Jorge Víctor Crisci:

Latin American champion of synantherology, phenetics, cladistics and biogeography

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ABSTRACT

Jorge V. Crisci is a pheneticist, cladist, biogeographer, systematist, mentor, speaker, husband and father. Jorge is many things, hard to outline into a simple idea, a man of many talents which he claims are a reflection of his own teachers' and students' accomplishments. Throughout a career of more than 50 years dedicated to the study of Compositae and theoretical phenetics, cladistics and biogeography, he has had an extensive production in terms of published works, students mentored and courses taught across the five continents. One of Latin America's brightest systematists opens a door to his life and work so we could witness an amazing journey about the power of daring to learn more and the courage to follow one's dreams.

Keywords: *Biography, education, history*

On a March 2022 afternoon I sat down to talk with Jorge Víctor Crisci, one of the most influential botanists in the development of phenetics, cladistics and biogeography in Latin America, and who made a name for himself within the Compositae, where two genera have been dedicated to him: *Criscia* (Nassauvieae; Katinas, 1994; Figure 1) and *Criscianthus* (Eupatorieae; Grossi et al., 2013). In Compositae, Jorge followed the steps of one of his mentors, Angel Lulio Cabrera. The objective of this article is to offer a window to his life and academic career.

Jorge was born on March 22, 1945 in Ensenada, Argentina, a small coastal industrial city on the Rio de la Plata, located in the outskirts of La Plata, capital city of Buenos Aires province. La Plata is famous within the world of natural sciences for its internationally recognized Natural History Museum ("Museo de La Plata").

Through a series of sad family misfortunes Jorge lost his father early and then his mother, and was raised by his maternal grandparents, who ensured that this young man from Ensenada could access a better education.

"The activities that occupied most of the inhabitants of Ensenada were the shipyard and the oil refinery. Since early age, and until I was 16 years old, I worked at my uncles' modest grocery-pub, located next to the shipyard gates. In this grocery-pub I had the opportunity to learn about life and how to overcome difficult situations. There I learned the value and meaning of responsibility with respect to the consequences of one's actions."

"In Ensenada, among refinery's workers, geologists were valued professionals. Under this influence, and excited about the idea of a future dedicated to geology, I decided to join the School of Natural Sciences and Museum of Universidad Nacional de La Plata (UNLP). Prior to entering the School, in the course of my last high school years (UNLP National School), I was able to access my first paid job at the University as a tutor for first-year students."

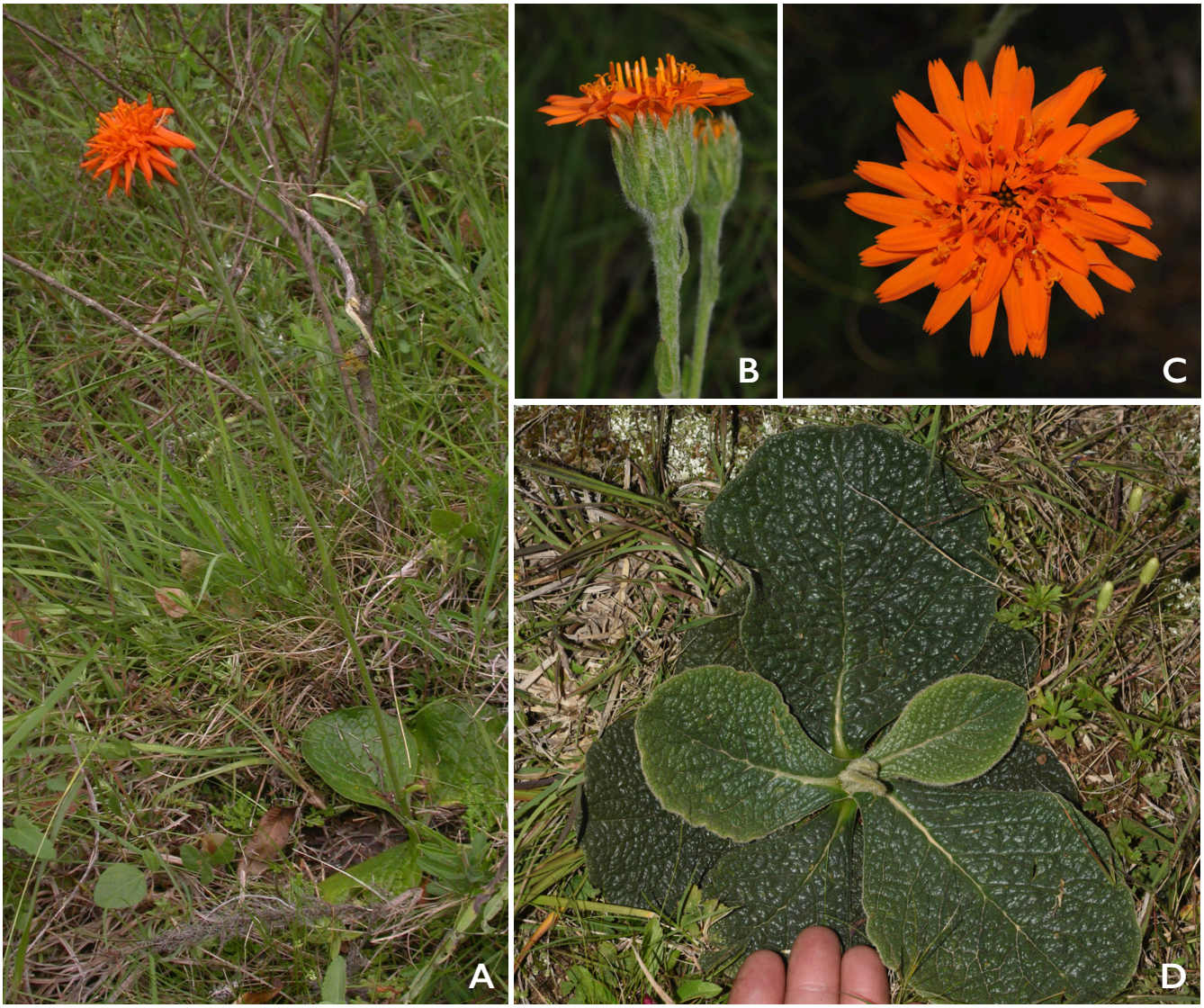


Figure 1. *Criscia stricta* (Spreng.) Katinas. The emblematic species, endemic of the Pampas, had been placed in several genera. Jorge's early phenogram indicated its aberrant position that showed it didn't match any of them. It would be up to Liliana Katinas, Jorge's wife and partner in botany, to cast the new species in a monotypic genus honoring Jorge's long commitment to the study of the Nassauvieae. **A.** Habit. **B.** Head, lateral view. **C.** Head, top view. **D.** Detail of leaves.' *Photos by J.M. Bonifacino.*

Jorge entered the School of Natural Sciences in 1963, and there he took subjects common to all careers, which included chemistry, botany, geology, zoology and anthropology. Aida (Adita) Pontiroli, specialist in Apiaceae, was his first lab teacher on Botany 101 ("Fundamentos de Botánica").

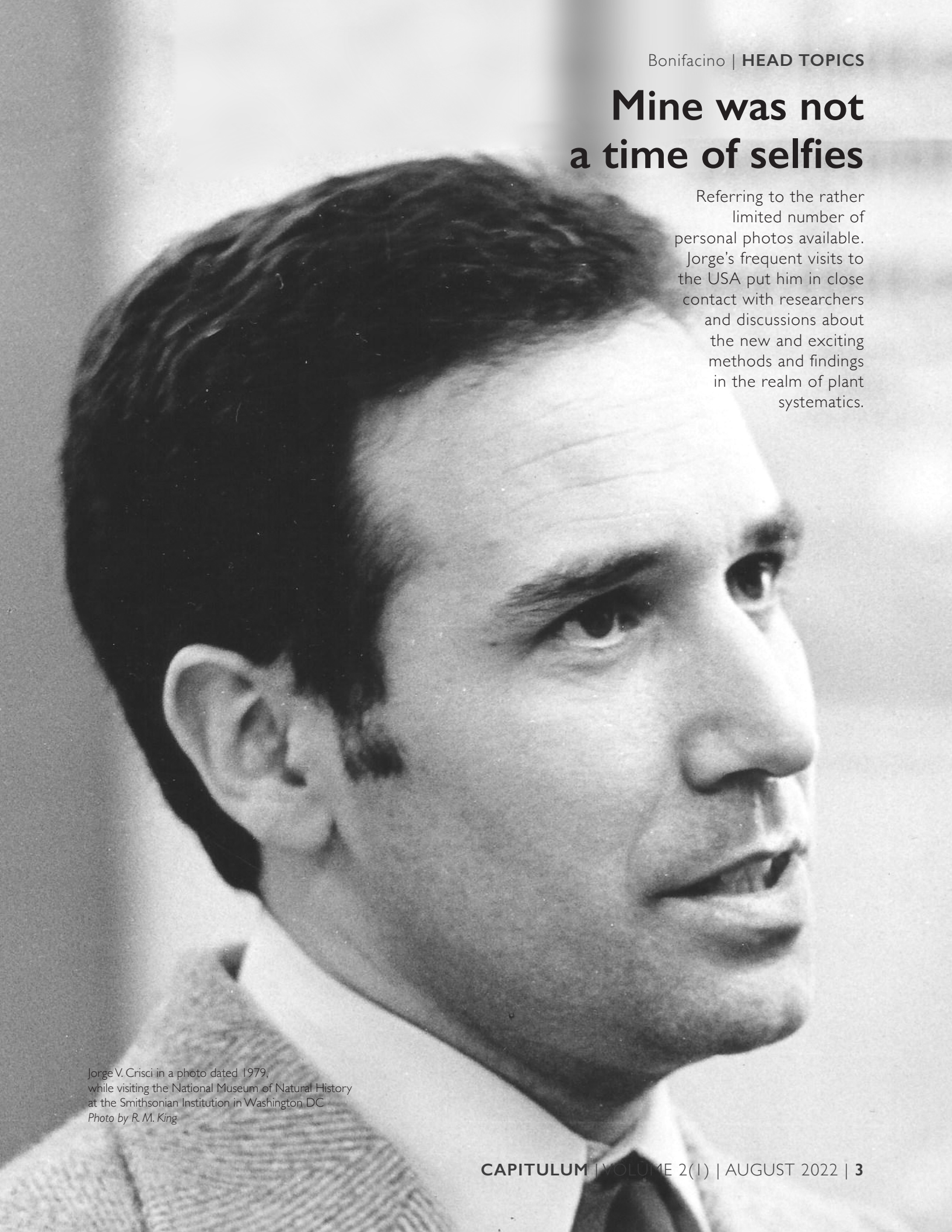
"In one of the many lab sessions, she said to me: 'I see that you and plants get along well, you should consider botany in your future'. Then, at the end of 1963, not without reservations, I decided to follow my career in botany… A geologist had good job prospects… but a botanist? It was not an easy decision."

The lectures of Botany 101 were given by Humberto A. Fabris, who was a student of Cabrera. The charismatic personality of Fabris, together with his excellent teaching skills, and Adita's enthusiasm, spurred in Jorge a deep love for botany, sealing his academic destiny within the gentle science.

"In December 1963, after passing the exams of four of the five subjects of the common cycle, Fabris summoned me to his desk at the La Plata Museum Herbarium, and told me about his collaboration with Cabrera in the Flora of Jujuy project, and made me a wonderful proposal for a young student: to join him on

Mine was not a time of selfies

Referring to the rather limited number of personal photos available. Jorge's frequent visits to the USA put him in close contact with researchers and discussions about the new and exciting methods and findings in the realm of plant systematics.



Jorge V. Crisci in a photo dated 1979, while visiting the National Museum of Natural History at the Smithsonian Institution in Washington DC
Photo by R. M. King

a month-long field trip to the mega-diverse province of Jujuy, traveling through a large part of northwestern Argentina. We were joined by Benno Schnack, professor of genetics at the Sciences School and already a distinguished scientist who had completed his postdoctoral work with G. Ledyard Stebbins in California."

"I then was 18 years old and had scarcely ventured far from La Plata, and at any rate not out of Buenos Aires province, so for me this trip was a revealing experience, one that definitely cemented my fascination with plants and exposed me to a world of incredible diversity."

In March 1964, after returning from his first trip to Jujuy and while working on the labels of the plants collected in Jujuy, Jorge met Cabrera, who had just returned from a stay at Harvard where he had completed his review of the genus *Mutisia* L. (Cabrera, 1965).

Jorge's Science School years passed rapidly, with the added value of the trips to Jujuy that he repeated in the successive summers. In 1965, he obtained a post as a Teaching Assistant in Botany 101, starting a long and prolific academic career of 55 uninterrupted years at the Universidad Nacional de La Plata. During these years, and in different stages, he was professor of Introduction to Taxonomy, Systematics of Vascular Plants, Evolution, and Biogeography. His academic career has culminated with an Emeritus Professor position at the same university.

In 1967, he obtained his B.S. degree in Botany and decided to continue his education by entering the Ph.D. program, choosing Fabris as advisor and as a subject a taxonomic revision of Argentinean Araceae (Crisci, 1971). He completed his Ph.D. in a period of two years with the help of an initiation scholarship of the National Council for Scientific and Technical Investigations (CONICET after its Spanish acronym).

"While working on my dissertation I had to make several collecting field trips, mostly to northern Argentina. When planning the first of them to northeastern Argentina, Cabrera, as Director of the herbarium, insisted that I should do it on my own and without a vehicle. At that moment in time, I would not describe myself as happy with that decision, but in the end it turned into a very positive experience, Cabrera definitely knew what he was doing! The trip was not free from hardships and difficulties, but being alone and with limited mobility, forced me to interact with the locals and through them I was able to obtain data on the plants I collected. Coincidentally, on the same date I was defending my Ph.D., an anthropology student, Omar Gancedo, also was defending his on the Guayaquí ethnic group from Paraguay. In this thesis he talked about the "Güembé" (Philodendron bipinnatifidum Schott ex Kunth) a species I had also included in my thesis. Genoveva Dawson, the professor of Applied Botany, alerted me of this shared interest and urged me to meet Gancedo, which eventually led to the publication of a work on the systematics and ethnobotany of Güembé (Crisci & Gancedo, 1971)."

Figure 2. *Moscharia solbrigii* Crisci. This species represents the starting point in a long career dedicated to the study of secondary heads in Compositae.
Photo by J.M. Bonifacino.

Upon finishing his PhD in 1968, the new professor of Botany 101, Irma Gamundi (Fabris had moved on to Systematics of Vascular Plants) offered Jorge to lead Lab classes, a position he would hold for four years. During this period, he learned a lot about teaching, another of his passions.

The Araceae are not a diverse group in Argentina, but they proved very useful in exposing Jorge to the fundamentals of systematics. However, they presented limited research opportunity, as they were not diverse enough within the country, at a time when the logistics of studying them beyond Argentina was not easy. He needed to choose another group of plants that could offer a future of possibilities free from the financial hurdles of having to travel abroad. The presence of Cabrera and the vast Compositae collection in La Plata herbarium (LP) made that decision an easy one.

"Cabrera was born in Spain and arrived in Argentina when he was 18 years old, accompanying his father, the famous zoologist Ángel Cabrera, who came to Argentina hired by the Museo de La Plata. Dealing with Cabrera was a real pleasure, he never lost his Spanish accent and had always a very gentle way of expressing himself. Cabrera had a way of conveying his infinite passion for Comps, a passion shared on weekends with his other love, sailing."

"I met with Cabrera to choose the group to continue my career as a botanist and he suggested me the genus Leucheria Lag. (Nassauvieae)."

"At that moment I didn't know it, but he really gave me a hard row to hoe [laughs]: Leucheria was an enormous constellation of scientific names in the midst of a fog of taxonomic confusion. In the end however, the challenge offered more pleasures than headaches. Once again, Cabrera's wisdom at work."

Like Cabrera, Jorge shares his passion for Compositae with another activity, in his case it is not sailing, but something that marks his Argentine condition as it is his fervor for football [soccer]. His serenity as a teacher and composure as a seasoned botanist is in stark contrast with his passion for playing football (when younger) or his cheering on Gimnasia y Esgrima La Plata at the soccer stadium! But this is only part of who he is. Outside academia, he is also a cinephile and a bibliophile with a zealous inclination for Jorge Luis Borges and his fictions.

The interaction with Cabrera was especially beneficial for Jorge. Cabrera had a legendary knowledge of Compositae and even in that pre-globalization era, he was already a world famous botanist. This was a bygone era without the communication facilities of today, with limited access to literature and where the answers to questions sent by actual mail took weeks or months to return. Cabrera was known everywhere, and that unquestionably opened doors.

Cabrera's influence on Jorge was not limited to systematics per se, but included another of his great passions, biogeography.

"In 1968, Cabrera said to me: '—I want to publish a new phytogeographic scheme, but I have doubts about some limits and ecotones between the Pampa, the Monte and Patagonia [biogeographic provinces]. *Need to check this in the field, wanna come along? We go in my Citroën—'. The idea was to check the ecotones, write down the list of the species we found, collect them and mark the places where they occurred on a map. It was an extraordinary journey and a huge learning experience for me."*

A few years later, Cabrera would finish publishing his classic biogeographic scheme, first including only the proposal for Argentina (Cabrera, 1971) and later extending it to the rest of Latin America (Cabrera & Willink, 1973). This scheme has withstood the test of time and methods and, with the exception of minor adjustments, remains intact today. Later biogeographic schemes, including maps of ecoregions of Argentina, were based on Cabrera's work. These achievements acquire more significance when one factors in that they were produced in a time without satellite images, in the absence of global positioning systems and without the help of computers. It was simply done by means of walking the land and marking points on paper maps.

The work in *Leucheria*, even with its many hurdles, gave Jorge a unique perspective for the most diverse early-diverging lineage in the Compositae, offering him a thorough understanding of its evolution. *Leucheria* is diverse on both sides of the Andes, which is what led Jorge into traveling to Chile. Several trips across the Andes resulted in a strong friendship with one of the most important botanists of Chile, Clodomiro Marticorena. With Clodomiro, Jorge not only learned about Chilean Compositae

A cornucopia of diversity revealed

In december 1963, Humberto Fabris, Jorge's professor made him a wonderfull proposal, to join him on a one-month long fieldtrip to megadiverse Jujuy. That would change his life forever.

Jorge V. Crisci while collecting plants in Jujuy in 1966.
Photo by Roberto Kiesling

and where they occurred, but he was also introduced to palynology (Marticorena & Crisci, 1972; Crisci & Marticorena, 1978).

In 1971 he entered the career of the Researcher at CONICET, whence in 1999 he reached the highest category of Senior Researcher.

The year 1972 was a turning point in Jorge's life. He won a position as Assistant Professor of Systematics of Vascular Plants. In that same year, and at the young age of 27 years, he obtained the prestigious John Simon Guggenheim scholarship that would allow him to continue his studies on *Leucheria* at Harvard University, following the steps of Cabrera himself.

"I am convinced that to some extent it was the paper on Philodendron that opened the door to my stay at Harvard. One of the members of the committee that evaluated the proposals for this scholarship was the prestigious ethnobotanist Richard Schultes, and apparently he liked this article much, as I learned when I finally went to Harvard and got to know him personally. Many times the opportunities come from the least thought of places. The time at Harvard was for me equivalent to being in a botanical amusement park. It was there that my interest in the development and evolution of secondary heads arose. It all started with a few samples of Moscharia (Figure 2) *that had been sent to me labeled as Leucheria."*

At Harvard Jorge worked with the Argentinean Otto Solbrig, who was a professor there and a well known specialist in population biology. Solbrig was a former student of Cabrera and he suggested a numerical and computational approach to tackle the complexity of *Leucheria* and the Nassauvieae.

Solbrig had been a professor at the University of Michigan in Ann Arbor, and had James Farris and Arnold Kluge as colleagues. Along with them, he had used the first computer programs for phylogenetic analysis. Especially the PRIM program (developed by telephone companies and used by biologists to implement a form of parsimony) and Wagner 72 (created by Farris to produce Wagner trees, an "ancestor" of the current phylogenetic programs that apply parsimony). This was a time when computer programs were "written" by punching holes on paper cards, as well as data and instructions. There were no screens, and the results to the operations were visualized on printed paper about half a meter wide!

"This year I was at Harvard, I met many key figures from the world of botany and biology who visited Harvard, such as the synantherologist Arthur Cronquist, the evolutionist G. Ledyard Stebbins and the anatomist Sherwin Carlquist. With them I discussed the subject of secondary heads in Compositae. These discussions were enormously beneficial for my research in the Nassauvieae. Stebbins was a truly inexhaustible source of ideas. We would remain in contact for many years to come. For Stebbins, the secondary heads were the result of a selection pressure to reduce the number of florets in the heads to avoid attracting phytophagous insects, and later to increase the number of florets again to achieve pollination success by means of grouping the many small heads, hence generating the so-called secondary heads."

"During that time at Harvard, I also met botanists Reed C. Rollins, Rolla M. Tryon, Bernice G. Schubert, Carroll E. Wood, paleontologist Stephen Jay Gould and evolutionist Ernst Mayr, who were all professors there. When I think retrospectively what they all had in common, apart from the greatness of intellect and the revolutionary and advanced ideas that each one of them imprinted in their fields, humility comes to mind as the ultimate common denominator."

Just before returning to Argentina in 1973, Jorge had the opportunity to meet another Harvard visitor, Robert Sokal, who together with Peter Sneath was the architect of the development of numerical taxonomy. Talking with Sokal about his work with *Leucheria* and its closest relatives, Sokal mentioned a new program, the Numerical Taxonomy System (NTSYS) written by F. James Rohlf, with which all sorts of numerical analysis could be carried out. It was then that, at the suggestion of Sokal, and thanks to the insistence of Gould, he wrote to Rohlf who generously gave him a copy of the program to take back to Argentina (Figure 3).

On his return from the USA, several of the papers started during his stay at Harvard came to fruition, including a description of a new genus dedicated to Marticorena (Crisci, 1974a), the revision of *Moscharia* with a reinterpretation of its heads (Crisci,

Figure 3. Magnetic tape of one of Rohlf's earliest versions of NTSYS (Numerical Taxonomy System), a cornerstone of numerical taxonomy. *Photo by P. Marchionni*

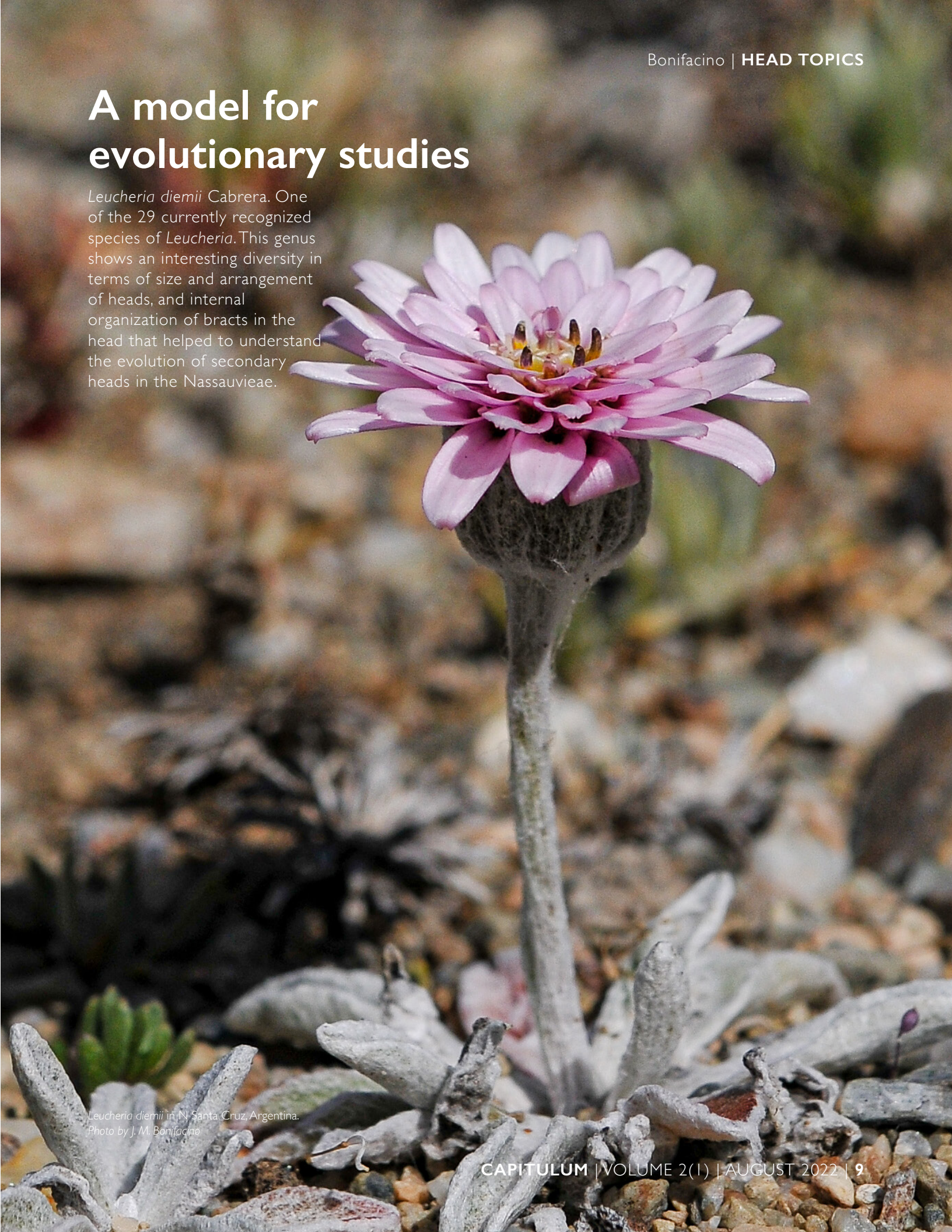
1974b), the numerical analysis (Cluster Analysis and PRIM) of the Nassauvieae (Crisci, 1974c) and the revision of *Leucheria* (Crisci, 1976). In all of them, two distinctive elements are combined, the focus on the Compositae with an emphasis on the early-diverging lineages together with a detailed analysis of their morphology, and the application of emerging techniques of taxonomic analysis.

"Back at the Museo de la Plata, the University had rented an IBM mainframe computer (at that time IBM did not sell computers, they rented them!). The NTSYS program was 200 kb and because of its size (figure that!) it could not be run during the day while the computer was being used by other researchers, so I punched the cards with the instructions and the data and left it with the technicians to be run through the night. The next day I would return and retrieve the results, in printed form. I used these programs while performing phenetic and cladistic analysis to different groups. Among these studies were those done in collaboration with the botanist Bruno Petriella on Cycadales, for which we used NTSYS and Wagner 72 on the mainframe for a phenetic and phylogenetic analysis (Petriella & Crisci, 1975, 1977)."

"Thanks to the stay at Harvard, I also met another visitor, Tod Stuessy, with whom we shared the interest in secondary heads. In 1978, thanks to an invitation from Stuessy, I spent a year as visiting professor and Fulbright-Hays Fellow at Ohio State University. In that same visit I traveled to Ann Arbor and I met with James Farris (the great theorist of numerical cladism) who gave me his new version of the Wagner program (Wagner 78). During my stay at the Ohio State University, I used Wagner 72 to infer the relationships among the Nassauvieae (Crisci, 1980). Together with Stuessy, we analyzed Melampodium (Millerieae) using numerical and computational techniques (Stuessy & Crisci, 1984b)."

A model for evolutionary studies

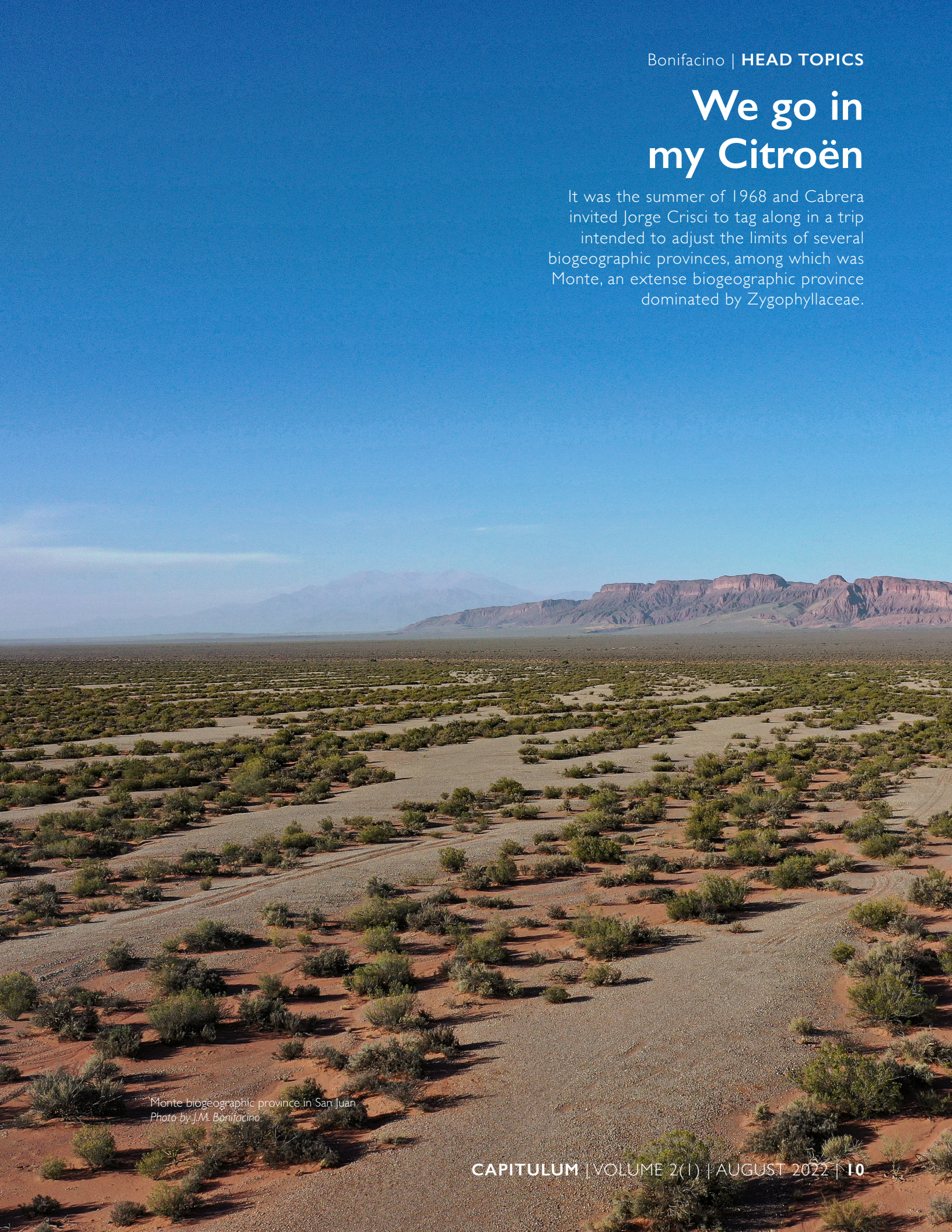
Leucheria diemii Cabrera. One of the 29 currently recognized species of *Leucheria*. This genus shows an interesting diversity in terms of size and arrangement of heads, and internal organization of bracts in the head that helped to understand the evolution of secondary heads in the Nassauvieae.



Leucheria diemii in N. Santa Cruz, Argentina. *Photo by J. M. Bonifacino*

We go in my Citroën

It was the summer of 1968 and Cabrera invited Jorge Crisci to tag along in a trip intended to adjust the limits of several biogeographic provinces, among which was Monte, an extense biogeographic province dominated by Zygophyllaceae.



Monte biogeographic province in San Juan
Photo by J.M. Bonifacino

"Numerical techniques were divided into two major areas, phenetics and cladistics, which differ on their philosophical basis. Phenetics is based on forming groups through the use of a large number of characters, all weighted equally. Cladistics is based on defining the groups by the evolutionary novelties or synapomorphies that support them. Both numerical methodologies hold much in common, so the meetings on the use of numerical techniques used to include contributions from both approaches. From the mid-1970s onwards, a great schism took place that set the two approaches apart, generating strong controversies that are reflected in the publications of the period. It is very interesting to note that with the appearance of molecular data, the phylogenetic analysis allowed the implementation of probabilistic models of evolution (maximum likelihood and bayesian). This division generated a sort of 21st century schism within phylogenetic methods (parsimony vs. probabilistic methods). I wonder what the next dichotomy would be, maximum likelihood vs. bayesian?"

At Ohio State University, Jorge also met a Stuessy's graduate student, Bob Jansen, who would later be responsible together with Jeffrey Palmer for discovering the chloroplast inversion that would mark the basal split between the Barnadesieae and the rest of the Compositae.

"During this visit I also met Vicki Funk, who was finishing her thesis on Montanoa *(Heliantheae). That meeting made an everlasting impression on me. Vicki was an incredible person, overflowing with enthusiasm and energy, a tireless worker. Cladistics was at its height at that time, and Vicki, despite her youth, was an influential figure. My feeling is that she has rarely been credited with being one of the most important figures in the theoretical development of cladistics. Let us not forget that she was the one who co-edited the first books where the basis of the cladistic approach to the classification were laid out, something that still is central to our efforts to understand how organisms evolved and are classified (Funk & Brooks, 1981; Platnick & Funk, 1983)."*

"In the early 1980s cladistics gained power among the systematists, especially after the theoretical contributions of Norman Platnick and Gareth Nelson from the American Museum of Natural History, which developed and improved the ideas proposed by Hennig (1950, 1966)."

In the words of Dickens… *"It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness, it was the epoch of belief, it was the epoch of incredulity, it was the season of Light, it was the season of Darkness…"*

"It was a fascinating time full of discussions that sometimes became heated. I attended some of the scientific meetings of the society that brought together practitioners of these methods, and had the opportunity to get to know the majority of those who built the theoretical foundations of cladistic methods based on parsimony such as Bremer, Kluge, Carpenter, Platnick, and Nelson among others."

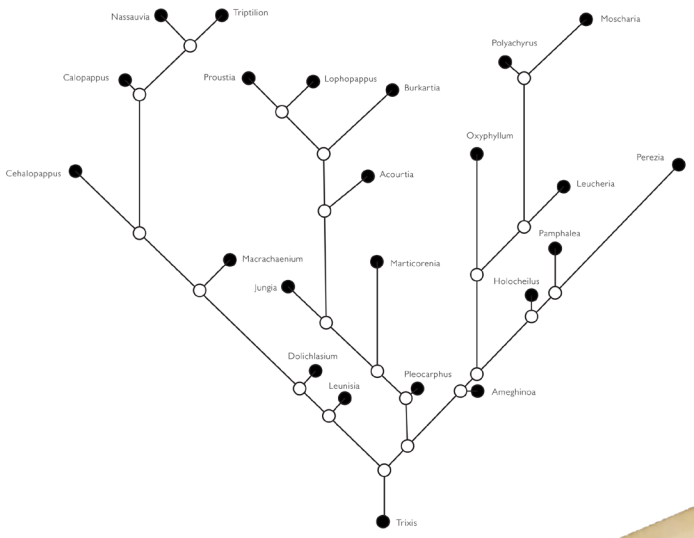
The end of the 1970s and the beginning of the 1980s were periods of much intellectual effervescence and methodological developments linked to cladistics, which eventually ended up being called "Phylogenetic Systematics". Jorge was an active participant in this process, and made important contributions in the use of parsimony, taxonomic congruence, primitive states, character polarization, and species concepts (Crisci & Stuessy, 1980, 1982; Stuessy & Crisci, 1984a; Crisci, 1984a; Crisci, 1981, 1982, 1983, 1984). During this period, Jorge also continued with his interest in numerical taxonomy, which led him to publish in 1983 a book that would summarize the methods currently in use. The book, although mostly dealing with phenetic methods, also contains a chapter dedicated to phylogenetic reconstruction using the algorithms created by Farris for Wagner 72 and Wagner 78 (Crisci & López Armengol, 1983).

"In 1986, I closed a deal with IBM, in which they gave us three personal computers and funded two IT positions for the development of an educational software on evolution (Crisci et al., 1989). Further adding to this, they also funded the visit of a specialist in computers and education, Ted Crovello, who had also worked on the systematics of Salicaceae using numerical and computational methods. With these computers that today would be outpowered by the simplest of the smartphones, but that back then were at the cutting edge, we began to work on phylogenetics, phenetics, and to perform evolutionary and biogeographical analyses. On the subject of education, I can't stress strongly enough the enormous influence that, from 1989 onwards, has had on me the great American educator Joseph McInerney. I met Joseph when we were

The mother of all numerical phylogenetic analyses

Wagner tree

This diagram was published by Crisci in 1980 as part of his study on the evolution of Nassauvieae



Wagner 72 in punch-card format. This program, written by Farris, was the first ever to perform phylogenetic analysis in the shape of Wagner trees. The program in order to run had to be "written" by manually punching the cards using a machine, together with the instructions and data. The output was retrieved in printed form.

Punch-card

Each card had 80 lines of code capable of holding instructions or data

Wagner 72

The "program" consisted of a whole deck of punched cards

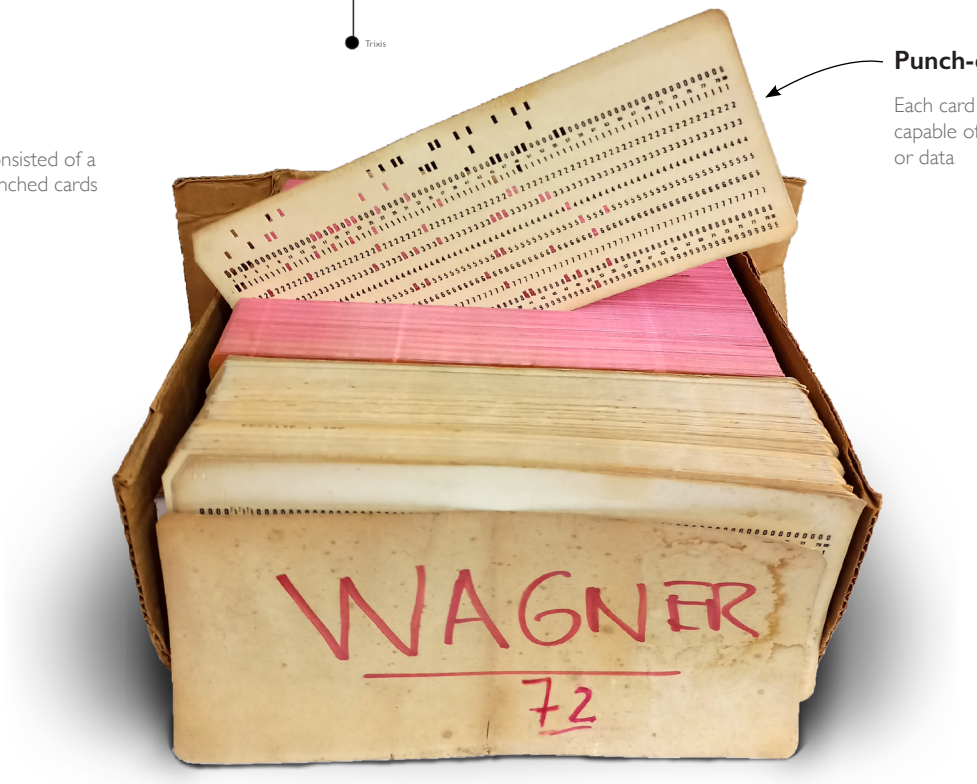


Photo by P. Marchionni

both part of the Biological Education Committee of the International Union of Biological Sciences and from there we had several joint projects (Crisci et al., 2014; Apodaca et al., 2019) and a book on systematic teaching in primary schools sponsored by UNESCO (Crisci et al., 1993)."

At the beginning of the 1990s, by invitation of Peter Raven, director of the Missouri Botanical Garden, Jorge traveled to Saint Louis, to participate with Raven's work group on Myrtales, with special emphasis on the Onagraceae. There he interacted with several researchers, especially Peter Hoch, that resulted in several contributions to understanding the evolution of that family (Boufford et al., 1990; Carr et al., 1990; Crisci & Berry, 1990; Crisci et al., 1990; Graam et al., 1993; Hoch et al., 1993a, b).

His visits to the Missouri Botanical Garden would repeat for several years, and he eventually was appointed an Honorary Curator of the institution. It is worth mentioning that these interactions with Raven further increased Jorge's interest in the conservation of biodiversity, and from then on, this topic would turn mainstream in Jorge's work.

Jorge's zeal for education is manifested in his published record (Crisci, 1994a, b; Crisci & Katinas, 2011; Apodaca et al., 2019; Figure 4) along with his efforts in the creation of educational software (Crisci et al., 1989; Andrews et al., 2002), but more importantly, it is reflected in the numerous courses taught in more than 20 countries, across the five continents. In this flurry of courses, he covered topics such as numerical taxonomy, phylogenetic systematics, biogeography, conservation of biodiversity, education, biological evolution, current state of systematics, comparative biology, collections of natural sciences, and scientific literacy and its relationship with democracy.

Jorge's presentations are charismatic and he invariably conveys his passion for the study of these disciplines. Literature and cinema always find a space in Jorge's talks, and allow him to present topics through the use of analogies and metaphors. Difficult topics and the latest advances are presented with wit and simplicity to make them accessible to diverse audiences.

The 1990s witnessed the creation in the Museo de la Plata of the Laboratory of Systematics and Evolutionary Biology (LASBE after its Spanish acronym), which represents the formalization of an eclectic group of systematists, led by Jorge, who seek to approach taxonomic and biogeographic problems from an evolutionary and multidisciplinary perspective (e.g., Crisci et al., 1991a, b; Crisci et al., 1994; Morrone et al., 1994; Semorile et al., 1994; Dewey et al., 1996). During this process, Jorge directed his efforts at another discipline, Biogeography, that had been introduced 20 years earlier by Cabrera himself. However, unlike Cabrera, who focused on the problem from a descriptive perspective, Jorge's approach to biogeography would be with a historical focus, facilitated by modern methodologies, including phenetics and phylogenetics.

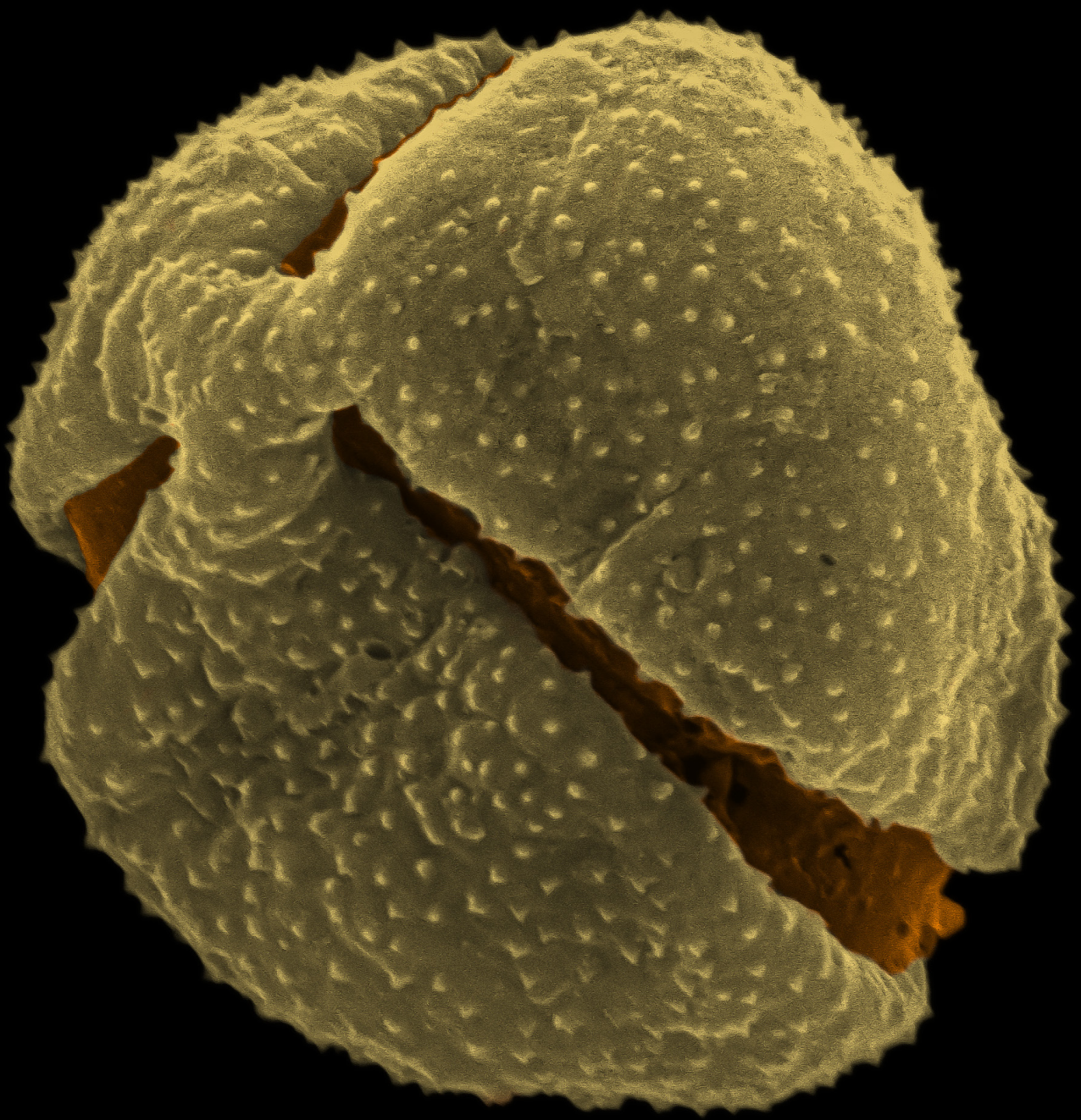
This is how Jorge produced a series of seminal works on the basic principles of historical biogeography (Crisci et al., 1991a, b; Crisci & Morrone, 1992a, b; Morrone & Crisci, 1990, 1992, 1995; Crisci, 2001a; Apodaca & Crisci, 2018) as well as several practical applications of these principles (Morrone et al., 1994, 1997; Katinas et al., 1999; Katinas & Crisci, 2000; Crisci et al., 2001; Roig-Juñent et al. , 2002). Jorge dedicated much of the last years of the XX and the first years of the XXI century to this discipline, which eventually led to the production of two books entirely dedicated to biogeography (Crisci et al., 2000, 2003).

Four recurring themes have also found space in Jorge's recent years, including the conservation of biodiversity (Crisci et al., 1999; Crisci, 2001b, 2006c, 2008; Posadas et al., 2011), the teaching of biological evolution (Crisci et al., 2014; Apodaca et al., 2019), the importance of natural history collections (Crisci & Katinas, 2017a, 2017b) and scientific literacy (Crisci, 2011, 2014, 2015, 2016).

Finally, the most recent years have been a time of synthesis, the end result of a rich history that includes a broad spectrum of themes that range from science education to more philosophical approaches on the future of taxonomy (Crisci, 2006a, b; Crisci & Katinas, 2020; Crisci et al., 2020). Without forgetting his fascination with secondary heads in Compositae,

SEM Miracles

Huanilipollis criscii Barreda & Palazzesi, Nassauvieae pollen, named in honor to Jorge Crisci. This morphospecies dated to the early Miocene, from the Chenque section, southeastern Chubut, Argentina, Chenque Formation (Barreda et al. 2008).



SEM of *Huanilipollis criscii* Barreda & Palazzesi
Photo by V. Barreda

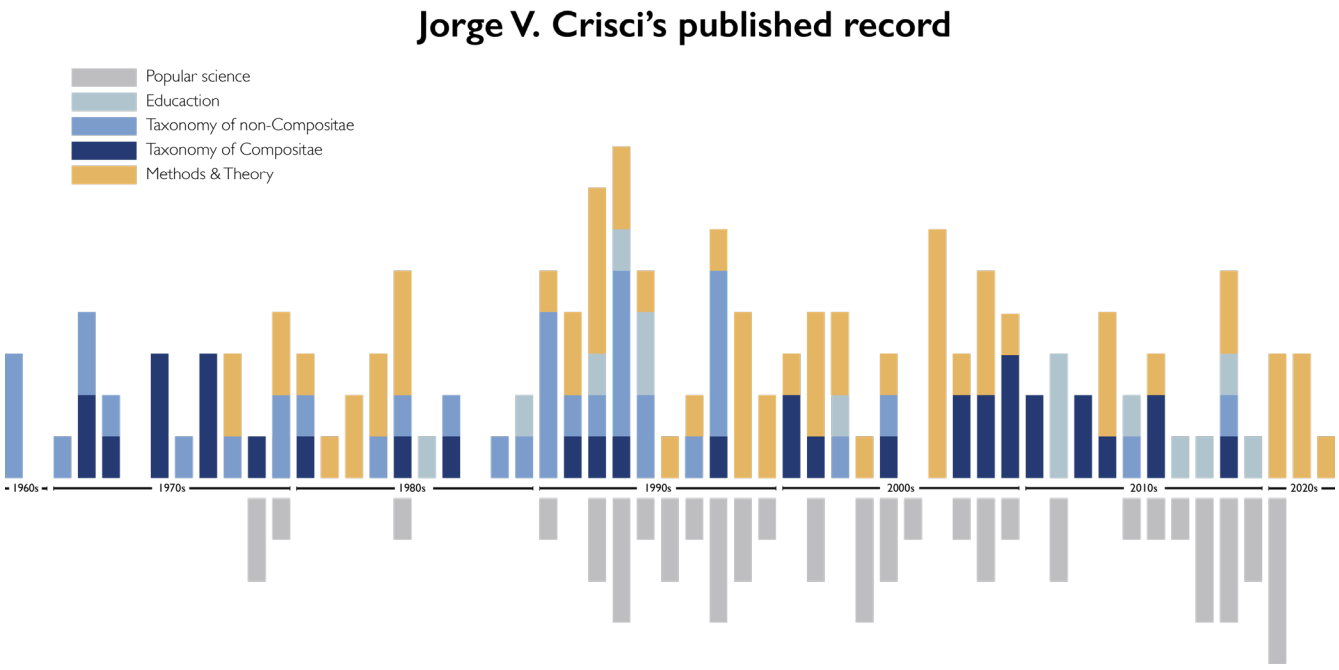


Figure 4. Jorge V. Crisci published record. The infographic shows Jorge Crisci's continued involvement in Compositae, but also his significant dedication to methods and education.

in 2008 he revisited the concept, this time joined with other colleagues and approaching the subject from the molecular data perspective, in another take at the evolution of secondary heads in the Nassauvieae (Katinas et al., 2008).

In 2020 Jorge published, together with his colleagues Facundo Palacio and María José Apodaca, a book on multivariate analysis for biological data and its application using the language R. The book includes chapters on phylogenetic estimation (parsimony and probabilistic methods, cf. Palacio et al., 2020). As evidenced by the number of reads (currently more than 120000 on Research Gate), this book covered a strong need for a treatise in Spanish on the subject.

In 2022 Jorge has come around full circle, as he published with Liliana Katinas and María José Apodaca a synopsis of *Leucheria* (Katinas et al., 2022), a contribution where all the advances in the systematics of the genus since his original 1976 revision are presented.

"I believe that one of the most challenging questions for synantherologists of the future is to find the morphological characters that support the main nodes of the phylogenetic tree of Compositae. Bremer (1987) was a pioneer in this theme and created several hypotheses, but given the progress of knowledge of current relationships (Funk et al., 2009; Mandel et al., 2019) I believe that a re-evaluation of the morphological traits supporting the nodes may be in order."

The moment is ripe for this type of work given the existence of robust and detailed phylogenies that show us the relationships between the different groups of Compositae. Knowing how these traits appear in the tree will not only satisfy our innate curiosity about the structures that define each group, but more importantly they will allow us to get closer to understanding the reasons that the Compositae are such a successful group of plants.

Now at 77, Jorge has been a witness and participant of one of the major revolutions in the history of biology, namely the development and maturation of modern systematic methods and biogeography. I am amazed by this rich history of experiences and contributions and was compelled to ask him about how he sees this journey, to which he gave a quintessential "Criscian" reply.

"I had always agreed with the vision that Spanish philosopher José Ortega y Gasset had on this very question:"

"Genuine vital integrity does not consist in satisfaction, in attainment, in arrival. As Cervantes said long since: The road is always better than the inn."
[Ortega y Gasset - Revolt of the Masses]

"It is highly likely that my 'inn' (i.e.: books, papers, courses, conferences, software) will not resist the test of time, but my 'road' — with its normal ups and downs — has been always marked by happiness because I simply love what I do. In this 'road' I feel like a fortunate and fortuitous link between two generations of brilliant biologists: my teachers (Cabrera, Fabris, Marticorena and Solbrig) and my students. I believe I have been a faithful mirror of other people's talents. The 'road' has not only given me the happiness derived from the work I do, but it also led me to meet Liliana Katinas, my loving companion in life, but also a scientific collaborator so effective and brilliant that at the end of my life she has become the last of my teachers. The 'road' that brought us together with Liliana, awarded us with the arrival of Victoria, our daughter, the part of the road taken I am more proud of."

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