Mexican Mycophilia: IWEMM9

By David Pilz and Jesús Pérez-Moreno

David Pilz is a consulting Forest Mycologist, P.O. Box 876, Corvallis, Oregon 97339, USA. Dr. Jesús Pérez-Moreno is a Mycology Professor and Researcher at the Colegio de Postgraduados, Departamento de Edafología, Km 36.5 Carr., México-Texcoco, CP 56230, México. David may be emailed at contact@pilzwald.com and Jesús may be emailed at jperezm@colpos.mx. All photos by David Pilz except where otherwise noted.

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Abstract: This article portrays the 9th International Workshop on Edible Mycorrhizal Mushrooms in México and the subsequent field trip. It is written from the perspective of a participant (lead author) and enhanced by the expertise of the organizer (co-author). Cultural, social, and tourism aspects of the events are emphasized, but citations provide additional information about the scientific program.

About IWEMMs

Steadfast readers of FUNGI Magazine might recall a previous article "Mayan Mycology in the Land of the Jaguars," about the 7th International Workshop on Edible Mycorrhizal Mushrooms (IWEMM7) that was held in La Antigua, Guatemala, July 30-August 3, 2013 and organized by mycologist Dr. Roberto Flores (Pilz et al., 2015). Perusing the beginning of that article will remind the reader about the focus, history and locations of the previous IWEMMs. Since then, there have been two more workshops.

The 8th IWEMM took place October 10-17, 2016 in Cahors, France and was organized by truffle specialist Pierre Sourzat. Information about that workshop and an abstract book of the scientific presentations are available online (Sourzat, 2016).

This article portrays the 9th IWEMM (https://iwemm9web.wixsite.com/mexico), which took place among some of the remarkably mycophilic cultures of Mesoamerica. It was held July 10-14, 2017 on the Montecillo Campus of the Colegio de Postgraduados in Texcoco, México (southeast of México City) and was followed by a Post-Meeting Field Trip, July 15-22. The co-author of this article, Jesús Pérez-Moreno, was the organizer of the workshop.

If you are sufficiently intrigued by IWEMMs to attend the next one, you will be in for a treat. The IWEMM10 is scheduled for October 20-23, 2019 in Suwa City, Nagano Prefecture, Japan, *in the heart of matsutake country*. The workshop is being organized by Dr. Takashi Yamanaka (Forestry and Forest Products Research Institute) and Dr. Akiyoshi Yamada, (Shinshu University). Both are preeminent matsutake researchers. As with all IWEMMs, an International Scientific Committee will help select the oral presentations and assist with publication of proceedings, abstracts, articles or books. For more information, check the IWEMM10 website periodically as information is added (https://iwemm10-nagano.com).

▲ Figure 1. Workshop logo by Mexican artist Dr. Cruz García-Albarado, aka Cruzgaali.

▶ Figure 2. Life-sized painting by Miguel Nava of a native morel harvester.

IWEMM Family Values

"Edible mycorrhizal mushrooms" might seem like a narrow research focus for an international workshop, but actually it overlaps with many areas of research, often resulting in interdisciplinary studies. Some of these broader topics are listed in Table 1.

As a result, many of the attendees at IWEMMs have cooperated not only with colleagues from around the world, but often with specialists and volunteers from entirely different disciplines. Through repeated participation in these workshops, a real sense of "family" has developed over the years among many of the attendees. And this family's values are laudatory: quality science, broad collaboration, diverse perspectives, and a desire to make the world a better place for both humans and nature. The theme of this IWEMM, "Mushrooms, Humans, and Nature in a Changing World," was derived from these values.

The workshop logo (Figure 1) illustrates this theme. Created by Mexican artist Dr. Cruz García-Albarado (aka Cruzgaali), the logo portrays several key elements. The two mushrooms are based on illustrations in the ancient Oaxacan Mixtec codex Yuta Tnoho. The tree was adapted from a drawing from the Aztec codex Mendoza from Central México and the human figure was inspired by 6,000-year-old cave painting in the state of Guerrero. The icons that look like a reversed question marks near the human's head and above an indentation in the trunk of the tree are a glyph for "the spoken word." The spiral background represents the dynamic interrelatedness of these elements.

México is a land of numerous indigenous mycophilic cultures that have used mushrooms for food and rituals for a long time, likely many millennia. Archaeological evidence, linguistic studies, pre-Hispanic codices and colonial writings provide multiple lines of evidence that there was extensive knowledge and use of mushrooms when the Spanish arrived. For instance, over 5,500 common names for mushrooms have been documented in various native languages of México. More than 450 species of wild edible mushrooms are still consumed, of which more than half are sold in markets (Pérez-Moreno and Guerin-Laguette, 2017).

Signifying the importance of wild edible mushrooms to rural communities in México, was a full-sized painting of a morel harvester presented to the workshop by artist Miguel Nava during the opening ceremonies (Figure 2). Also, during the opening ceremonies, a thirteen-minute video produced by Mexican film maker Jaime Kuri explored the theme of the workshop (Kuri, 2017). A subsequent online, four-minute video gives viewers an immersive feel for how colorful the workshop was (Leon, 2017).

Over 350 workshop participants from the Americas, Europe, Africa, the Middle East, Australasia, and Asia presented 122 research topics in 28 oral presentations and 94 posters. The oral presentations began with a distinguished keynote speaker Sir David Read, Emeritus Professor at the University of Sheffield, UK. Not only is he a giant among mycologists (co-author of the textbook "Mycorrhizal Symbiosis"), but he has a wonderfully witty and sharp sense of humour (British spelling intended). In his opening presentation, he calculated that if all the ectomycorrhizal hyphal threads in all the mycelia that existed on planet Earth each year were stretched out end-to-end, that they would reach across the diameter of the Milky Way galaxy!

The scientific presentations were divided into six sessions entitled: 1-Diversity, Taxonomy and Ecology, 2-Sustainability, Traditional Knowledge, Conservation and Economic importance, 3-Food Science and

Figure 3. Group photo of international attendees celebrating cultural diversity by dressing in traditional attire from their homelands. Photo by Lucila Aragón Carrillo.

Figure 4. Children painting mushroom statuettes.

Health and Biocultural importance, 4&5-Cultivation, and 6-Climate Change, Molecular Biology and Genomic Sciences. Readers who are interested in further exploring the abstracts of the scientific presentations and posters are invited to download the proceedings (Pérez-Moreno and Guerin-Laguette, 2017). To date, eleven workshop papers have been published in two scientific journals (*Revista Fitotecnia Mexicana* 2017, *Scientia Fungorum* 2017). Eight of the articles are in English and all can be freely downloaded. A book is also in the works and will likely be published in 2019. Written by IWEMM participants and a few colleagues who could not attend, it contains sixteen chapters reflecting topics such as diversity, biogeography, biotechnology and climate change. Contact the co-author, Jesús Pérez-Moreno, for updated information about this forthcoming book.

Providing social interludes to the numerous talks and posters, the organizers arranged a memorable evening at the world-famous Ballet Folklórico de México at the Palacio de Bellas Artes in downtown México City. Costumed performers dramatically recapitulated the history of México in music, dance and song. On Thursday, attendees also had the opportunity to hunt for mushrooms in nearby forests or visit the ancient city of Teotihuacán.

The capstone to the workshop on Friday was the "Bio-Cultural Fair." It was a celebration of the diversity of mushrooms, as well as the people who love them. Harvesters from twelve indigenous Mexican cultures brought fresh mushrooms they had collected. These were exhibited in basketry of their ethnic group. They also exhibited and sold a rich array of their traditional mushroom handicrafts. Likewise, the workshop attendees were themselves encouraged to dress in the traditional attire of their homelands, resulting in a group photo of cultural inclusion (Figure 3). Activities included a presentation of Mexican Charros (horse-riding demonstration), dancers in Aztec costumes, freshly cooked tortillas filled with huitlacoche (the edible corn smut fungus, *Ustilago maydis*), a presentation about inoculating corn to cultivate huitlachoche and various children's activities (Figure 4).

Perhaps the most impressive part of the Bio-Cultural Fair was the display of high-resolution facsimiles of mushroom imagery found in parts of several extant pre-Hispanic codices. These included the Mayan Madrid and Dresden codices, as well as the Mixtec Tonindeye and Yuta Tnoho codices. Many such codices have gone through repeated name changes. The names used here for the Mixtec codices are recent suggestions based on the native language, rather than who possessed the codices after the Spanish conquest (Jansen and Jiménez, 2004). The Yuta Tnoho codex depicts the "first dawn" or "the creation of the world" (Hernández-Santiago et al., 2017) and its association with entheogenic mushrooms. Figure 5 shows representative illustrations from the facsimiles on display. One of the species that might have been depicted in these codices is shown in Figure 6. Ethnic communities including the Mazatecs, Chinantecs, Zapotecs, and Nahua groups still use *Psilocybe* mushrooms ritually.

One last note on the workshop itself. Many of the individuals helping with the events were mycology students. Their posters presented mycological studies from various regions of the country. Pursuit of this scientific discipline is flourishing in México. Indeed, during the closing ceremonies of the workshop, awards were presented to four bilingual students from native ethnic groups. During his 30-year career, Dr. Jesús Pérez-Moreno has trained more than

Figure 5. Left – A character holding entheogenic mushrooms on the first dawn (creation of the world). Right – Another figure holding mushrooms shaped more like those shown in Figure 6. Both figures appeared on folio 24 of the Mixtec codex Yuta Tnoho from Oaxaca.

Figure 6. Fresh display specimens of *Psilocybe zapotecorum* mushrooms.

Figure 7. Doug Olson looks on as Monserrat Pérez-Arteaga learns about "mushrumps," (telltale bulges on the forest floor caused by emerging mushrooms).

50 mycologists. They are currently working throughout México, studying native fungal diversity and its ecological significance, the cultural and economic importance of wild mushrooms, effective technologies for inoculating native trees with edible ectomycorrhizal mushrooms and the usefulness of these techniques for improving reforestation. Some of these former students actively participated in the organization of the IWEMM9, including: Dra. Magdalena Martínez-Reyes, Dr. Faustino Hernández Santiago, Dra. Jazmín Cortes-Sarabia, MSc José Luis Barragán Soriano, MSc

Figure 11. Intricate mushroom artwork traced on the bottom of a *Ganoderma* conk; on display at the annual forest mushroom fair in Cuajimoloyas.

Figure 8. Aztec "Crying baby" musical instrument.

Ana Carolina Guerrero-Chávez and MSc Sigrid Cázares-Esquivel.

Field Trip

Fifty people participated in the eight-day post-workshop field trip, filling a modern bus. With the exception of a visit to Oaxaca for the last two days, most of the places and peoples visited were located in the central highlands to the east and southeast of México City in the states of México, Morelos, Tlaxcala and Veracruz.

On Saturday, the group visited the Tlahuica people, who distinguish and consume more than 160 species of edible wild mushrooms found in central México. They live near the Lagunas de Zempoala National Park, which is renowned for its seven

Figure 9. Olmec statuette.

pristine lagoons surrounded by scenic forest of oaks, cedars, pines and fir. Local leaders greeted the group with a welcoming ceremony that included placing beautiful necklaces of fresh mushrooms and flowers on our necks; an ancient welcoming ceremony among Tlahuica people. After a mushroom hike with the locals, we savored their myco-gastronomy and enjoyed a fresh mushroom exhibition of local species. To wrap up the visit, we joined the Tlahuica people in dancing to both their ancient

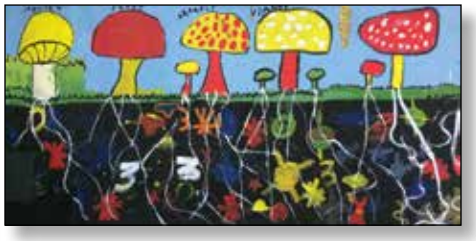

Figure 10. Mushroom artwork, by Cuajimoloyas children, that includes depiction of fungal hyphae.

and more-modern traditional music.

On Sunday, the group visited the village of Nanacamilpa, which is named after the Aztec word for mushroom, "nanacatl." The local police were quite bemused watching our group photographing the town logo of a mushroom on their department vehicles. Afterwards, we visited the Nahuatl community forest of Piedra Canteada. In order to sustainably use their community forest, they organized a nature park with miles of hiking paths and built an eco-hotel, restaurant, and campground. In our honor, they were hosting their "First International Forest Mushroom Fair." During the day we forayed for mushrooms in their *Abies*, *Quercus* and *Arbutus* forest (Figure 7).

Later, at mushroom display tables

Figure 12. Fresh (*Amanita jacksonii*) and dried (a mix of *Amanita jacksonii* and *A. basii*) "Caesar´s" mushrooms for sale in the Cuajimoloyas market.

Table 1. Edible Mycorrhizal Mushroom Research Topics

Taxonomy & distribution	Symbioses	Forest management	Economic importance	Climate change
Evolution	Genomics	Habitats and productivity	Cultural importance	Conservation
Ecology	Biotechnology	Harvest management	Traditional knowledge	Sustainability
Biodiversity	Bioactive compounds	Cultivation	Land tenure	Food security and health

Examples of how the topic of "Edible Mycorrhizal Mushrooms" encompasses many related avenues for interdisciplinary research.

(filled with specimens by the park rangers), Benjamin Valdés, an expert on pre-Hispanic musical instruments, demonstrated several replicas. One was similar to the Australian didgeridoo, but the most amazing one was the crying baby instrument (Figure 8). It is filled with water, and when tipped forward and back repeatedly, it leaks tears out of the eyes while creating a "crying" sound.

Large vats of fresh pulque were available for sampling during dinner. Afterwards came the highlight of our visit and what makes this park world-famous: its designation as the Santuario de las Luciérnagas, or the Sanctuary of the Fireflies (Vance et al., 2017). These forest fireflies are a locally endemic species, that was only recently recognized and named *Macrolampis palaciosi* S. Zaragoza-Caballero. As dusk descended, we were led up a steep, rutted, slippery logging road into the midst of a dense forest. We were instructed to use no flashlights and to be utterly quiet (which was probably not necessary, but it lent to the awe). As the forest darkened, we witnessed an amazingly dense display of firefly mate-seeking. Apparently, México is not a very litigious society because we were instructed to walk back in the pitch dark (except for the fireflies), in a long line, holding hands. There were no mishaps.

On Monday, we started the day by visiting the huge Mayan archeological site of Cacaxtla where thousand-year-old, original-paint color murals have been excavated. Later in the day, we visited the Biodiversity Laboratory of the Center for the Investigation of Biological Sciences at the Autonomous University of Tlaxcala where Dra. Adriana Montoya is heading up a program focused on Ethnomycological Studies. While there, indigenous Náhuatl cooks treated us to a sumptuous feast of locally collected and prepared edible mushrooms, including *Amanita jacksonii* and *A. basii*, the Mesoamerican equivalents of the European *A. caesarea* mushroom.

On Tuesday we visited the Institute of Ecology (INECOL) in Xalapa in the cloud forests of the state of Veracruz. We were hosted by Dr. Gerardo Mata Montes de Oca, a specialist in mushroom cultivation and by Dr. Francisco Gerardo Loera Hernández a plant taxonomist. The Institute has an herbarium with 47,000 fungal specimens, including 84 type specimens of *Psilocybe* species and varieties (Instituto de Ecologia, 2018). Late in the day, we visited the Museum of Anthropology in Xalapa, which specializes in the Olmec culture and displays the giant carved-stone Olmec heads. On a lighter note, it is one of the few places in Mesoamerica where the lead author has seen statues or figurines that were not related to powerful elites or militarism (Figure 9).

On Wednesday, on the way to Oaxaca, we visited an *Agaricus* mushroom farm, Hongos Rioxal, in Las Vigas de Ramírez, Veracruz. Later we passed by the spectacular volcanic peaks of Pico de Orizaba [a.k.a. Citlaltépetl from Nahuatl citlal(in)=star, and tepētl=mountain] and the adjacent Sierra Negra. Towering 18,491 feet above sea level, Citlaltépetl is the third highest mountain in North America and globally second only to Mount Kilimanjaro in height above the surrounding topography (termed, prominence).

On Thursday, we visited the famous 2,000-year-old Tule tree. It is the largest Montezuma cypress (*Taxodium mucronatum*) in the world. Although only approximately 130 feet tall, its immense trunk is heavily buttressed. If the trunk is measured along the convoluted folds of its surface, it has a greater circumference than any other tree in the world (although not the greatest diameter). Three kids were our niños guías (little guides) and they pointed out how various parts of the trunk resembled body parts. At one point, I heard them refer to "Monica Lewinski's legs."

Afterwards, we wound our way up the surrounding Sierra Norte to the 10,000-foot-elevation Zapotec ecotourism village of San Antonio Cuajimoloyas. We missed their 17th Regional Forest Mushroom Fair by only one week, but parts of the event lingered for us. Costumed greeters welcomed us in the main display hall with a copal incense ceremony. The walls of the hall were painted by local children with mushroom designs, including ones depicting fungal hyphae (Figure 10). Included in the display was

a very detailed sketch on a *Ganoderma* conk (although *Amanita* was amusingly misspelled "*Amalita*," Figure 11).

Several booths in the town center were still selling fresh *Amanita jacksonii*, although the dried specimens, that were labeled "Amanita Caesarea," were likely a mix of *Amanita jacksonii* and *A. basii* (Figure 12). Later, the Zapotec community was gracious enough to allow our group to foray for an hour in their community forest. After our foray, local cooks served us a variety of dishes prepared with their local mushrooms.

By Friday, some of the field trip participants simply wanted to spend some time in Oaxaca city. Indeed, we were in-between the two Mondays of the celebration of the world famous Guelaguetza Festival. This regional Oaxacan festival dates back to pre-Hispanic times and includes a host of local indigenous groups converging to celebrate their cultural richness and ethnic diversity. The city was, therefore, alive with parades and celebrations, and the famous city Zócalo (town center) was bustling with activity.

Other field trip participants visited the pre-Hispanic site of Monte Albán on a ridge, six miles west of Oaxaca City. One of the longest continuous urban centers in Mesoamerica, it was a center of trade and culture for over a thousand years starting around 500 BCE.

Another highlight shared by a few participants was a visit to the Oaxaca Museum of Philately (Museo de Filatelia de Oaxaca, 2018). It has an extensive mushroom stamp collection under the category "Flores que no son flores" (Flowers that are not flowers). The entire collection was donated by the preeminent Mexican mycologist, Dra. Evangelina Perez-Silva (Figure 13). It consists of more than 400 mushroom stamps from 44 countries. The catalogue of this collection is available as a PDF file from the lead author.

During Dra. Perez-Silva's ongoing 50-year career at the National Autonomous University of México, she has focused on the taxonomy, ecology, edibility, and toxicity of mushrooms. She has published over 100 scientific papers, given hundreds of lectures, mentored and inspired many aspiring mycologists, investigated traditional and gourmet mushroom cuisines, wrote mushroom recipe books, and focused on rescuing traditional knowledge about the importance of edible wild mushrooms in México. In 1965, along with Gastón Guzmán, she co-founded the Mexican Mycological Society, which is now called the Mexican Association for the Study of Fungi A.C (https://www.facebook.com/SociedadMexicanadeMicologia/).

Reflective of Mexico's mycophilic culture, in 1985 the postal service issued a collection of mushroom stamps illustrating 50 different species and noted which ones were poisonous (Moore, 2018). The stamps in the collection that Dra. Perez-Silva donated also included rare *Psilocybe* stamps. Interestingly, four of these are from the African nation of Benin, and one from Argentina (Figure 14).

Although México has not released any *Psilocybe* stamps per se, in 2004 the country released a María Sabina commemorative stamp honoring the 110th anniversary of her birth (Figure 15). She was the Mazatec curandera (native healer) from the town of Huautla de Jimenez, Oaxaca whose psilocybin mushroom ceremony was popularized in the article "Seeking the Magic Mushroom," by Robert Gordon Wasson in the May 13, 1957 issue of *Life* magazine. Thus, the modern world was introduced to the surviving entheogenic mushroom rituals of some of the indigenous cultures of México.

Figure 13. Renowned Mexican mycologist, Dra. Evangelina Perez-Silva attending the IWEMM9, which was organized by her former student, Dr. Jesús Pérez-Moreno. She is wearing a huipil (native dress) of the Tehuana women of her native Oaxaca.

For readers interested in pursuing this topic further, on a shelf of a book store in Oaxaca, there was a special issue of the journal *Arqueologia Mexicana* entirely dedicated to the topic of the "Hallucinogens of Pre-Hispanic México" (*Arqueologia Mexicana*, 2003). Although the articles are in Spanish, they are all translated into English in the final pages.

On Saturday, the long but very scenic drive back to México City from Oaxaca allowed time for reflection on the numerous impressions the

Figure 14. *Psilocybe* stamps in the Oaxaca Museum of Philately.

Figure 15. María Sabina commemorative stamp in the Oaxaca Museum of Philately.

group had assimilated from visiting the mycological side of México. The landscape, ecosystems, mycota, and human cultures of México are all incredibly diverse. These aspects of diversity interact as an integrated whole, very much like the workshop logo depicts. Visit yourself and share in the rich tapestry of Mexican mycophilia!

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