

A Summer in Mexico

A trip through the culture
of Mexico and the science of
CIMMYT

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The Culture of Mexico: My
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Although I've never admitted it before, I was a little disappointed when I found out that I was being sent to Mexico for my Borlaug-Ruan Internship. Although I knew CIMMYT and the work would be amazing, I thought I would be missing out on the cultural differences apparent in other countries. I believed that Mexico could never offer the same cultural experiences as distant countries such as Egypt and Ethiopia. I cannot begin to express how wrong I was. My internship in Mexico was rewarding, educational, and definitely a cultural experience. The Mexico I experienced was not the westernized, made for tourist resort city but a unique, historical, and highly individualized society that has been developing for thousands of years. Everywhere I went, I could see Aztec influences mingled with Spanish and French inspiration which, together, created a society all its own.

As soon as I boarded the plane for Mexico City from O'Hare Airport in Chicago, I realized that Mexico would not be "another America." All around me, I heard conversations and instructions in Spanish; I saw rows of people dressed in a mixture of American and Mexican clothing; and I realized that I was the only one with blonde hair on the entire plane other than one stewardess. Having had what I thought to be extensive experience with Spanish in high school with five years, I strained to understand the instructions being given by the stewardesses; however, when I was only able to grasp phrases and a few general ideas, I realized that Mexico would be a lot different from my high school Spanish classes.

The differences between classroom Spanish and societal Spanish were further evident to me on the 45 minute drive from the airport to CIMMYT with a driver who was either unable or unwilling to speak English. He gave me a running commentary on sites along the road and the songs on the radio; and while I was able to understand some of what he said, I was constantly asking him to repeat what he said or to speak more slowly. However, I am happy to report that as my time spent in Mexico increased, my comprehension of the language also increased and by the time I left, I rarely had to ask people to repeat or speak more slowly.

Upon arriving at CIMMYT, I was introduced to the head of the housing department who gave me a key to my room and helped me with my luggage. After unpacking and settling into the room, I set out downstairs to e-mail my family and Lisa Fleming to let everyone know that I had arrived safely. Upon entering the common room, nine people turned around to look at me and I was surprised to notice that none of them were from Mexico. Without delay, Khaelik from Bangladesh, introduced himself and presented me to Haydar and Anise, also from Bangladesh, Songul from Turkey,

Moke from Ethiopia, Amini and Mohammed Jafar from Iran, Patrick from Kenya, and Roma from Kazakhstan. Although I admit that it took me at least a week to get everyone's name right, these nine people quickly became part of my CIMMYT family. Shortly after, Dr. Marilyn Warburton, head of the Diversity section of the Biotechnology program in which I would be working, came in and



introduced me to Jason and Katie, two Iowa State University Interns who were also working in the Biotechnology program. Being close in age and united by a common language, Katie, Jason and I became constant companions for the duration of the summer and were able to do quite a bit of traveling together.

That night, Katie and Jason took me into Texcoco, the closest city to CIMMYT, for a traditional Mexican dinner. Both the city and the food showed me that I had a lot to learn about the new country in which I would be spending the next two months of my life. Looking at a Spanish menu composed almost entirely of foods that I had never heard of, I chose what I thought to be the safe choice of fajitas. However, when the food came, my meal was not the American version with strips of meat and peppers with flour tortillas; instead I was given maize tortillas with a mixture of onions, mushrooms, cheese, tiny chunks of meat, peppers, a sausage that I later learned was chorizo, and a cream type cheese. Although I liked the mixture, the salsa that I was given was really spicy and it took a little while to get used to the texture of maize tortillas. After that meal, I re-evaluated my expectations of the experience that I would be having over the next two months.

The next morning I met with Eleutario from the training office who would be handling paperwork, money, and travel while I was in Mexico. He gave me a brief tour of the CIMMYT campus and then took me to Dr. Warburton's office in the Applied Biotechnology Center (ABC). Dr. Warburton gave me an overview of the work done in ABC and then introduced me to Dr. Margarita Mauro with whom I would be working on my project. Described in more detail in Part 2, the project that Margarita and I would be working on was an extension of two previous projects whose goal was to develop a method and find the data to trace the genealogy of maize and its adaptation to the European climate. Over the next five weeks, we harvested plants in the greenhouse, lyophilized them, extracted the DNA, tested the DNA's quality, put the DNA through the PCR machine with many different primers, ran sequencing gels with the amplified DNA from the PCR, and finally analyzed the allelic frequencies found in the sequencing gels. Although not all of the work was done within the five weeks that I worked on the project, I was able to participate in all of the stages of the procedure.

Even with a heavy laboratory schedule, I was able to travel quite a bit both within the context of the program and on weekends with Katie and Jason. As I traveled, I realized that just as American culture differs from north to south and east to west, Mexican culture changes regionally. Over the course of the two months, I spent time in Texcoco, Mexico City, Puebla, Puerto Vallarta, Tlaltizapan, and Taxco.

Texcoco, only five minutes away from CIMMYT, became like a second home to me. Several times a week, groups of us would go to the city to eat dinner, watch a movie, or visit the market. In Texcoco, I viewed extreme poverty for the first time. Having grown up in a wealthy, suburban area, the only experiences I had previously had with poverty of any type were serving meals at a homeless shelter and although those people were destitute, it was nothing compared to what I saw in Texcoco and other parts of Mexico. Walking down the street in Texcoco usually involved stepping over the bodies

of several people sleeping on the streets, some even younger than me. Every twenty feet on the major streets, beggars sat with small plastic cups. What was really difficult to see was that most of the people on the streets had several small children with them; children without shoes and clothing that fit. Although the percentage of people that are destitute was small, the number of people living just slightly better was very high. At the public market, many of the stands were run by people who were obviously in need of money, education, and food. Walking through Texcoco on a weekday afternoon, I saw a lot of children working at family stands who ought to have been in school. This perhaps left the greatest mark on me and really made me appreciate the educational opportunities that were given to me.

The first real traveling that I did with Katie and Jason was a day trip to the zocalo in Mexico City. After about an hour and a half of bus rides and metro trips, we made it to the Zocalo, a large public square in front of the National Cathedral. We visited the SCHP Art Museum, the Parliament Chambers in the Palacio Nacional, the National Cathedral, the public market and the Templo Mayor. While the beggars were not as visible in the area of Mexico City which we visited, I was astounded time and time again by the number of people who would approach us selling some trinket or another. Every few feet, we would reply “No gracias,” to someone waving a box of candy or an armload of necklaces in front of us. Bartering was also a completely different experience. In the public market, I had just purchased a necklace for 15 pesos (approximately \$1.25) which I thought was a pretty good price but an English lady beside me told me that I probably could have gotten in for 7 pesos had I bargained. It was through her that I learned that bartering is expected in Mexican markets and although I never became completely comfortable with it, my bartering skills did improve over the course of the two months.



Our next trip was to Puebla for the weekend, a three hour bus ride away from Mexico City. Upon arriving in Puebla, I knew that this would be very different from both Texcoco and Mexico City. European influences were everywhere: from architecture to city organization; from clothing to restaurants. Although there were still beggars and people trying to sell us items, they were fewer and farther between than in Mexico City and Texcoco. Occupied by both the French and Spanish, I could tell the strong impact of the European but it was also obvious that the Mexicans took the city and made it their own.



Little hints of Mexican architecture decorated the European facades, brightly colored paint created Mexican murals on the sides of buildings, and taco stands lined the streets. Probably my favorite of the



Mexican cities, Puebla offered many cultural experiences: from mole poblano, a spicy chocolate sauce poured over chicken to the indigenous peoples' rights protest that we briefly witnessed in the Zocalo.

Contrary to the blending of European and Mexican cultures evident in Puebla, Puerto Vallarta, our next destination, offered a mix of American and Mexican cultures. Surprisingly, in Puerto Vallarta, the hamburger and pizza restaurants were more numerous and visible than taco stands and restaurants. We were hard-pressed to find an authentic Mexican restaurant when we wanted dinner. American advertisements and billboards lined the streets, English was more commonly spoken on the streets than Spanish, and fair coloring was much more common than anywhere else we'd been in Mexico. Yet, through all of this American influence, the roots were still very Mexican; public transportation was still the most common way of getting around, the pace of life was still very relaxed and laid back, and people were still very friendly and open. It disturbed me to see the number of tourists with no respect for the society, people, or land which they found themselves surrounded by. All too often I saw people throw trash out the window, become disgusted if a local didn't understand the foreign English language, or complain loudly about how much "better" things were in the United States. Although I am proud of my country and heritage, the callousness of people frustrated me.



The next time I left Texcoco, it was not with Katie and Jason but with Dr. Scott McClean and Dr. David Bergvinsen who took me to the CIMMYT subtropical station at Tlaltizapan. Warmer and more humid than the CIMMYT headquarters in El Batan, Tlaltizapan is a small station where many El Batan scientists conduct their field experiments. I was given a tour of the premises and also got to observe some entomological infestations that Dr. Bergvinsen was overseeing. It was also on this trip that I first tasted raw sugar cane. Dr. McClean, intent that I experience as much of Mexican culture as possible, stopped and bought a package of sugar cane from a woman standing on the side of the highway. He then instructed me to bite off a piece, chew until the juice was gone and then spit it out the window. Although I enjoyed the sweetness of the cane, it took a while before I was able to consider spitting out the window of a car moving at over 50 mph. I was reassured that the cane was very biodegradable and would not harm the ecosystem, although that won't be an experience to repeat any time soon.

Taxco was the next and final place on our travel itinerary. Although almost four hours away, we decided to make a one day trip to the village nestled in the mountains.



Unlike the flat and well organized Puebla, Taxco was built into a mountain and is made up of layers of narrow and uneven streets. Known for its silver mines, Taxco was a shoppers paradises with silver stores lining every street. It was fascinating because the shops almost transported one back into the times of mining with rustic décor and obvious craftsmans' pride. The small and modest zocalo was but a stage for the magnificent cathedral that is representative of the tremendous importance of the Roman

Catholic church in the lives of Mexicans. Although the National Cathedral was magnificent and the many churches of Puebla were gorgeous, the Cathedral in Taxco was, in my opinion, the most amazing. Almost as large as the National Cathedral, the Cathedral in Taxco dominated the landscape and its influence was evident in the amount of religious art and representations seen in the silver and other handicrafts of Taxco.

Given a limited period of time and available travel, I believe that I was able to experience a lot of what Mexico has to offer; although I would love to go back and visit more of the country.

Although American influences are strong in Mexico, there are many unique customs and traditions that define Mexican life. First, Mexican's place a strong emphasis on family and remaining together. College students are more likely to move in with siblings which are close in age than friends and people often live close to their childhood homes where their parents may still reside. This close family structure is also represented within the community support systems. Because family members usually remain close to home even after moving out, most small communities remain relatively unchanged in composition over time. This leads to a great importance placed on community celebrations and events. I was given the opportunity to attend a celebration in La Purificacion, a small town near CIMMYT. Although larger than many in the area, La Puri, as it is known to locals, remains tight-knight. Attending the fireworks and carnival with friends, I noticed that everyone seemed to know everyone else. Everyone always had friendly comments, questions about family members, or polite inquiries for each other; it felt like a very large family.

Community celebrations are certainly not the only kind of fiesta in Mexico. It seemed to me that Mexicans use any excuse to get together, dance, and socialize. Even at CIMMYT, we often had parties for new, returning, or leaving staff members as well as a weekly party at the Rincon. However, Mexican parties are a far cry from either the wild teenage parties or the elegant dinner parties held by adults; Mexican parties are less focused on who has the nicest clothes or the best date and simply allow people to congregate together to enjoy each other's company. To really impress people at a fiesta, one must either be a really good salsa dancer or a very open, friendly person, those seem

to be the only qualifications necessary to become the life of the party. I did manage to pick up a few salsa steps over my two months in Mexico, although I would not classify myself as a “dancer.” Fiestas are more than just an opportunity to dance and have fun, they allow people to remain close and caught up in each others’ lives.

Although American consumerism is definitely seeping into Mexican society, I found that there is a much greater emphasis on people in Mexico than on material possessions. I will forever remember the great friendships I found in Mexico and will always be grateful for the societal opportunity offered to me through those friendships.

CIMMYT, International & Project Background



CIMMYT International, a CGIAR organization, is comprised of 17 regional headquarters with its headquarters in El Batan, Mexico. As a non-profit organization, CIMMYT, el Centro Internaccional de Mejoramiento de Maize y Trigo or the International Maize and Wheat Improvement Center, conducts research with an aim of improving the quality of maize and what around the world.

“CIMMYT has a global mandate to conduct maize and wheat research to benefit developing countries. Through strong science and effective partnerships, CIMMYT creates, shares, and uses knowledge and technology to increase food security, improve the productivity and profitability of farming systems, and sustain natural resources in developing countries.” – CIMMYT Mission Statement

Maize Breeding, Wheat Breeding, Biotechnology, Economics, and Natural Resources are the five units incorporated into CIMMYT, Int. and those units execute research in several major programs: Genetic Resources, Tropical Ecosystems, Intensive Agro-Ecosystems, and Rain-fed Agro-Ecosystems.

I was fortunate enough to be placed within the Biotechnology Unit which is housed within the Applied Biotechnology Center at CIMMYT. The Biotechnology Unit was founded in 1990 with a goal to increase seed quality through the use of biotechnology. Five major divisions exist within the international Biotechnology Program although only four are currently housed in Mexico: Apomixis, Abiotic Stresses, Biotic Stresses, Diversity, and Genetic Engineering. Although I was given the opportunity to work with or learn about all five divisions, the project I undertook occurred within the Diversity program.

The Diversity program seeks to gain and utilize knowledge about the genetic variances within both maize and wheat landraces. Through studying landraces from around the globe, scientists are able to collect information to study stress resistance, genealogical developments, and breeding possibilities. By maximizing diversity, scientists can ensure the survival of a species. If every landrace of maize were identical or very similar, one new disease could wipe out the maize harvest around the world. Furthermore, when looking toward possible crosses, the best parents almost always have very different genetic make-ups.



The project on which I worked with Dr. Margarita Mauro focused on the genealogical transformations of maize, especially the transplantation of maize from the Americas to Europe. Our project is an extension of two previous projects conducted with similar goals.

Undertaken by INRA, France, the first project of this nature aimed to review the introduction of maize to Europe through RFLP analysis of 217 maize populations from the Americas and Europe. RFLP, restriction fragment length polymorphism, markers are molecular markers which can be used to determine the genetic distance between maize populations. Defined as the amount of similarity or dissimilarity between the genomes of two individuals or species, genetic distance among maize can be used to determine both the number and nature of maize introductions in Europe. In this project, researchers utilized 29 RFLP loci or markers on 30 individuals of each population, divided into two bulks of 15 individuals. The research revealed three probable introductions of maize into Europe: the initial introduction of Caribbean landraces by Columbus in Southern Spain, an introduction of North American landraces in Northern Europe, and a third introduction of South American landraces in Italy and the Mediterranean region. However, the limited number of populations and RFLP loci could not reveal exactly which landraces were introduced where and when.

Therefore, another project was undertaken at INRA, this one utilized SSR, simple sequence repeat, markers on 275 populations of maize. Although 46 SSR markers were tested on bulks of 15 from each population, only 23 were used in the relationship analysis, the others being deemed either invariable or unreliable. This study reconfirmed the results found by the previous study which not only re-enforced those findings but also established SSR markers as reliable in maize diversity studies.

In conjunction with INRA, CIMMYT is undertaking a third project to trace the genealogy of maize, not only in Europe and the Americas but also Asia and Africa, where even less is known about the evolution of landraces. The first steps of the project are to collect maize samples from around the world and to find more SSR markers which may be reliably used in diversity studies. This year researchers hope to complete more thorough analysis of maize varieties in Central and South American as well as add in some African landraces. Next year then, researchers will add more African landraces and Asian landraces. When all of this data is collected and analyzed, it will present a world wide picture of maize genetic diversity which should allow analysts to determine where landraces originated and when.

Once completed this project will not only allow scientists a clearer understanding of maize evolution but will also allow institutes and governments around the world the ability to increase the variances in their crops. For example, if a specific African landrace originated in Peru, farmers in that area are likely to find another suitable landrace in the same area, rather than trying to import on from North America. The potential benefits are tremendous if the information is properly used.

Furthering the ability to analyze maize through the verification of SSR, simple sequence repeat, markers.

Lindsey Negaard, completed with Dr. Margarita Mauro and Dr. Marilyn Warburton at CIMMYT, Int. headquarters in El Batan, Mexico; Summer 2004

Introduction

Worldwide, 600 million tons of maize were consumed in 2003; maize is the staple food in more than 20 countries and represents more than half of the average daily caloric intake in three countries. More than 170 million people depend upon the production for their livelihoods and over 130 million of those live in Sub-Saharan Africa. As the most widely grown cereal crop, maize plays a vital role in global food security and therefore, as knowledge about maize and the maize genome increases, so will scientists ability to increase global food security through maize.

One of the important characteristics of maize is the great genetic diversity available and to preserve that diversity is an important mission of scientists worldwide. Maize diversity allows for selective breeding, the development of hybrids resistant to specific stresses, as well as the development of landraces for almost any climatic condition. Better knowledge about maize genetic diversity is key to improving global food security through maize.

Abstract

Through the analysis of allelic frequencies of individuals and bulks, the suitability of specific SSR makers for maize diversity studies may be determined. If more SSR makers are found which may be reliably used in the analysis of maize populations, worldwide understanding about maize and its genome will increase therefore allowing for an increase in food security in many developing nations.

Materials and Methods

When completing a genetic diversity project, a researcher must have some way of determining genetic variance between landraces of a given species, such as maize. The most current and accurate method is the use of SSR, single sequence repeat, markers coupled with PCRs, polymerase chain reactions. Through the use of two primers, a forward and reverse, taq polymerase, nucleotides, target genomic DNA, and a set temperature cycle, PCR thermocyclers target specific SSR markers, repetitive sequences of base pairs within the genome.



In order to determine the reliability of maize SSR markers in diversity studies, two sample populations of 15 individuals, bulks of the 15 individuals as well as a collection of multiple populations were tested with 59 primers representing 59 SSR markers.

The first step of this process involved gathering samples of the populations and extracting the DNA. Once the DNA was extracted, a dilution of 10 nanograms/microliter was created which would be acceptable for the next steps.

After a DNA dilution was created, the populations were allocated into trays for PCRs. The PCR Thermocycler amplified the SSRs designated by the primers, the amplified DNA is then put into a Sequencing machine which uses a pre-determined and pre-measured standard to determine the base-pair band sizes of the amplified DNA. The sequencing machine then transmits the information to a computer where the Genescan program analyzes the data.



We were then able to use the analyzed data to determine the consistency of allelic frequencies between the individuals and the bulks. If the allelic frequencies were consistent then the SSR marker may be used for the genetic diversity study, however inconsistent markers were discarded. Of the markers tested, almost half were found acceptable for use in diversity studies, although some required certain manual corrections.

Conclusion

Of the 59 SSR markers analyzed, 12 were found to be sufficiently accurate to be used in diversity studies and an additional 18 were acceptable after certain corrections are made. These 30 SSR markers will be used in addition to the reliable SSR markers from the previous study in order to expand the diversity study to Asia and Africa as well as incorporating more landraces of Central and South America. Within the next several years, researchers at CIMMYT, headed by Dr. Marilyn Warburton, hope to have a comprehensive study of maize diversity across the globe.