

Cochineal – Under the Microscope

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On recent ranch trips over the last couple of months to El Mesteño Ranch and Arboretum, I began noticing what seemed to me to be an extremely large amount of cochineal (*Dactylopius coccus*) on the prickly pear cacti (*Opuntia engelmannii* var. *linderheimeri*)---significantly more than I had noted in previous years. Here in deep South Texas, we commonly refer to prickly pear cacti by its Spanish name “nopal.” As a steward of this property, I have established the routine and habit of what I call “vigilant observation.” On each visit, I make it a top priority to skim and scan fence lines, look for anything blooming, measure and record precipitation, look for tracks and other sign, and so forth, on this small patch of endangered Tamaulipan thornscrub.

What makes this year more unusual, as far as my memory can recollect, is that this year the amount of this scale insect seems to have more than doubled from previous years. This got me to thinking. Why is this happening? Despite a few citizen scientist theories I have put together to try to better understand (and possibly explain) the cochineal explosion, I really do not have any answers---only more questions. Nevertheless, I now have plenty of scale insects available to be harvested to afford me the opportunity to pick up with a natural dyeing experiment using cochineal that I put on hold about a year and a half ago.

As I reflect on the cochineal phenomenon of recent days, two thoughts come to mind. The first thought is that this is the year that I am going to try my natural dye experiment with cochineal. I formally began this experiment about three years ago. However, I put my experiment on hold, because the numbers of cochineal insects at El Mesteño Ranch and Arboretum, based on my random, walking surveys at that time, were notably low. Therefore, instead of harvesting cochineal at El Mesteño Ranch and Arboretum, I chose a different approach to collecting cochineal. I decided to grow my own. Subsequently, I created a small “nopalry,” which is the term used to describe a farm that produces cochineal, in my backyard to try and raise enough cochineal for my natural dye experiment.



Nopalry in author's backyard circa 2020

My second thought on the current cochineal explosion is one of genuine concern for the status of the prickly pear population, including all the wildlife that it supports, at El Mesteño Ranch and Arboretum. After just a month or so of heavy cochineal infestation, I have observed that the cacti seem to wither up and die under the effects of a heavy cochineal infestation. This is

disconcerting to me as numerous animal inhabitants of this little ranch on the South Texas Sand Sheet utilize prickly pear cacti and tunas as part of their diet throughout the late summer months.

Some of the animals that rely on prickly pear include the Texas tortoise, javelina, and coyote, just to name a few. While other animal residents, such as rodents, snakes, and some birds choose the cover and protection of prickly pear glochids and spines as the perfect spot to hide or build their nests. Oh, and then there is the prickly pear jelly that I enjoy making and sharing, but I digress.

Initially, I did not notice the cochineal explosion. In fact, it took me a few weeks to realize that I was not just dreaming up a seemingly significant increase in the scale insects. I decided to collect observational data regarding how many prickly pear cacti were under a heavy infestation. I implemented walking surveys of the property to collect and record observational data on the cochineal in my nature journal. I paid particular attention to the number of prickly pear pads that seemed to be covered entirely by the white, fluffy substance. This white substance is secreted by the tiny cochineal nymphs to protect them from water loss and the sun. I also divided up the property into quadrants and took note of the areas with heavy cochineal infestation.

It did not take but just a handful of purposeful strolls around the property, over the course of a few visits, to be able to gather enough observational data to show that the cochineal infestation was growing. In fact, I began to see areas go from just a single prickly pear cactus with several pads covered with cochineal white fluff to exceptionally large patches of three or more cacti with numerous pads on each one entirely covered. The cochineal insects were spreading at an alarming rate---right before my very eyes.

Frankly, in the beginning of this cochineal explosion, I saw the demise of a few prickly pear cacti



as a blessing. Why would I think this? Well, most of the invasive grasses I battle with my shovel and hoe happen to be smack dab in the center of huge groups of stickery, thorny, unforgiving prickly pear patches. Consequently, I thought that if a few of these patches died back, it would help me get in closer to combat the invasive grasses that compete with our natives for prime real estate and moisture.

Wilted prickly pear cactus covered with white fluff of cochineal insect

After a few months of monitoring this heavy infestation, I also observed what appear to be end stages of the effects of the cochineal infestation on the cacti. In the beginning, the prickly pear pads appear green, plump with moisture and sporting just a few patches of cochineal white fluff in the glochids that occur on the surface of the pad. Over time, the amount of white fluff will begin to increase. Many of the green pads, most recently, are currently solid white with cochineal

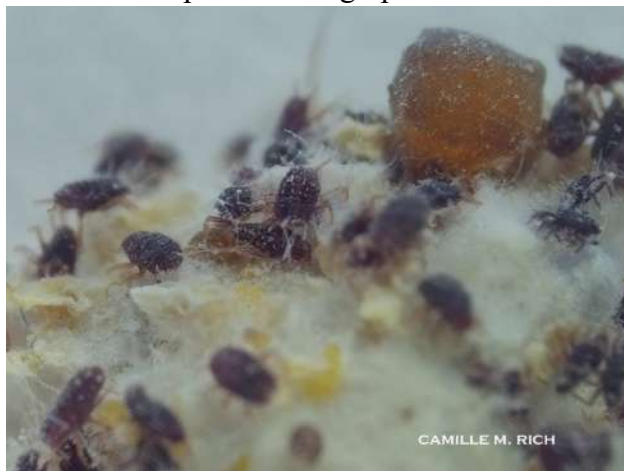
fluff ---giving them the overall appearance of huge, Texas-size cotton balls. Prickly pear pads that have been under heavy cochineal infestation for some time will begin to turn shades of pale yellow or pale green---most assuredly on their way to turning brown, completely drying out, and withering away.

After a few weeks under heavy infestation, I am also observing a simultaneous weakening of the central base structure of the affected prickly pear cacti. The afflicted cacti will look as though they are wilting and begin to droop over. Once they have seemingly wilted, it becomes difficult for them to bear the weight of their pads. Additionally, I have begun to observe a pattern in the end stage whereby almost as soon as I notice an individual's pads have begun to fall off, it seems to be only a matter of a few more days until the whole cactus is dead and lying on the ground.

From what I can distinguish, this wilting stage appears to most likely be the final, end stage before an individual cactus ends up on the ground---nothing more than a heap of pale yellow or pale green pads covered in cochineal. Once the cacti hit the red, sandy soil, there they will remain and continue the process of desiccation---drying up and withering away until they are nothing more than mere brown, crispy pads resembling Texas-size tortilla chips. It is quite incredible that such a small insect could wreak large-scale havoc on hardy, well-armored flora.

Are you the slightest bit curious about what this scale insect looks like?

Here are a couple of micrographs of cochineal insects I took with my microscope for you.



Microscopic view of the cochineal insect



Size comparison of cochineal on a dime

A few exciting, fun facts about cochineal for your review and consideration:

- The cochineal insect has been used for centuries to produce a beautiful red pigment.
- Historically speaking, the regions of Puebla, Tlaxcala, and Oaxaca, Mexico, had systems for breeding of cochineal and engineering ways to breed them for maximum red pigmentation in the dyes they yielded.
- The Mayans and Aztecs used the cochineal pigment in rituals and for trade; red was symbolic of the gods, sun and blood.
- Farms where cochineal insects and their host cacti are cultivated together are called "Nopalries."

- This bright red pigment has been used in many works of art, including “The Bedroom” by Vincent van Gogh.
- The red pigment became an international symbol for power in Europe, and the secret of its origin was carefully guarded by Spain.
- This highly sought after pigment was used in uniforms for the English---hence, the resulting term: English “Redcoats.”
- This intense, red pigment became a symbol of authority and was utilized in the robes worn by Roman Catholic clergy.
- The red pigment, which is carminic acid, is the product of a substance that the female cochineal uses to protect her eggs from predators.
- In South Africa, some cochineal species have been used as a means of biocontrol for invasive cacti species.
- Some insects are natural enemies of the cochineal including lady bugs, ants, parasitic wasps, and lacewings, just to name a few.
- Some rodents (especially rats), birds, and reptiles also feast on cochineal.
- It takes approximately 70,000 insects to make one pound of cochineal.
- Colors that cochineal can produce include scarlet, crimson, and orange.
- In more recent times, cochineal has been replaced by synthetic dyes.
- Nevertheless, cochineal continues to be used in cosmetics and beverages.



Cochineal insects on top of a newly minted dime