trunk, believed to be caused by the attack of Pantophthalmidae (Diptera) larvae. The immatures of the family Nosodendridae were still unknown. Still, after these observations, a myriad of larvae, pupae, and adults of this species was found in other locations in Casuarinas with exudate (Costa *et al.*, 1986a) The same occurred with larvae of at least two other families that were still unknown: Lutrochidae (Costa *et al.*, 1996) and Cneoglossidae (Costa *et al.*, 1999b), collected inside wood underwater in lakes and streams, and those of Armatopodidae (Costa *et al.*, 1985), found in ravine soil inside the forest, among others.

The vast collection of Neotropical Coleoptera (Coleção de Imaturos de Coleoptera (CIC-MZUSP)) (Fig. 4) founded by Cleide and expanded by her and other for several years is deposited at the MZUSP and keeps receiving new contributions every year. The collection is currently com-

posed of more than 50,617 specimens, including 20,364 larvae, 9,607 larval exuviae, 3,320 pupae, five pupal exuviae, and 17,317 adults. The collection comprises 103 beetle families, 471 genera, and 662 species, especially from the Neotropical region, most of them identified by specialists in each family (Barbosa *et al.*, 2013).

Travels to study material and meetings abroad and in Brazil

Similar to what has been observed in different countries with colonial roots, the development of the knowledge on the Brazilian biodiversity was pro-

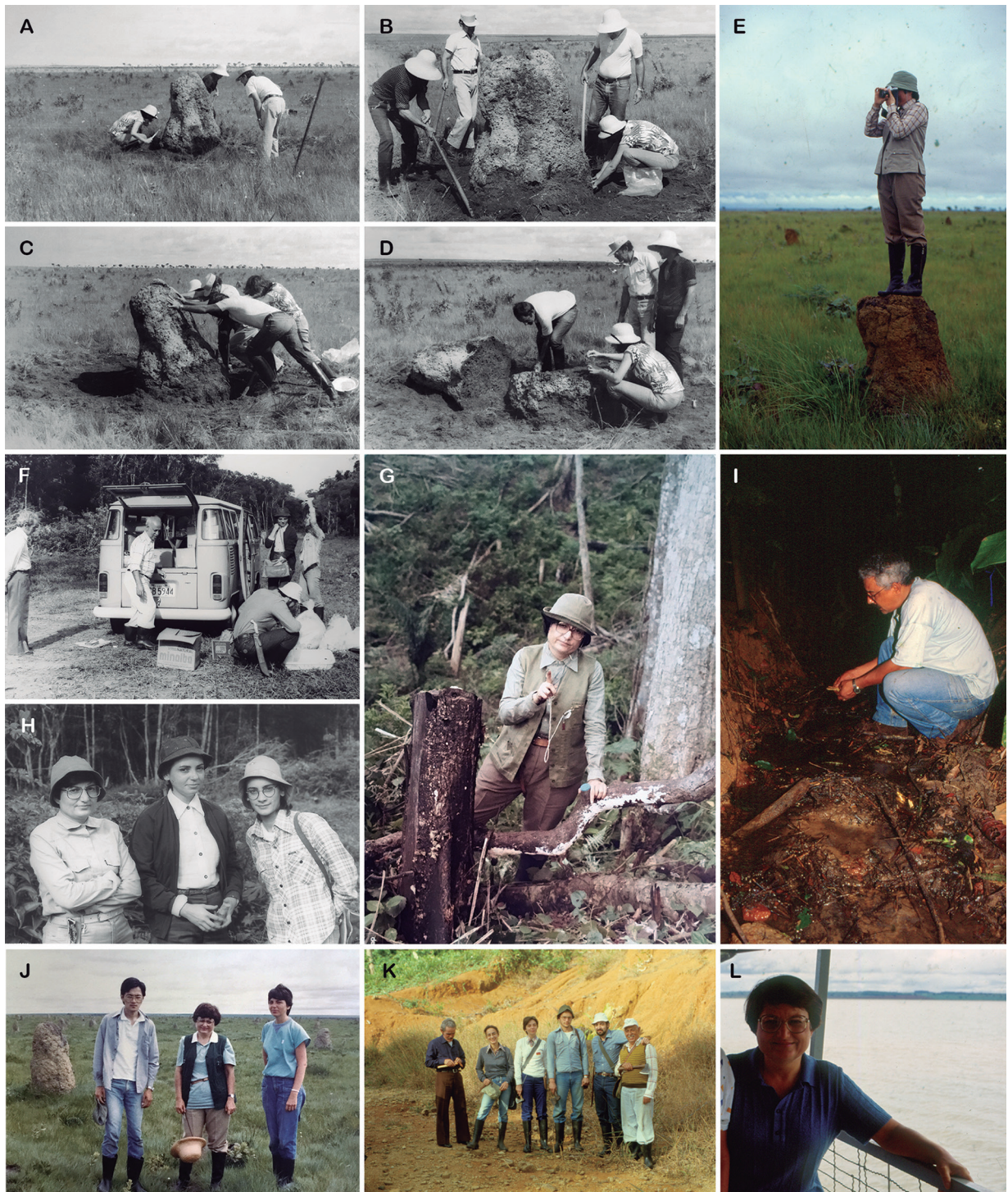


Figure 5. Cleide Costa at fieldwork. (A-E) Expedition to Parque Nacional das Emas, Goiás, to search for bioluminescent Elateridae, March-April 1984; (A-D) Collecting elaterid larvae from termite molds; (E) Cleide standing higher to photograph the vastness of luminous termite mounds in central Brazil; (F) Francisco de Abreu, Lázaro Silva, Sergio Vanin, Sônia Casari, and Wanessa Zorzan at Peruíbe (São Paulo), December 1980; (G) Cleide Costa searching for Coleoptera larvae in decayed tree trunks, Peruíbe (São Paulo), December 1984; (H) Cleide Costa, Sônia Casari and Wanessa Zorzan at Peruíbe (São Paulo), April 1981; (I) Édson Teixeira searching for *Cneoglossa edsoni* Costa, Vanin & Ide, 1999 in their type-locality, Parque Estadual da Cantareira, São Paulo, 1992; (J) Sergio Ide, Cleide Costa and Sônia Casari at Costa Rica (Mato Grosso do Sul), December 1987; (K) Francisco de Abreu, Wanessa Zorzan, Sônia Casari, Luis Roberto Fontes, Sergio Vanin and Lázaro Silva at Peruíbe, (São Paulo), July 1981; (L) Cleide Costa on a ferry, crossing the Paraná River, between São Paulo and Mato Grosso do Sul, 1984.

foundly delayed in comparison with European countries. Taxonomy is a budding science in Brazil, dating only from the 20th century. Although our diversity is relatively well represented in national collections, the main obstacles for research in systematics and taxonomy were the lack of reference material with reli-

able identification and the absence of fundamental literature.

To compensate for these challenges, the solution found was to travel overseas for an extended period to examine the Old World collections, bringing back home a large amount of undetermined specimens for compar-



Figure 6. Cleide Costa *et al.* Present and late colleagues and friends. (A) Cleide and Ubirajara Martins; (B) Cleide, Ubirajara Martins, Sergio Vanin and Nelson Papavero; (C) Carlos Estevão Simonka, Sergio Ide and Cleide Costa at the release of book *Insetos Imaturos: Metamorfose e Identificação*, May 2006; (D) Fieldwork team at Parque Nacional das Emas (Goiás): José Sanches, two field assistants, Etelvino Bechara, Sônia Casari, Cleide Costa and Dalton Amorim, March 1984; (E) Hans Reichardt, June 1972; (F) Cleide Costa, John Lawrence and the students of the Lawrence's Coleoptera Course, MZUSP, August 2000; (G) The MZUSP Coleoptera team and visitors: Luiz Roberto Fontes, Gabriel Biffi, Bruno Zilberman, Francisco Nascimento, Antonio Santos-Silva, Juarez Fuhrmann, Rafael Sousa, Thiago Polizei, Letizia Migliore, Juan Pablo Botero, Cleide Costa, Sergio Vanin, Eugenio Nearns (USA) and Sônia Casari, July 2018; (H) Etelvino Bechara, Sônia Casari, Vadin Viniani, Cleide Costa, Dila Solange Napp and Walter Wittmer (Switzerland), October 1994; (I) Seiroku Sakai (Japan), Cleide Costa, José Luis Leme and Maria Regina Ferreira, September 1991.

ison, and to gather the most amount of information as possible, in hopes that it would be enough to enable future studies with Brazilian material. Traveling abroad was unusual for Brazilian scientists in the 1960's and 1970's, especially in light of the historically underfunded governmental institutions.

Thanks to Cleide's proactivity and prominence as a scientist, she was highly successful in obtaining funds for long travels abroad and nationally (Table 1). In her numerous trips and visits to institutions, Cleide was able to study thousands of essential materials, from type specimens to unidentified exemplars, enabling the present and future works for herself and her students' projects. Pursuing literature was an indispensable part of her travels. Whenever photocopies were unavailable, Cleide spent several days in libraries copying papers and books manually.

After collecting literature and analyzing the type material abroad, she visited Brazilian institutions trying to identify and gather the material deposited.

Cleide's good relationship with several curators and researchers abroad fostered the exchange of material and literature from other institutions. Due to these efforts, Cleide was able to build an impressive reference collection at the MZUSP, with numerous specimens identified from direct comparison with their types, and many more new types designated from her discoveries.

While traveling, Cleide always learned about best curatorial practices from other museums, updating her expertise with the most modern methodological and technical methods. Some were successfully applied in her research, as well as in improvements to the museum's organization and facilities.

One of her most prolonged periods abroad was during her Post-Doctoral research in the Biosystematics Research Institute, Ottawa, Canada, and the United States National Museum, Smithsonian Institution, Washington D.C, USA. She had, in 1989, the invaluable opportunity to be in Glasgow, Scotland, to work alongside the distinguished coleopterist Roy A. Crowson and discuss with him the morphology of immature beetles. Later, in 1991, she went to Australia to examine beetle classification with John F. Lawrence, another renowned coleopterist.

Apart from traveling with the specific purpose of studying beetle specimens, Cleide has also attended numerous international scientific meetings, congresses, courses, and conferences (Fig. 7).

Cleide as a University graduate and postgraduate professor and advisor

As a postgraduate professor and advisor, Dr. Costa taught classes in different areas of entomology, such as comparative morphology of adults and immatures, insect systematics, and insect physiology.

Cleide was part of postgraduate programs in several institutions. A few examples of the programs she was part of are "Zoologia" (IBUSP), "Sistemática, Taxonomia e Biodiversidade" (MZUSP), "Entomologia" (Universidade

Table 1. Travels to study material and scientific meetings.

Year	Institution visited
1966	Museu Nacional do Rio de Janeiro, Rio de Janeiro, Brazil Instituto Oswaldo Cruz, Rio de Janeiro, Brazil
1970	British Museum Natural History, London, England Institut Royal des Sciences Naturelles de Belgique, Bruxelles, Belgium Muséum National d'Histoire Naturelle, Paris, France
1971	Instituto Oswaldo Cruz, Rio de Janeiro, Brazil
1973	Museu Nacional do Rio de Janeiro, Rio de Janeiro, Brazil Instituto Oswaldo Cruz, Rio de Janeiro, Brazil Coleção Campos Seabra, Rio de Janeiro, Brazil
1973-1974	Biosystematics Research Institute Ottawa, Canada
1976	Departamento de Zoologia, Universidade Federal do Paraná, Curitiba, Brazil
1979	Museu Nacional do Rio de Janeiro, Rio de Janeiro, Brazil Instituto Oswaldo Cruz, Rio de Janeiro, Brazil
1981	Australian National Insect Collection, Canberra, Australia Australian Museum, Sydney, Australia Bishop Museum, Honolulu, USA
1983	United States National Museum, Smithsonian Institution, Washington DC, USA University of Glasgow, Glasgow, Scotland
1986	Departamento de Zoologia, Universidade Federal do Paraná, Curitiba, Brazil
1988	Departamento de Zoologia, Universidade Federal do Paraná, Curitiba, Brazil
1989	Natural History Museum, London, England Department of Zoology, Glasgow, Scotland Institut Royal des Sciences Naturelles de Belgique, Bruxelles, Belgium Musée Royal de l'Afrique Centrale, Tervuren, Belgium Muséum National d'Histoire Naturelle, Paris, France
1991	The State Museum of Natural and Cultural History, Oregon, USA University of Hawaii, Honolulu, USA Bishop Museum, Honolulu, USA Commonwealth Scientific and Industrial Research Organization, Australia.
2004	Muséum National d'Histoire Naturelle, Paris, France
2006	Institut Royal des Sciences Naturelles de Belgique, Bruxelles, Belgium Museo Nacional de Ciencias Naturales de Madrid, Madrid, Spain Muséum National d'Histoire Naturelle, Paris, France Oxford University Museum of Natural History, Oxford, England Royal Museum for Central Africa, Tervuren, Belgium
2009	Royal Museum for Central Africa, Tervuren, Belgium Charles University in Prague, Faculty of Sciences, Prague, Czech Republic
2011	Departamento de Zoologia do Instituto de Investigação Científica Tropical de Lisboa, Lisbon, Portugal Departamento de Biologia Animal da Faculdade de Ciências de Lisboa, Lisbon, Portugal Departamento de Zoologia do Museu da Ciência da Universidade de Coimbra, Coimbra, Portugal
2013	Museo Nacional de Historia Natural, Entomología, Santiago, Chile Muséum National d'Histoire Naturelle, Paris, France Museu de Ciències Naturals de Barcelona, Laboratori de Natura, Barcelona, Spain
2014	Natural History Museum, London, England University of Oxford, Oxford, England
2017	Charles University in Prague, Faculty of Sciences, Prague, Czech Republic.

Federal do Paraná, Curitiba) and "Ciências Biológicas" (UNESP, Botucatu). During these courses, she always encouraged students to perform comprehensive investigations on many aspects of entomology, integrating natural history and morphology traits of adults and larvae. She also advised students at the master's, doc-

toral, and post-doctoral levels and in several coleopteran families, such as Elateridae, Lycidae, Phengodidae, Passalidae, Scarabaeidae, Geotrupidae, Chrysomelidae, Curculionidae, and Carabidae (Fig. 8). Her former students include specialists in several Coleoptera families (Table 2).

As part of her activities as professor and due to her expertise in insects, more specifically in beetles, she participated in dozens of graduate committees, including masters and doctoral degrees examining boards, as well as evaluation boards for public hiring committees for the role of tenure-track positions in different universities.



Figure 7. Cleide Costa *et al.* Cleide at national and international conferences and events. (A) Symposium/Workshop on the higher classification of Coleoptera, Detroit, USA, December 1983; (B) Coleoptera Larvae Workshop, Honolulu, USA, June 1991; (C) PrIBES 2000, São Paulo, February 2001; (D) International Insect Fair, Prague, Czech Republic, October 2013; (E) Marcela Monné, Cibele Stramare Ribeiro-Costa, Lúcia Massutti Almeida, Cleide Costa and Luciana Marinoni, III Symposium of Coleoptera, XXX Brazilian Congress of Zoology, Porto Alegre, February 2014; (F) Immature Beetle Meeting 2017, Prague, Czech Republic, October 2017; (G) Robin Kundrata and Cleide Costa at Prague, Czech Republic, October 2017. Figure F from Seidel *et al.*, 2017.

Table 2. Postgraduate students advised by Dr. Cleide Costa (Fig. 8).

Year	Postgraduate student	Subject and current position
1979	Sergio Antonio Vanin	Ph.D. in Curculionidae systematics; faculty member of Departamento de Zoologia, Instituto de Biociências da Universidade de São Paulo
1980	Maria Eulina Jorge da Silva	PhD in Carabidae morphology
1983, 1990	Sônia A. Casari	M.Sc. and Ph.D. in Elateridae (Agrypninae, Hemirhipini) systematics; faculty member of the Museu de Zoologia da Universidade de São Paulo
1988	Claudio Ruy Vasconcelos da Fonseca	Ph.D. in Passalidae systematics; faculty member of Instituto Nacional de Pesquisa da Amazônia, Manaus, AM
1992, 1999	Sergio Ide	M.Sc. in Geotrupidae systematics and PhD in Scarabaeidae (Dynastinae, Phileurini) systematics; research scientist of Instituto Biológico de São Paulo
2002, 2007, 2010	Simone Policena Rosa	M.Sc. and Ph.D. in Elateridae (Agrypninae, Pyrophorini) systematics; Postdoctoral research in Elateridae (Physodactylinae) systematics; faculty member of Universidade Federal de Itajubá, MG
2012	Flávia Rodrigues Fernandes	Ph.D. in Chrysomelidae (Cassidinae) systematics
2014	Vinicius de Souza Ferreira	M.Sc. in Lycidae (Lycinae) taxonomy
2015	Felipe Francisco Barbosa	M.Sc. in Elateridae taxonomy (Thylacosterninae)
2017	Hingrid Yara Souza Quintino	Ph.D. in Phengodidae (Mastinocerinae) systematics

**Figure 8.** Cleide Costa and her students. (A) Maria Eulina Jorge da Silva; (B) Sergio Ide, Sergio Vanin, Cleide Costa and Sônia Casari; (C) Claudio Ruy V. da Fonseca; (D) Flávia Rodrigues Fernandes; (E) Felipe Barbosa, Hingrid Yara Quintino, Vinicius Ferreira, Cleide Costa and Simone Rosa. Photos from personal archive.

Dissemination of science, taxonomists training and the importance of collections

Most lines of research are only fully accessible and comprehended among a small circle of specialists. Unlike most of her fellows, Cleide was deeply concerned about disseminating science not only among her peers but also among the general public of biologists, early students, non-scientists, and children.

As part of her outreach program, Costa used her beloved bioluminescent beetles to catch people's attention to varying topics in entomology and natural history. She published various articles in magazines and journals directed at children on the chemistry of bioluminescence, insects' life-cycles and morphology, the importance of biodiversity, and others (Costa, 2009; Costa & Miruna,

1997; Ide & Costa 1993; Loffel *et al.*, 1995; Lucírio & Costa, 1996; Migliaccio *et al.*, 1985; Moióli & Costa, 2004, 2005; Viganò & Costa 2005).

Besides formal classes for graduate and undergraduate students, Cleide was also worried about the amount of time necessary to train taxonomists adequately. This led her to organize and teach conferences and basic-level courses of entomology in Brazil and abroad, notably about Coleoptera identification and larval morphology. In one of these courses, held in the MZUSP, Dr. John F. Lawrence taught lessons on Coleoptera morphology and systematics for Brazilian and other South American students and professionals (Fig. 6F).

Another of Cleide's main interests is the importance and future of entomological collections. She authored a series of papers about the state of knowledge

of Coleoptera in Brazil, emphasizing the main Brazilian collections (Costa, 1999, 2000a; Costa *et al.*, 2000). In 2000, she organized, in São Paulo, the “III Jornada Ibero-americana Sobre Diversidade Biológica. Inventário e Estimativa da Biodiversidade em Insetos hiperdiversos (Coleoptera, Diptera, Lepidoptera e Hymenoptera) – II Workshop Ibero-americano de Entomologia Sistemática” (PriBES 2000), a conference with the participation of many Ibero-American researchers dedicated to discussing and proposing the production of inventories and estimates of biodiversity in hyperdiverse insect orders (Fig. 7C). As a member of the Cyted PriBES (Projeto Ibero-americano de Biogeografia e Entomologia Sistemática) network from 1999 to 2002, she participated actively as an assistant coordinator, and as a founding member (2003–2006) in the organization and implementation of the Red CYTED XII.I. RIBES (Rede Ibero-Americana de Entomologia Sistemática), along with JH Llorente (UNAM-México), who was its coordinator.

Cleide is a founding member of the Red XII: L “Red Iberoamericana para la Conservación e Informatización de Colecciones Biológicas – Sistemas de Información”, coordinated by E. Romero, (MACN Bernardino Rivadavia-Buenos Aires), inaugurated in 2004. Additionally, she is a founding partner of the AMNAT – A Associação Memória Naturalis: Cidadania, Ciência & Cultura, since 2002; participating in its board of directors as a member of the “Conselho Fiscal” and as a representative for the association’s articulation with Cyted’s networks on biodiversity and biological collections in Latin America (Costa, 2000a, 2005; Costa *et al.*, 2000; 2002a, b; Aguiar *et al.*, 2009).

Honors and awards

In recognition of the importance of her work, Cleide Costa was awarded with the following honors and distinctions:

- 1988** Award “Alexandre Rodrigues Ferreira” offered by the “Sociedade Brasileira de Zoologia”, for the publication of the book “Larvas de Coleoptera do Brasil”.
- 1994** Award “Bunka de Pesquisa” offered by the “Banco Sumitomo & Sociedade Brasileira de Cultura Japonesa” for the publication of the book “Larvas de Coleoptera do Brasil”.
- 2002** Honorary Partner of “Sociedade Brasileira sobre Vetores e Pragas Sinantrópicas”.
- 2015** Tribute from the MZUSP for her “50 years of outstanding performance, dedication, ethics and love for the research and teaching”.

The entomological community also recognizes Cleide’s immense contributions to the field in publishing high quality systematic and taxonomic works, through her intensive efforts of collecting, describing and archiving specimens, and by her unceasing fondness for forming professionals, teaching and disseminating science. The importance of her contributions can be veri-

Table 3. Taxa named in honor of Cleide Costa. Taxa marked with an asterisk are patronyms presented in this special volume.

Taxon name	Family
<i>Akamboja cleidae</i> Roza, Quintino, Mermudes & Silveira, 2018	Phengodidae
<i>Austrolimnius cleidecostae</i> Polizei, Costa & Bispo, 2020*	Elmidae
<i>Brachysectra cleidecostae</i> Lawrence, Monteith & Reid, 2020*	Brachysectridae
<i>Brachys cleidecostae</i> Migliore, Casari & Paiola, 2020*	Buprestidae
<i>Canthon cleidecostae</i> Vaz de Mello, Nunes & Costa-Silva, 2020*	Scarabaeidae
<i>Cardiorhinus costae</i> Golbach, 1983	Elateridae
<i>Chlorota cleidecostae</i> Medeiros & Grossi, 2020*	Melolonthidae
<i>Cleicosta</i> Vega-Badillo, Zaragoza-Caballero & Ivie, 2020*	Phengodidae
<i>Cleidaria</i> Nascimento & Santos-Silva, 2020*	Cerambycidae
<i>Cleidaria cleidae</i> Nascimento & Santos-Silva, 2020*	Cerambycidae
<i>Cleidecosta</i> Johnson, 2002	Elateridae
<i>Cleidecostini</i> Johnson, 2002	Elateridae
<i>Cleidella</i> Roza & Mermudes, 2020*	Phengodidae
<i>Conoderus costae</i> Guzmán de Tomé, 1998	Elateridae
<i>Diochus cleidecostae</i> Caron & Navarro, 2020*	Staphylinidae
<i>Hovorestenia cleidae</i> Botero, 2020*	Disteniidae
<i>Laccodytes costae</i> Braga & Ferreira-Jr., 2020*	Dytiscidae
<i>Laselva cleidae</i> Rech & Linzmeier, 2020*	Chrysomelidae
<i>Lobobrachus cleidecostae</i> Campaner & Will, 2020*	Carabidae
<i>Meroplinthus costae</i> Golbach, 1984	Elateridae
<i>Neapion (Neotropion) cleidecostae</i> De Sousa, 2020*	Brentidae
<i>Oecidiophilus cleidecostae</i> Zilbermann & Fontes, 2020*	Staphylinidae
<i>Opseleter costae</i> Rosa, 2004	Elateridae
<i>Passalus (Passalus) cleidecostae</i> Bevilacqua & Fonseca 2020*	Passalidae
<i>Peltariopsis cleidecostae</i> Biffi & Geiser, 2020*	Cantharidae
<i>Physodactylus costae</i> Chassain, 2005	Elateridae
<i>Plectonotum costae</i> Constantin, 2020*	Cantharidae
<i>Podischnus cleidecostae</i> Duarte & Grossi, 2020*	Melolonthidae
<i>Psilocladus costae</i> Vaz, Silveira & Rosa, 2020*	Lampyridae
<i>Sphaerion costae</i> García & Nascimento, 2020*	Cerambycidae
<i>Stenocyphus costae</i> Del Río & Lanteri, 2020*	Curculionidae
<i>Xenolycus costae</i> Ferreira & Silveira, 2020*	Lycidae
<i>Ytu cleidae</i> Vanin, 1991	Torridincolidae

fied in the enormous repercussions of her scientific papers and textbooks, and the high attendance to her lectures and speeches. Furthermore, her legacy is cherished through all the taxa named in her honor (Table 3).

Once again, the coleopterists’ community pays tribute to the outstanding entomologist and colleague Cleide Costa, by participating in this series of papers celebrating her career. This special volume of *Papéis Avulsos de Zoologia* features articles in numerous areas of Coleoptera research that were cherished by her, such as the description of new taxa, taxonomic revisions, studies in comparative morphology, phylogeny, natural history, and, especially, a several papers on the morphology and metamorphosis of immatures. The participants include experienced and novice coleopterists, old friends and young admirers, and authors from Brazil and from all over the world.

The wide coverage of taxonomic groups of Coleoptera, the diversity of subjects dealt with and the many nationalities of the authors assembled in this volume are a testament to the scope and importance of Cleide Costa’s legacy. The following papers intend to demonstrate an appreciation of the legacy she has left to Coleopterology.

- Bevilaqua, M. & da Fonseca, C.R.V. 2020. Two new species of *Passalus* Fabricius (Coleoptera: Passalidae) from the western Brazilian Amazon with comments on the taxonomic limits of the subgenera. *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-13, e202060(s.i.).19. DOI
- Biffi, G. & Geiser, M. 2020. A revision of *Peltariossilis* Wittmer (Coleoptera: Cantharidae), a surprisingly diverse Amazonian radiation. *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-26, e202060(s.i.).16. DOI
- Botero, J.P. 2020. Review of the genus *Hovorestenia* Santos-Silva (Coleoptera: Disteniidae). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-10, e202060(s.i.).07. DOI
- Braga, R.B. & Ferreira-Jr, N. 2020. *Laccodytes costae* sp. nov., and new records for the genus from Brazil (Coleoptera: Dytiscidae). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-4, e202060(s.i.).17. DOI
- Campaner, C. & Will, K.W. 2020. New species and nomenclatural notes in *Lobobrachus* Sharp (Coleoptera, Carabidae, Pterostichini). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-9, e202060(s.i.).33. DOI
- Caron, E.; Navarro, B.V. & Cajaiba, R.L. 2020. *Diochus cleidecostae*, a new species from Brazilian Amazon and a discussion of the sexual dimorphism on sternum VIII (Coleoptera: Staphylinidae: Staphylininae: Diochini). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-6, e202060(s.i.).31. DOI
- Constantin, R. 2020. A contribution to the genera *Plectonotum* Gorham and *Hyponotum* Wittmer with the description of sixteen new species from Peru (Coleoptera, Cantharidae). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-27, e202060(s.i.).34. DOI
- De Sousa, W.O. 2020. A new species of *Neapion* (Neotropion) Alonso-Zarazaga from Paraguay (Brentidae: Apioninae). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-4, e202060(s.i.).14. DOI
- del Río, M.G. & Lanteri, A.A. 2020. A new enigmatic species of broad-nosed weevil endemic to Brazil and its phylogenetic placement within the tribe Naupactini (Coleoptera: Curculionidae: Entiminae). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-11, e202060(s.i.).30. DOI
- Duarte, P.R.M. & Grossi, P.C. 2020. Contribution to the knowledge of *Podischnus* Burmeister, 1847 (Coleoptera: Melolonthidae: Dynastinae) with the description of two new species from Brazilian Amazon Forest. *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-15, e202060(s.i.).22. DOI
- Ferreira, V.S. & Silveira, L.F.L. 2020. A new suspected paedomorphic genus of net-winged beetles from the Atlantic Rainforest (Coleoptera, Elateroidea, Lycidae). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-6, e202060(s.i.).35. DOI
- García, K. & Nascimento, F.E.L. 2020. Elaphidiini (Coleoptera, Cerambycidae) from the Caribbean region of Colombia: New species, taxonomic notes and new geographical records. *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-8, e202060(s.i.).23. DOI
- Gimmel, M.L. & Leschen, R.A.B. 2020. First report of *Austroporus doctus* (Blackburn) from New Zealand and description of its larva (Coleoptera: Phylacridae). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-8, e202060(s.i.).29. DOI
- Gnaspini, P.; Peck, S.B.; Antunes-Carvalho, C; Perreau, M. & Gomyde, E.C. 2020. To be or not to be a tibial comb: A discussion on the (past) use of tibial armature in tribal/subtribal organization in Cholevinae (Coleoptera: Leiodidae). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-12, e202060(s.i.).18. DOI
- Lawrence, J.F.; Monteith, G.B. & Reid, C.A.M. 2020. A new *Brachypsectra* LeConte from Australia (Coleoptera: Brachypsectridae) with comparative notes on adults and larvae. *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-10, e202060(s.i.).02. DOI
- Lima, R.M.; Santos, S.B.O.; Vaz, S; Gomes, A.L.S. & Sousa, W.O. 2020. Description of the larva and pupa of *Apion brevicorne* Gerstaecker, 1854 (Coleoptera: Brentidae: Apioninae) with biological information. *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-13, e202060(s.i.).08. DOI
- Liu, Z.; Ślipiński, A. & Pang, H. 2020. Descriptions of larval and pupal morphologies of *Macrohyliota militaris* (Erichson) (Silvanidae: Brontinae: Brontini). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-7, e202060(s.i.).05. DOI
- Medeiros, R.A.F. & Grossi, P.C. 2020. A new species of *Chlorota* Burmeister (Melolonthidae: Rutelinae: Rutelini) from Cerrado and Amazon biomes transition. *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-7, e202060(s.i.).26. DOI
- Migliore, L.J.; Casari, S.A. & Paiola, G. 2020. Morphology of the adult and immatures of a striking new species of leaf-mining *Brachys* Dejean from Brazil (Buprestidae, Agrilinae). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-11, e202060(s.i.).32. DOI
- Muona, J. & Teräväinen, M. 2020. A Re-evaluation of the Eucnemidae larval characters (Coleoptera). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-13, e202060(s.i.).28. DOI
- Nascimento, F.E.L. & Santos-Silva, A. 2020. Two new genera of Desmiphorini (Coleoptera, Cerambycidae, Lamiinae) with description of a species with non-retractile parameres. *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-10, e202060(s.i.).20. DOI
- Newton, A.F. 2020. Potential phylogenetic significance of the number of functional abdominal spiracles in beetle pupae, with focus on Staphylinoidae (Coleoptera). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-27, e202060(s.i.).36. DOI
- Polizei, T.T.S.; Costa, L.S.M. & Bispo, P.C. 2020. *Austrolimnius cleidecostae*, a new species of riffle beetle (Coleoptera: Elmidae) from Brazil with habitat notes and updated key of the Brazilian species of the genus. *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-10, e202060(s.i.).12. DOI
- Pollock, D.A. & McClarin, J. 2020. Description of the late- or last-instar larva of *Ischyomius* Chevrolat, with comments on the family placement of the genus (Coleoptera: Tenebrionidae: Pythidae). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-6, e202060(s.i.).11. DOI
- Rech, T. & Linzmeier, A.M. 2020. First species of *Laselva* Furth from Brazil (Chrysomelidae: Galerucinae: Alticini). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-4, e202060(s.i.).09. DOI
- Roza, A.S. & Mermudes, J.R.M. 2020. A new genus of railroad-worm beetles from the Atlantic Rainforest from Brazil (Coleoptera: Phengodidae, Mastocerinae). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-12, e202060(s.i.).10. DOI
- Shepard, W.D.; Clavier, S. & Cerdan, A. 2020. A generic key to the known larval Elmidae (Insecta: Coleoptera) of French Guiana. *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-9, e202060(s.i.).15. DOI
- Sousa, R.C.J. & Fuhrmann, J. 2020. Morphology of immature stages of *Paraegidium costalimai* (Coleoptera: Scarabaeidae: Orphninae) and remarks on egg-busters in Scarabaeidae first-instar larvae. *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-16, e202060(s.i.).13. DOI
- Ulysséa, M.A. & Albertoni, F.F. 2020. Morphology and biological notes of *Macrosiagon octomaculata* (Gerstaecker) triungulinid and a summary of the knowledge on immature stages of the genus (Ripiphoridae). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-26, e202060(s.i.).25. DOI
- Vanin, S.A. & Bená, D.C. 2020. Description of larva and pupa of the weevil *Hybolabus amazonicus* Voss (Attelabidae: Attelabinae), a leaf roller on Brazil nut (*Bertholletia excelsa*). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-8, e202060(s.i.).03. DOI
- Vásquez-Ordóñez, A.A.; Löhr, B.L. & Marvaldi, A.E. 2020. Comparative morphology of the larvae of the palm weevils *Dynamis borassi* (Fabricius) and *Rhynchophorus palmarum* (Linnaeus) (Curculionidae: Dryophthorinae): Two major pests of peach palms in the Neotropics. *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-14, e202060(s.i.).27. DOI
- Vaz, S.; Silveira, L.F.L. & Rosa, S.P. 2020. Morphology and life cycle of a new species of *Psilocladus* Blanchard, 1846 (Coleoptera, Lampyridae, Lampyridinae), the first known bromeliad-inhabiting firefly. *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-15, e202060(s.i.).24. DOI
- Vaz-de-Mello, F.Z.; Nunes, L.G.O.A. & Costa-Silva, V. 2020. A new species of the genus *Canthon* Hoffmannsegg (Coleoptera, Scarabaeidae, Scarabaeinae, Deltochilini) from central Brazil. *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-6, e202060(s.i.).04. DOI
- Vega-Badillo, V.; Zaragoza-Caballero, S. & Ivie, M.A. 2020. A new genus of Phengodidae (Coleoptera) from the Neotropical Region. *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-7, e202060(s.i.).06. DOI
- Zilberman, B. & Fontes, L.R. 2020. New species and morphological notes on the termitophilous genera *Fonsechellus* Silvestri and *Oecidiophilus* Silvestri from Brazil (Staphylinidae, Aleocharinae, Corotocini, Termitoecina). *Papéis Avulsos de Zoologia*, 60(Special Issue): 1-13, e202060(s.i.).21. DOI

**Complete list of Cleide Costa's publications,
including research papers, textbooks, book
chapters and popular diffusion papers**

1966

1. **Costa, C.** 1966. On a new genus of Hypolithinae (Col., Elateridae). *Papéis Avulsos de Zoologia*, 19(23): 261-267.

1967

2. Martins, U.R. & **Costa, C.** 1967. Gênero *Crotchida* Fowler (Col., Languriidae). III. Espécies com élitros paralelos. *Papéis Avulsos de Zoologia*, 20(6): 59-64.
3. Reichardt, H. & **Costa, C.** 1967. *Ptyopteryx britskii*, a new Neotropical genus and species of the hitherto Ethiopian Torridincolidae (Myxophaga). *Papéis Avulsos de Zoologia*, 21(2): 13-19.

1968

4. **Costa, C.** 1968a. Descrição de uma espécie nova do gênero *Anoplischius* (Col., Elateridae). *Papéis Avulsos de Zoologia*, 21(16): 161-164.
5. **Costa, C.** 1968b. Gênero *Pyrophorus*. I. Espécies com antenas curtas e vesículas luminescentes laterais (Col., Elateridae). *Papéis Avulsos de Zoologia*, 22(8): 61-83.

1969

6. **Costa, C.** 1969. Gênero *Pyrophorus*. 2. Redescricao de algumas espécies (Col., Elateridae). *Papéis Avulsos de Zoologia*, 22(24): 249-262.

1970

7. **Costa, C.** 1970. Genus *Pyrophorus*. 3. Life-history, larva and pupa of *Pyrophorus punctatissimus* Blanchard (Col., Elateridae). *Papéis Avulsos de Zoologia*, 23(8): 69-76.

1971

8. **Costa, C.** 1971a. Descrição de fases imaturas de Pyrophorinae Neotropicais (Coleoptera, Elateridae). *Revista Brasileira de Entomologia*, 15(4): 21-30.
9. **Costa, C.** 1971b. Gênero *Pyrophorus*. 4. Redescricao e revalidação de *Pyrophorus divergens* Eschscholtz (Col., Elateridae). *Papéis Avulsos de Zoologia*, 24(4): 65-72.
10. **Costa, C.** 1971c. Gênero *Pyrophorus*. 5. Redescricao de *Pyrophorus ignitus* Fab. (Col., Elateridae). *Papéis Avulsos de Zoologia*, 24(7): 113-116.

1972

11. **Costa, C.** 1972a. Gênero *Pyrophorus*. 6. Redescricao de *P. tuberculifer* Eschscholtz, *P. phosphorescens* Castelnau e descricao de quatorze espécies novas (Coleoptera, Elateridae). *Papéis Avulsos de Zoologia*, 25(21): 199-227.
12. **Costa, C.** 1972b. Sobre a larva e pupa de *Semiotus ligneus* Linnaeus, 1767 (Elateridae, Semiotinae). *Papéis Avulsos de Zoologia*, 26(4): 51-53.

1973

13. **Costa, C.** 1973. *Buckelater* gen. nov. (Coleoptera, Elateridae, Cardiophorinae). *Revista Brasileira de Entomologia*, 5(5): 33-36.

1975

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