

A Twenty-First Century Spice: A Journey to Madagascar and the Promise and Peril of the Wild *Tsiperifery* Pepper

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ABSTRACT: The quest for spices is a story both global and particular; here, three researchers – an anthropologist, a plant ecologist and a conservationist – go on a journey to Madagascar to understand a pepper with an unusual flavor (the *tsiperifery* pepper, wild harvested from a vine in the genus *Piper* that grows in Malagasy forests) and they witness the early consequences of these realities in this singular place. As is so often the case, the story is of both promise and peril, for the plant, the people involved in its domestication and production, and for the natural forests where the plant is grown. But this story, because it is about a potentially *new* spice for global trade, is very twenty-first century.

Madagascar, the world's fourth largest island, has a long, complex engagement with the spice trade. This is a story told in many areas of the globe after the Columbian Exchange and the emergence of the modern spice trade. However, due to Madagascar's long geographic isolation, there are unique elements: it is one of the world's biodiversity hotspots, with 90% of all the animals and plants endemic to the island, from the iconic lemurs to Ravinala palms and baobab trees.

So many of the trade-offs involved in the global spice trade are made manifest in Madagascar, and this paper will consider them. This will make a compelling contribution to this year's theme of Spices and Herbs because it is a story in the making and also a story concerning various possible futures – for a plant, people, and a place.

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Introduction by Amy

How did it all begin? This decision to go to Madagascar? Well, I came late to the idea. The initial conversations started between Maya Moore, a Food Systems PhD student who has worked on conservation and community development in Madagascar for over a decade and Eric Bishop-von Wettberg, an expert in plant breeding, genebank management, crop domestication, and the sequencing of plant genomes. In conversations during a graduate seminar, their mutual admiration for the unparalleled biodiversity of plants (and animals) to be found on this amazing island nation emerged. Maya presented on the case of a particular wild vine found in the (increasingly compromised) Malagasy rainforests, the *tsiperifery* pepper vine in the genus *Piper*. There was an immediate sense of shared possibility; Eric loves a good never-been-domesticated story and Maya plans to carry out her dissertation research at the

intersection of conservation efforts, climate change resilience and farmer livelihoods. There was a small grant opportunity at the University of Vermont for transdisciplinary research efforts. Why not go and find out more about the plant, the people, and the possibilities? But they needed one more collaborator to fulfil the expectations of the grant – transdisciplinary research recasts and reframes and thus requires multiple perspectives.

My interest in taking this long trip, which involved eighteen hours in an airplane, several airports and multiple stops at passport control, was primarily professional. I have been enthralled with the consequences of the Columbian Exchange and the colonial rush to move plants desired by Europeans for their flavor and aroma to far flung outposts for decades. As is the case with many budding food studies scholars of my generation, Sidney Mintz's book *Sweetness and Power* was a touchstone for me; his articulation of the push and pull between production and consumption before, during and after colonialism shaped my scholarship forever. I have taught about the topic to culinary students, university undergraduates and graduate students specializing in food systems. I never tire of the topic and I have often thought about Madagascar, the world's fourth largest island, which has a long, complex engagement with the spice trade. Vanilla came from Mexico by way of La Reunion in 1840; cloves, native to the Maluku Islands of Indonesia, were first introduced onto Madagascar's St. Marie island even earlier (Danthu et al., 2014), even though Madagascar would not be fully colonized by the French until 1894.

390 This is a story told in many areas of the globe after the Columbian Exchange and the emergence of the modern spice trade. However, due to Madagascar's long-term isolation, there are unique elements: it is also a biodiversity hotspot, with 90% of all the animals and plants endemic to the island, from the iconic lemurs to Ravinala palms and baobab trees (and I will confess to a lifelong fascination with this place due to its relationship to evolutionary history). The promise of the plant and the pepper, endemic to such an unusual natural environment, was too good to pass up.

So, we became a team (with Maya as our fearless trip leader). We spent days together exploring the eastern half of the island, witnessing the almost completely deforested landscape, going into rainforest preserves to see lemurs, visiting with farmers, spice traders, conservationists, and sharing many meals. This was an unforgettable experience. There is so much to say, but the here is the main point: we completed our journey with the shared realization that this not a romantic story – there was no Indiana Jones inspired narrative here. Rather, it was a humbling one. The modern human desires for spices and the quest for variety in our diet has transformed landscapes and shaped political, economic and cultural destinies for centuries and in all cases (including this one) what transpired cannot be cast within the frame of the hero (or heroine) myth. Instead, this is a cautionary tale.

In this essay, we will explain the significance of the plant from the point of view of botany, cultivation, domestication, culinary and medicinal uses, and subsistence livelihoods;

explore why spice exporters, conservationists and development agents have turned their attention to this spice; share the perspectives of those interested in making it part of the global spice trade; speculate on the future of it from domestication to distribution.

Introduction: Our Story

The global spice trade defines the modern human experience, past, present and future. The desire for the tastes and flavours provided by them – the fruit of the black pepper vine and the allspice tree, the inner bark of the cinnamon tree, the flower bud of the clove tree, the seed pod of the vanilla vine, the seed of the cacao tree, the seed (nutmeg) or seed coat (mace) of nutmeg trees, the root of the ginger and turmeric plants – have propelled civilizations, justified colonialism, inspired plantation production systems, precipitated complex trade networks and concomitant trade conflicts, expanded cuisines, transformed sensory experiences and on and on. Our initial research questions were formulated to facilitate Maya's dissertation related research interests and a shared dialogue. What could we find out about the desire for this pepper apparently sparked from a specialized group of food aficionados, and how we might consider the 'improvement' of food crops and implications for farmer livelihoods?

Madagascar is one of the world's least developed countries with 90% of the population engaged in types of subsistence activities and 75% living on less than \$1.90 per day. Thus, a persistent tension exists between the uniqueness of Madagascar's natural heritage and the market logics of growing and selling tropical spices and other desirable foods (vanilla, cacao and coffee among others). Many of these tensions are as long-lived as the first plantings of vanilla, coffee and cacao over a century ago, but because *tsiperifery* vine is thought to be unique to the island and has never been domesticated or grown in plantations, this is also a story about very contemporary preoccupations: conservation of rainforest, protection of biodiversity, climate change and livelihoods resilience, and models for development.

So together, our trio – Amy, trained as an anthropologist and chef and now a food scholar; Eric, educated as an ecologist with a long standing involvement in plant domestication and genetics; and Maya, learning how to combine conservation and food systems, set out to engage with 'real world' actors across the food system, from farmers to NGOs, spice exporters and plant scientists, all working together to domesticate the pepper with the hopes of exporting it far from the island's shores. Maya and Amy initially travelled together and then after five days we were all together. We began and ended our trip in the capital, Antananarivo. We then went south and east to Ranomafana, in an area of rainforest now actively conserved within Ranomafana National Park. From there we went back to the capital and headed east towards Andasibe and Mandraka.

Madagascar, Spices, Foraging, and Domestication

Madagascar is known as a modern day 'spice island,' with a location identified by the European colonists to have the right set of growing conditions in order to grow the highly

desired spices of clove, vanilla, and more at a large scale for export to Europe and beyond. Interestingly, even through today, visitors to Madagascar may observe that the traditional cuisine generally does not use these spices, or many others either. Indeed, beyond the use of a very hot pepper sauce (*sakay*) and some ginger, Malagasy dishes are usually only flavoured with salt (copious amounts) and the occasional addition of a bit of black pepper or curry powder, the latter most certainly introduced by the *karana*, an Indo-Pakistani migrant population, and both of which come in small, red cardboard boxes produced in the capital by the spice company, TAF Products Madagascar. It is possible that the relative blandness of the native Malagasy diet lies in the long history of relying primarily on rice as the main carbohydrate staple of the diet as well as the main livelihood of the people, as the majority of the population continues to be involved in subsistence farming. Or it may be that export crops were never incorporated into the cuisine as ‘of this place and people’ by those engaged in growing and harvesting them; these were simply valuable flavours to others.

Most spices grown commercially in Madagascar today were domesticated elsewhere and introduced, beginning with the colonial plantations that began in the nineteenth century. The process has been to bring the plants to the island, to create efficient means of producing the desirable aspects (the pods, the buds, the seeds, the pulp, etc.) through the use of cheap local (and originally forced) labour, and then export those parts of the plant across the globe. Over time, a broader range of spices have arrived in Madagascar and have been grown commercially for export. These include cacao, cinnamon, turmeric, ginger, black pepper and *baie de rose*. Even coconut was introduced to the island.

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The *tsiperifery* pepper is the first new spice to be introduced to the Madagascar export market in nearly a century. This wild pepper plant has been found growing throughout the eastern rainforest corridor and is used in traditional Malagasy medicine. But unlike other spices grown in Madagascar, it is thought to be native and has never been cultivated or domesticated. Documented by British botanists as far back as 1890 who listed it as one of 4000 ‘economic plants’ native to Madagascar, it was not actively pursued as a commercial crop until the past decade.

Thus, at this moment, all of the *tsiperifery* currently being exported, or sold in-country to foreign tourists and expats, is being collected from the rainforest. In our travels to learn more about the plant, the peppercorns and those engaged with thinking about it as a new spice for the global market, there emerged a visible tension as to the model for the future of this spice. Could it remain a wild and foraged spice emerging from family farms or small farmer collectives, or should it become a domesticated crop produced in larger plantations? Neither approach, we learned, was ideal.

Foraging for this peppercorn – the current approach – in order to go beyond the everyday subsistence needs of those living in or around the natural habitat of the plant is a practice which researchers have warned is unsustainable and could lead to endangering the



FIGURE 1. The plant and the pepper.

wild resource (Razafimandimby et al. 2017). This is because, like most *Pipers*, *tsiperifery* is a vine which can grow up to 20m high in the rainforest canopy, making the berries difficult to harvest without cutting down the entire vine or the tree that it is growing on. In the wild it occurs at low density. Furthermore, unlike the majority of plants but similar to date palms, papayas, and hops, it occurs in separate male and female forms. Only the females produce the peppercorns, but the males must be present nearby for pollination (see Figure 1).

Black pepper, however, has been domesticated in ways that make it easier to grow. Through its long cultivation history. It has been selected for hermaphroditism, and for ease of cultivation in plantation settings. Most wild black peppers occur in male or female forms,

while most cultivated black pepper have been selected by humans to be hermaphrodites, which greatly eases production practices on plantations (Nair, 2004). A number of other *Piper* species have histories of human cultivation as well, although none is as widely grown or dependent on human care as black pepper. One is long pepper, known in Greek and Roman times and, like black pepper, native to India. Another is Cubeb pepper, native to Indonesia, and still sometimes used medicinally and in cigarettes. All *Piper* species have similarities in their fruit structure and their chemistry. *Piper* species all make piperine, a secondary metabolite that is thought to protect them from insect pests, and that also confers their unique aromatic flavour. However, different species do vary in their levels of piperine as well as in other secondary metabolites, shifting their flavour.

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We toured the southeastern part of this island and visited people engaged with *tsiperifery* pepper in various aspects of the supply chain. We wanted to know about the plant, but we also wanted to know why there might be an export market, who was involved in sourcing it and moving it from the rainforest to the nation's capital and then ultimately beyond (especially to France, sarcastically nicknamed 'Sweet Mother' in Malagasy).

We all shared a concern: any new spice species is still a wild plant, though it might be planted and protected by people. There are so many possible (and unintended) consequences to making it the object of culinary attention. Wild harvest or domestication is but one of a series of decisions that will have cascading effects for the plant, people engaged with it, and the natural environments where it will thrive. The promise of a *lucrative* yet also *harmless* transformation

of a wild plant to a luxury flavour has not been borne out by history – why and how would it that happen in this case?

The narrative as to just when and why the *voatsiperifery* pepper was ‘discovered’ and became a desirable spice for those seeking sensory uniqueness leading to this rush to source, possibly domesticate, and sell it – to tourists coming to Madagascar and to gourmets around the globe is not entirely clear.



FIGURE 2. The pepper as it is sold to tourists.

One story is that some (commonly shortened to *tsiperifery*) pepper was brought to France for the annual *Salon de Gastronomie*, an international agro-food exhibition in France where chefs gather in search of new flavors.

Today, the 3-star Michelin chef, Anne-Sophie Pic, sells *tsiperifery* in her line of spices. Master French chocolatier, Francois Pralus, brought *tsiperifery* further into the spotlight when he incorporated it into his 2013 *Buche de Noel*. And the pepper has gained attention in the U.S. as well; celebrity chef Wolfgang Puck has included it in his recipes and Lake Champlain Chocolates had a special *tsiperifery* chocolate bar, now discontinued.

However wild pepper was brought to the attention of chefs in France and more widely in the West, likely anyone who encountered it was ‘wowed’ by its aromatic properties, the same ones that are used as plant defences against herbivores in its native rainforest habitat. We also suspect that it was spice traders who were behind the re-introduction of the spice to European sensibilities – after all, someone had to ship it to France and present it at the *Salon de Gastronomie*. Thus, although this is the first new spice plant to emerge from Madagascar in a century – as was the case in pre-colonial and colonial eras – the power and the glory went to middlemen, not the planters and harvesters.

Ultimately, as spice export has become more competitive, with more and more companies owned and operated by foreigners because it is so lucrative, exporters are looking for ways to ‘spice up’ their repertoire. Adding another pepper to the other pepper and pepper-like species that they are exporting (black pepper *Piper nigrum*, *baie de rose* which is not *Piper* but has some similar aromatic characteristics...), increases their edge on the European and American markets (see Figure 2).

Foraging, Harvesting, and Selling *Tsiperifery*

A consortium of agronomists and spice export companies was created to work with smallholder farmers to begin incorporating the wild pepper into their pre-existing

agroforestry plots. We spoke to people involved with the consortium and they introduced us to those involved in planting and harvesting it. The spice export companies were looking for sufficient supply to meet their newfound demand, conservation organizations were hoping to employ yet another strategy for protecting the diminishing rainforest (90% of which is thought to have been lost), and development organizations were keen to aid farmers in diversifying their holdings in order to augment their income and raise their standard of living. None seemed to consider the implications for connecting peasant farmers to the vagaries of the global market, and the increased vulnerabilities that this might pose.

The consortium began providing technical assistance to farmers on how to identify and collect the pepper, aiding them in obtaining proper harvesting permits, as well as supporting their efforts to incorporate and strengthen their cooperatives. We visited one such cooperative of smallholder farmers living about 10 hours southeast of the capital near Ranomafana National Park. This farmer cooperative had been approached by the consortium to initiate trials to grow *tsiperifery* in the understory of their previously established agroforestry fields. The farmers had received trainings in order to develop more than an occasional foraging system for the pepper, but rather a more organized system of planting, harvesting and fermenting that would create a greater and more consistent value-added supply. The farmers that we met with seemed interested in the project, though not overly motivated – more *laissez-faire*, particularly since the initial spice exporter (Jacarandas) had already lost interest since the cooperative of farmers could not produce the quantity of pepper they required for a robust supply chain. The cooperative had been asked to construct bamboo ladders to reduce the need to cut down the high growing pepper vine, but the farmers felt that these ladders were too cumbersome to carry into the forest, and too slippery and dangerous to climb.

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We learned that, in the past, local people collected the pepper opportunistically when they went into the forest and used it, not only as a medicine,



but also to season some dishes. They used fresh, green berries to season *ravitoto* (a dish made of pounded manioc/cassava leaves) or cooked bananas (see Figure 3). Since realizing its ‘value’ to the outside world, they told us that they have discontinued this practice. They do still use it as a traditional medicine – leaves and stem made into a tea and used as a cough medicine.

FIGURE 3. *Ravitoto* with *tsipefery*.

The President of the cooperative also told us that he had received a phone call from another spice company, MadaEpice, but was unsure how they got his number. People have also been trying to buy seedlings from them; they were even approached by an NGO that wanted to get involved and plant a lot of pepper. Thus, he sensed that there is still a market and he stated that he remained motivated. He also seemed to be running his own side business with his personal connections to the capital, purchasing and selling green berries from other farmers, who had probably collected it from the forest, and drying it with the know-how that he had received through the trainings.

However, many in the cooperative seemed sceptical as to the worth of adding the pepper to their smallholder cash crops, such as vines for harvesting vanilla pods. Furthermore, they had heard stories of a nearby village being approached and asked to collect the blue seeds of the Ravinala palm, wild ginger, and the seed of the Ramy tree for the French fashion house, Christian Dior, and the project had not gone well. Thus, they recognized the fickleness of the market and the challenges of working in a cooperative. Their pepper vines were scattered few and far between among their other fruit trees, sometimes growing on the same tree as a vanilla vine. At the level of the forest floor (so to speak), people were wary.

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A growing trend among conservation organizations has been to promote cash cropping, particularly using shade-grown agroforestry techniques, among smallholder farmers. The rationale is such new techniques would provide more ready access to cash and more than beyond subsistence and slash and burn agricultural techniques. The idea was that in return, there would be reduced pressure on forests and enhanced biodiversity. However, there has been little to no evidence that this conservation strategy works. In fact, there are instances in which increased demand for a product that is still being wild harvested has led to overexploitation of the resource. Thus, without careful planning, the ultimate result could be more local people going into the forest and harvesting unsustainably. This is a concern for the promotion of *tsiperifery*.

At the gates to Ranomafana National Park, a young entrepreneur (real name is Khen) operates a small family restaurant out of which he also sells spices, including *tsiperifery*, which he purchased locally. He is certain that the pepper was collected somewhere nearby though he is unsure if it came from within the park boundaries or the forest surrounding the protected area. He is unaware that – just down the road – a local conservation organization is working with farmers to try and domesticate the pepper.

Furthermore, since there is currently no certification program available for wild pepper, purchasers have no way to identify/trace if it was harvested in a sustainable manner. Even spice exporters that pride themselves on sourcing sustainably are exporting *tsiperifery* that has been harvested from the wild because there is no cultivated supply yet in existence. We have already seen evidence of them losing interest in working with smallholder farmers that could not produce the amount of pepper that they required – thus, they must inevitably return to



FIGURE 4. The vine plants for domestication.

purchasing from local collectors to meet their demand. Without an integrated system along the supply chain explicitly incorporating values above commodity crops and access to case, this will never be a sustainable system.

If Not Wild then Domesticate!

But there is another idea afloat in Madagascar – why not try to create a means for plantation system, the model used for cacao and other globally desired flavours? Efforts to domesticate the *tsiperifery* are now underway, with an aim to select for some of the traits that are found in black pepper, such as hermaphroditism and a bush stature. Domesticating *tsiperifery* could make it easier to grow in in plantations, and potentially reduce impacts on forests. But such efforts face significant biological challenges due to the complex nature of crop domestication (see Figure 4).

Our second visit was to a Malagasy-French businessman's plantation located just a few hours to the east of Antananarivo (along a major trucking route that links the capital to the primary port of Madagascar, Toamasina). The vast swath of land (10,000 hectares) had been inherited by his grandfather after Madagascar gained independence from the French in 1960 and was now divided among his descendants. He had experimented with growing the pepper in the shade starting in 2013, and is now interested in planting his pepper seedlings out in full sun because the pepper in the forest understory was taking too long to grow. His location, with easy access to both the capital and the port at Toamasina, as well as financial capital make it probable that he will control the market if he is able to successfully propagate this pepper on his hilly land. But what of the smallholder cooperative in Ramafana? Can they compete with a European educated businessman who speaks both French and English and has lots of connections?

There was also confusion about how to propagate the pepper, given that it has both male and female plants. Like other species in the *Piperaceae*, wild pepper is dioecious – having separate males and females. This trait complicates seed set in plantations, as males are necessary, and are difficult to identify prior to flowering. In date palms, another crop with two sexes, early planters realized that one or two non-fruit bearing plants were essential in their groves. Date palm plantations still include a small number of males to this day. Alternatively, in some dioecious species, like hemp and papayas, there are rare

hermaphrodites. These individuals can be selected to create a hermaphroditic crop, like black pepper and many commercial papaya varieties. Cultivation becomes much easier for these two at large scale when all individuals produce fruit.

Understanding the *tsipifery* plant, we realized, was crucial for a successful transition from indigenous and occasional practice to the reality of a globally desired and distributed spice. Trial and error only for the sake of money would not benefit the plant, the people, the rainforest or the nation. Later, we met with the FOFIFA Researchers who are leading the national efforts in Madagascar to study *tsiperfery* (in an interesting twist, all three of the researchers as woman PhDs, in a nation where access to higher education is still very limited).

For these researchers, the first step was to map the distribution of wild resource. Their team has found that the wild grows from the northern tip of the island down to the southeast, all along the eastern rainforest corridor. Their second step is to work out the relationship of the wild Malagasy pepper to related species by means of DNA sequencing. There is still uncertainty about how the pepper arrived in Madagascar, as it appears to be more closely related to the mainland African species than to *Piper borbenense*, another pepper found on La Reunion. Furthermore, they have identified four different morphotypes (m1-m4), which suggests either genetic diversity or differential responses to Madagascar's incredibly complex landscape. Further genetic testing will be needed to answer this question.

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Finally, they have also established a living collection in Beforona. One of the researchers has established multiplication by seed, which means that they harvested seed from plants. Having a supply of seeds, preferably from their living collection (i.e. not from the forest), is a basis any breeding program. It is also an essential resource for determining if any variation in flavour of the pepper is due to either genetic differences or differences in location. As researchers, we now acknowledge the power of contextual knowledge. A better understanding of the plant, the practices, the organization of power and control over distribution, and the already existing relationships across the system seems the best way to address the current ad hoc approach.

Conclusion

There is a clear need for international assistance. Remarkable as the local researchers and conservationists are, there is no infrastructure for DNA sequencing in Madagascar. Partnerships with responsible researchers abroad are needed for training and for access to research infrastructure. In addition, to determine the uniqueness of the Malagasy *tsiperifery* pepper, it must be compared to other peppers from La Reunion and mainland Africa.

In recent decades protections for valuable species have changed remarkable. Back in the 1870s the British were able to take rubber seeds from the Brazilian Amazon back to Royal Botanic Garden Kew, leading the establishment of massive British rubber plantations across the Malayan peninsula without any benefits being returned to Brazil. We now have a set

of international frameworks, such as the Convention on Biological Diversity, the Nagoya Protocol to the CBD, as well as the International Treaty on Plant Genetic Resources for Food and Agriculture that provide standardized means for foreign researchers to access materials and means for benefit sharing with countries providing materials.

In the case here, we asked if we could get material under the standard material transfer agreement (SMTA) to grow at our university for teaching and research. It quickly became apparent this would be impossible. Even getting DNA to contribute to the needs for sequence data was impossible. Unfortunately, the frameworks have stifled research, without similar impacts on exporters.

Spice traders and NGOs are already starting to lose momentum with the domestication project. In some instances, retailers have already moved on to the next taste. Funds for research are also increasingly difficult to access. However, diversifying the spice trade has benefits, in terms of protecting against disease outbreaks in other species, creating an agricultural system more resilient against climate change, and possibly diversifying sources of income for smallholder farmers. There are ways to integrate the knowledge about the plant, the practices, the organization of the global spice trade to reduce other pressures on Madagascar's unique and threatened forests. But much work remains to be done before that happens.

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