

Chapter 2

A Reflection on the Career: Following a Path to Moths and Butterflies

Pedro Barbosa

Because I was born in a small rural town along the southeastern coast of Puerto Rico, I was surrounded by nature and caterpillars. But having been taken to New York City at the age of three, I was not really aware of these magnificent creatures during those early years. For the few of us who grow up in urban environments like Spanish Harlem (Fig. 2.1, Upper panel) but love butterflies, seeking butterflies and moths is not exactly like looking for moths and butterflies in the Amazon, or the forests of New Guinea, but it is challenging and scary in its own way. I would visit those exotic places many years later, but as a youngster I could not even imagine those places. But how does anyone become seduced by butterflies and moths in the middle of a concrete jungle? As a youngster in the city, the insects that I was most exposed to, up close and personal, were flies, ants, cockroaches, and bedbugs.

As a kid in the city, flies and ants were interesting little critters, and I could look at them through a toy microscope that my uncle got me; cockroaches were inevitable coinhabitants that seemingly could not be avoided. Unfortunately, they were also a constant icon of failure for some reason I cannot remember, and the bedbugs just made me itchy and sleepless (Fig. 2.1, Lower left panel).

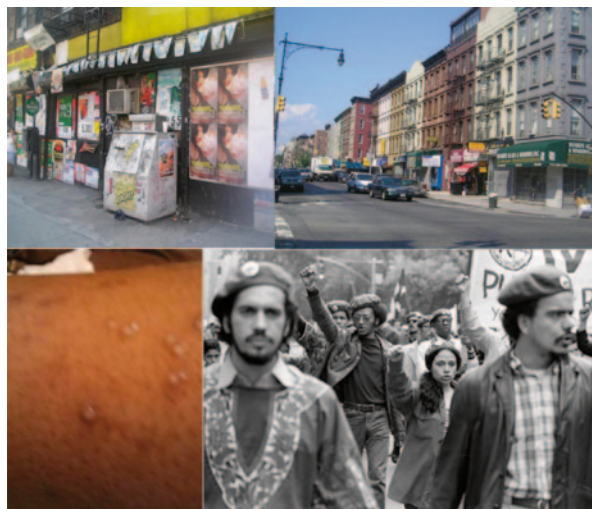
Still I was fascinated by insects. The fascination was not an adaptive survival trait, but a source of ridicule and bullying by other youngsters who enjoyed inflicting pain. Luckily, one very effective way to avoid those other youngsters was to spend a lot of time at the zoo, libraries, and museums. Hoodlums, whether they were random individuals or gangs, such as the Young Lords (Fig. 2.1, Lower right panel) in the 1950s and 1960s, did not spend much time in any of these places.

What does this have to do with butterflies and moths? Well, it was on one of these trips to a museum that I saw a display of the Lepidoptera collected in New York City. It was my first introduction to moths and butterflies and to my beloved luna moth. It was a very dusty, old display. I never actually did see any of these species in the display, flying around, but it made an impression on me and started a lifelong love. I needed to seek out places where I might see these wonderful

P. Barbosa (✉)

Department of Entomology, University of Maryland, College Park, USA
e-mail: pbarbosa@umd.edu

Fig. 2.1 *Upper panel:* Homes and stores in Spanish Harlem (<http://www.sky-scrapercity.com/showthread.php?t=504084>). *Lower left:* reaction to bedbug bites. *Lower right:* The Young Lords—the dominant youth gang in Spanish Harlem; a group consisting of children of migrant Puerto Ricans who came to the country in the 1930s and 1940s. (<http://www.latintrends.com/?s=the+young+lords&submit=Search>)



creatures and other insects as well. So, I had no other choice. I walked across the George Washington Bridge just to find some green grass, trees, maybe a couple of flowers, and of course insects, many of which were moths and butterflies. Growing up in New York City I did not see much nature near my house, and since my family did not own a car, I would frequently walk across the George Washington Bridge to New Jersey to find more nature and less concrete (Fig. 2.2). Apart from wanting to escape the concrete jungles of New York, I loved being around what was the closest to the “natural world” and observing what was there and what they did. Not in my wildest dreams did I ever imagine that my interests in biology and insects, in particular, could become anything resembling a job. I had no idea, as a youngster, that anyone would pay you for doing what you love.

Fig. 2.2 The George Washington Bridge: the long trek from Spanish Harlem to New Jersey



My first realization that an interest in entomology could become a job and a career did not occur until I was an undergraduate in college. Furthermore, that realization came about in the most unusual way. I attended the City College of New York, a school on the edge of Harlem. I planned on becoming a medical doctor, but soon realized I disliked the reality of being a pre-med at that time. Despite this, I always had a passion for science. Although I was a “poor student,” this was not the case when I took biology courses. In other words, I only did well in the classes I liked, but those classes were all biology related. I loved those courses and so was interested. As a result doing well in the courses came easy to me because I was learning about things I cared about.

As I moved through college, I drifted away from the goal of becoming a doctor, even though I had no idea how anyone could have a career or make a living by loving and working with insects. But luckily, life is what happens while you are making other plans. In college, as an undergraduate, two life-changing experiences brought me back to my love of insects. As an undergraduate, I took just about every biology course offered. In those courses, I interacted with pre-meds. Let us say that the people who were attracted to that career path were clearly neither my kind of people nor the type of people I wanted to be with. Second and most important, as well as oddly enough, I was lucky that many of the biology teachers I got to know had a background in entomology or botany, which further drew me to both those interests. I got an opportunity to talk to these professors, not so much about the particular courses they taught but about their love of insects and plants. Who knew that decades later I would be totally absorbed in plant–insect interactions, in particular, and the magnificence of caterpillars and Lepidoptera–plant interactions, in general.

At any rate, the goal of being a doctor disappeared and the beginning of a lifelong love of insects began. Unfortunately, with an attitude of working hard only in courses I loved, and not so much on those I did not really like or “get,” was not the best strategy for moving into a career of any kind. As one would predict, I did not have the best grade point average (GPA) or even an OK GPA. I mention this because as one might predict I did not really have many options regarding the graduate program to which I might be accepted. Thus, at the end of the application process I only had three choices: Texas Tech University, University of Hawaii, and University of Massachusetts (UMASS) at Amherst. My thinking at the time was that, given that in those days, as far as I was concerned, Maryland was the Deep South, and I was not sure I would like Texas Tech University. Second, as a young man I thought there was no way I would get any work done in Hawaii, so that left UMASS and that is where I headed. Again I was very lucky. Neither I nor my parents could afford a car with which I could get to Amherst, Massachusetts. However, Mr. and Mrs. Perlow, who owned and operated a men’s clothing store and for whom I had worked throughout most of my college years, drove me to Massachusetts. I was excited about going to this exotic place. I had seen Tasmanian devils and red pandas in the zoo but never cows and goats, or corn for that matter.

I was very happy to be accepted in a graduate program, but it meant a detour since my advisor worked on mosquitoes. Dr. T. Michael Peters, in retrospect, not a well-known researcher, but without a doubt, for me an absolutely great advisor.

In his mind, where I grew up was irrelevant, and the fact that I was a street-smart but world-stupid kid from the ghetto in no way affected what he expected of me—he was the best! He did not assume I needed to be pampered because I was an ill-prepared inner city kid. I remember asking him what it took to succeed as an entomologist. And, he outrageously said, you need to have 12 publications by the time you get your PhD. What did I know? So I did it plus one, not because I was special but because that was the goal that was set for me. Obviously, I could not do it by myself, so it also taught me the complexities of collaborative research because without working on joint projects with others in the lab, I would not have ever been able to reach my goal.

When I completed my PhD, I was lucky enough to get a faculty job at Rutgers University. This is where two situations helped return me to moths and butterflies. In the Entomology Department, the vast majority of the faculty worked on mosquitoes. I did not want to be just another mosquito researcher. Second, at the time, an invasive species, the gypsy moth, was moving south into New Jersey. Thus, I had an opportunity to work with this moth and hopefully help mitigate the potential damage of this pest or slow its spread. Gypsy moths affect different plant species to varying degrees. I reasoned that if I could get specific information about the severity of harm to different tree species, I could estimate likely levels of damage and predict which sites or areas were more likely to experience a severe outbreak of this pest. My studies revealed that secondary plant compounds, among other things, played a role in the rate of development, size, and reproductive potential of the insects that feed on them. Secondary plant compounds include chemicals that defend against herbivory.

Thus, I began to work with other plants, as model systems such as tobacco, in order to investigate how defensive chemical compounds, in this case nicotine, affected the insects that feed on tobacco as well as the parasitoids that attack these insects. That was the beginning of a 39-year career as a professor working on the biology and ecology of moths. In particular, I focused on the theoretical and applied ecology of plant–insect interactions with an emphasis on tri-trophic level interactions. The latter entails investigating how plants directly or indirectly affect both the insects that feed on plants (i.e., herbivores) and also the natural enemies that attack the herbivores. On the applied end of things, I was interested in how these interactions influenced or enhanced conservation biological control or natural biological control.

My most recent research, prior to my retirement, illustrated this type of interaction. I explored the factors that explain the abundance and diversity (Fig. 2.3) of Lepidopteran species on trees. I investigated how plants, such as the two tree species, *Acer negundo* L. (box elder) and *Salix nigra* (Marsh) (black willow) (found in northeastern riparian forests and on which caterpillars feed), can influence parasitoid–host interactions. The tree species were selected because although both occur in the same habitat, they differ in significant ways. I examined the caterpillars that occurred on the two tree species and found that the tree species on which caterpillars feed affect their susceptibility to parasitism. I found that the level of parasitism

Fig. 2.3 The wonderful diversity and amazing intricacies of the caterpillars of Lepidoptera



of caterpillars on one tree species was double that of the same caterpillars on the other tree species, even among species that occur on both tree species.

The question of what was leading to these different levels of susceptibility led to a research project on insect immune systems conducted by one of my graduate students, Dr. J. Gwen Schlichta. She used a technique to study the mechanism of a caterpillar's defense against parasitism. A glass bead dyed red, representing the egg of a parasitoid, was injected into caterpillars. The "egg" was then surrounded by blood cells which formed a capsule. Once encapsulated, a real egg would die. This process differed depending on the tree species on which caterpillars occurred, suggesting that tree leaves consumed by caterpillars may contain a chemical which affects the caterpillar's ability to defend against a parasitoid.

I end this biographical sketch by emphasizing that even if one neither gets lost in remote forests nor is abducted by rebels, or some other exciting adventure, the concrete jungles of Spanish Harlem (and any other urban and suburban areas) have their own challenges for a caterpillar lover. I think that my experiences in less than pristine urban and suburban habitats led me to working in northeastern woodlands, later in my career. I was motivated by a desire to let others understand that the concrete jungle of urban and suburban habitats may not be the Amazon, but the green areas in those areas are home to amazing butterflies and moths, as well. More important is the opportunity that my life's love of insects provided me to make a difference in the lives of my students. I have loved working with students. For each student, my role evolved from an advisor teaching how science is "done," to occasional therapist, to a friend. I have learned and have always been amazed at the impact one has on students. It sometimes is difficult to realize that students really take what one says to heart. For example, one time I was taking a walk and chatting with one of my students at a meeting and he said "remember at that meeting in Toronto; we were walking outside and you said ..." I thought to myself, wow! How did he

remember that, it was years ago! That is when I realized students remember everything. It really illustrated to me that I really did have an impact, and I was honored.

I have always believed that one's world is only as small as you make it. So, the idea of being a generalist has always been the ideal objective. So other than my love of moths and butterflies, I love collecting masks from many cultures, which to me is the ultimate in being a generalist and appreciating a diverse and challenging world. So, I have developed a love of masks as a window into the cultures of this world. After many years I now have masks from Mexico, New Guinea, and Central and South America, as well as Africa. It is fascinating to me how masks are parts of social rituals of so many cultures and play such significant roles in these societies. But I have to admit that I cannot leave my love of insects completely behind so I also like to take pictures of, yeah you guessed it, caterpillars.

I also enjoy bronze casting and developing multimedia art pieces. My love of art is driven by a quote I once heard, attributed to Arthur M. Sackler, who presumably said, "Science is a discipline done with passion, and Art is a passion done with discipline." Although I retired in 2010, I am still writing books and working with students. I have been very lucky to have interacted with, and worked with over 100 undergraduates, and many, many graduate students, and postdocs; perhaps because I cannot imagine life without entomology. It is wonderful to find one's passion and go for it, surrounded by great people with the same passion, or those whose fledgling passion for insects and biology in general can be supported and expanded. Finally, I also love spending time with Gail, our grown children, and our six grandchildren. Who knew where a love of moths and butterflies would lead.

Prof. Pedro Barbosa PhD grew up in New York City, and after completing his BS in biology at the City College of New York, he went to the University of Massachusetts for his masters degree in the Department of Entomology and stayed there to complete his PhD. When he completed his PhD, he took a faculty position in the Department of Entomology and Economic Zoology at Rutgers University and stayed there for 2 years. In 1973, he returned to the Department of Entomology at the University of Massachusetts as an assistant professor and became an associate professor in 1978. In 1979, he took a position as an associate professor in the Department of Entomology at the University of Maryland and became a full professor in 1982. Pedro retired in 2010 and is currently an emeritus professor.

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