

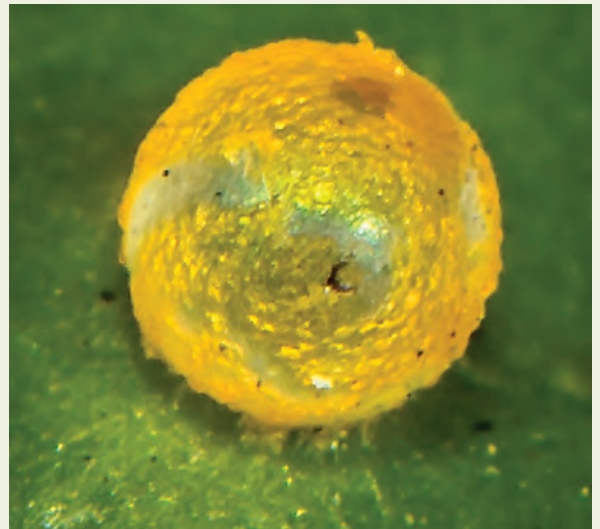


Florida Szechuan Pepper: A Financial Opportunity

By Francis E. “Jack” Putz and Nidhi Patel, University of Florida

Now that we’ve decided to call off the planned IPO and forego the profits from commercializing our discovery of a Floridian source of Szechuan pepper, we’re ready to describe an incredible opportunity for farmers in the South to cash in on a native plant while reducing America’s trade imbalance with China. The source is *Zanthoxylum clava-herculis*, locally known as Hercules club, prickly ash, tickle-tongue, and toothache tree, a native American species with untapped commercial potential. Our research revealed that capsule valves from the fruits of this familiar hedgerow species provide a suitable substitute for Szechuan pepper imported from China and sold in this country for \$9.99 per ounce. With the citrus industry crippled by Huanglongbing disease (i.e., citrus greening), Florida Szechuan Pepper might be just the ticket for farmers seeking financial solvency. We decided against cashing in on our discovery when we confronted the bureaucratic complications of patent registry and profit-sharing with our university as well as creeping suspicions about various nefarious political shenanigans related to this wonder-crop.





Far left: *Zanthoxylum clava-herculis* – photos by Shirley Denton.

This page: *Zanthoxylum clava-herculis* spines – photos by Shirley Denton. Giant Swallowtail Butterfly and Giant Swallowtail Butterfly egg – photos by John Lampkin. Larva of the Giant Swallowtail on *Zanthoxylum clava-herculis* – photo by Marc Minno.

Jack's interest in the genus *Zanthoxylum* dates back to when he discovered that vine infestations were significantly less likely on species of trees with trunks armed with spines, prickles, or thorns than on otherwise similar trees with spineless bark; *Z. panamensis* was one of those armed and vine-free species. Spinescence is often considered a legacy of the need for defense against browsing by big beasts such as the ground sloths and mastodons that were common before the mega-faunal extinction at the dawn of the Homogeocene, but his data suggested an alternative to the "Anachronistic Armaments" hypothesis. Diligent young scientist that he was, rather than risk making an incorrect inference of a process from a pattern, he set about to test his idea experimentally.

To test the hypothesis that vines that twine (predominantly counterclockwise) around armed tree trunks are sawn off when the trees sway in the breeze, he planted a fast-growing vine that twines (*Dioclea megacarpa*) at the bases of fifty *Zanthoxylum* saplings and fifty smooth-trunked saplings. Saplings of both sorts were common around the complex of laboratory and residence buildings on Barro Colorado Island (BCI) in the Canal Zone (now Panama) where he then resided. Once the vines ascended the saplings, he commenced the experimental treatment, which involved daily sessions of sapling swaying to mimic the effects of wind.

Jack was quickly bored by sapling swaying so he automated the process by tying saplings to nearby doorknobs so that when the doors opened and closed, the saplings were jostled. The experimental design involved some path crossing with strings and the laboratory complex did appear just a bit like a giant spider web, but automation worked perfectly. The treatments were terminated somewhat prematurely in response to vociferous complaints from other BCI residents about having to step over the taught strings.

After each vine-twined sapling was jostled back and forth hundreds of times, not a single vine stem was damaged. That counter-intuitive finding still perplexes Jack 40 years later, but he is convinced that something was askew with the experimental design and remains convinced about the brilliance of this natural history insight.

While vine sawing still seems like one of their roles, trunk spine/prickle/thorn multi-functionality is suggested by their increased densities and sizes on resprouted trees, which support the anti-herbivore defense hypothesis. Be that as it may, spines provide no defense against leaf miners and the caterpillars of the glorious giant swallowtail butterfly (*Papilio cresphontes*). Similarly, the white-tailed deer that nibble the young leaves are not spine-deterred. Fortunately (or not), given recent advances in molecular genetics, it should soon be possible to test the effects of toothache tree prickles on formerly extinct mammoths, glyptodonts, and shovel-tusked gomphotheres.

Our discovery of the commercial potential of capsule valves of our own *Zanthoxylum* started when Nidhi, then a dental school-bound undergraduate, inquired about research opportunities in Jack's lab. From his list of potential projects,



Above: *Zanthoxylum clava-herculis* – photo by Shirley Denton.

she selected a sketchily described one about toothache tree, little suspecting where that selection would lead.

Nidhi's dive into the literature soon revealed that fruit capsule valves from various species of *Zanthoxylum* are used as a spice in countries spanning the globe. Szechuan pepper from the Chinese species *Z. simulans* (or *Z. fagara*, *Z. piperitum*, or *Z. bungeanum*) is the best known commercially, but other species contribute to the cuisines of Nepal and Tibet (*Z. alatum*), India (*Z. rhetsa*), Korea (*Z. schinifolium*), Japan (*Z. piperitum* 'sansho'), and Indonesia (*Z. acanthopodium*). *Zanthoxylum* capsules are also reportedly employed by cooks in Africa, and one Mexican chef reported that in addition to the pungent flavor, she appreciates that mouth-numbing enhances the taste of chilies and other spices.

Zanthoxylum bark, leaves, and fruit capsules pack a one-two punch of flavor and tongue-numbing. As a member of the Rutaceae, the family that includes oranges, grapefruits, and kumquats, the citrusy flavors of limonene, citronellal, methyl cinnamate, and cineol are expected, but the numbing property is unique to the genus. That anesthetic response is due to alkamides derived from polyunsaturated carboxylic acids, most likely tetradecapentaenoic acid with isobutylamin, also known as hydroxy sanshool. Sanshool apparently acts like some other anesthetics by activating sensory neurons and inhibiting background potassium conductance.

The defining encounter of the collaboration between junior student and senior professor occurred a fortnight after Nidhi started her on-line research. The two met in person for the first time when they sat across from each other in Jack's lab; between them on the table was a bowl of freshly collected *Zanthoxylum clava-herculis* capsule valves. After chatting for a few minutes about classes and shared interests, Jack asked Nidhi point-blank, "Are you going to eat one?"

With no hint of alarm about the question, Nidhi slowly looked down at the bowl, looked up into Jack's face, and replied, "Are you?"

Jack hid his amusement about her pluck, nodded with the solemnity fitting for the occasion, and we both selected slivers of capsule valve. After deep breaths, we popped them into our mouths and started to chew, looking into each other's faces

all the while. As we masticated, the pungent lemony flavor was soon overwhelmed by a remarkably strong numbing of tongue and lips. We withstood the sensation for as long as possible and then both bolted for the sink where we jostled for access to the water.

Once the buzz diminished, we sat back down to consider possible research projects about this remarkable spice. Nidhi's first comment was that she'd tasted Szechuan pepper before, but by another name and in a dish cooked by her Gujarati mother.

Given that the Florida species was not yet known to culinary science, we decided to compare it with store-bought Szechuan pepper on the basis of the citrus flavor and numbing intensity. For experimental subjects we recruited family members, including Nidhi's Delta Phi Omega sisters. We asked our subjects to rate on five-point scales the citrus flavor and numbing effect of powdered Florida and store-bought Chinese Szechuan pepper. We carried out the same comparison but with a noodle dish Nidhi prepared with Chinese five-spice seasoning (cinnamon, cloves, star anise, fennel seeds, and Szechuan pepper) with either Chinese or Floridian *Zanthoxylum* pepper. Our results revealed that in regards to both flavor and anesthetic effect, Florida Szechuan came in close second to the Chinese import and was uniformly endorsed as an excellent spice.

Markets for Florida Szechuan Pepper will undoubtedly soar when it's realized that it can be readily substituted for the imported product in recipes for a wide variety of dishes. Increasingly, consumers care about the sources of their food, so marketing efforts should consider taking the *terroir* tack. The huge demand from beer brewers for pepper remains to be tapped; they want locally grown hops, so when Florida Szechuan Pepper becomes commercially available, they will buy it in bulk. The novelty ice cream market should also be explored. We initially thought that applying the name "pepper" to this product would confuse consumers, but given growing snobbery about white and black pepper from *Piper nigrum* (Piperaceae), Brazilian pepper from *Schinus terebinthifolius* (Anacardiaceae), and chili pepper from *Capsicum* spp. (Solanaceae), perhaps a rutaceous pepper will have market appeal. Florida Szechuan Pepper oil and tabasco-like sauce might also find ready markets among sophisticated consumers with refined palates.

Even if Florida-style Szechuan pepper isn't a market sensation for food and people don't incorporate its delicious young leaves into their diets, the species should definitely be included in our pharmacopeia. In addition to the hydroxyl sanshools that cause tongues to tingle, toothache trees also produce a stunning array of flavonoids, terpene, benzophenthridine, pyranoquinoline, quaternary isoquinoline, and aporphyrine alkaloids, as well as several lignans. Which of these compounds is effective against what ailments is not yet entirely clear, but Chinese pharmacists prescribe *Zanthoxylum* extracts to fuel the body's "middle burner," whose energies power immune responses and aid digestion.

We believe we are the first researchers to discover the commercial potential of *Zanthoxylum clava-herculis* capsules

as a substitute for imported Szechuan pepper but are nevertheless concerned that other forces may be at play. What tipped us off was that from 1968 to 2005, the United States Food and Drug Administration banned imports of Szechuan pepper on the pretext that it might transmit *Xanthomonas axonopodis* bacteria, the cause of citrus canker. Toothache tree is a distant cousin of citrus in the same botanical family and it may, indeed, carry that dreaded disease. But import bans and tariffs are also a good way to protect fledgling industries. A familiar example of this sort of protectionist action by the government were the steep tariffs on imported tung oil in the 1950s and '60s that kept local tung growers in business long after the industry was no longer viable. But when Florida's Institute of Food and Agricultural Sciences representatives were asked about commercial interests in Florida Szechuan Pepper, they acted as if they'd never heard of the idea. Similarly, when a senior administrator in the Trump Administration was asked the same question, he too pleaded ignorance.

Would-be growers of Florida Szechuan Pepper will be pleased to learn that toothache trees are drought-hardy, require little fertilization, start reproducing when only 2 years old, and take to pruning like the best of bonsais. Jack planted less than 5 acres on 10-foot centers and is already enjoying the fruits of his labor. He also discovered that if a neighbor's controlled burn escapes, the top-killed trees resprout readily from their prominent lignotuber. The sprouts are prickly, but quickly regain reproductive status so you're back in the money almost overnight.

Realization of the market potential of Florida Szechuan Pepper will benefit from a marketing campaign, which might start with a name change. The services of the folks who describe fine wines should be employed so that the spice's pungent bouquet, opening notes of citrus, and the way it closes with a buzzing finish are all stressed.

References and Further Reading

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About the Authors

Francis E. "Jack" Putz teaches botany, ecology, and tropical forestry at the University of Florida and conducts research focused on nature conservation. He is the author of *Finding Home in the Sandy Lands of the South*, a volume of Florida-based natural history essays, *Yaupon Wins: An Ethnobotanical Novella*, and, under the *nom de plume* of Juan Camilo Moro, the steamy jungle novel *Borneo Dammed: A Very Family Affair*, all available from Amazon and Kindle.

Nidhi Patel graduated from the University of Florida where she was an active member of the South Asian Sorority *Sigma Sigma Rho*. She is currently completing a master's degree in medical sciences at Lake Erie College of Osteopathic Medicine (LECOM) where she will attend dental school.