

Story and photography courtesy of Jonathan del Rosario and Brian A. Perry, California State University East Bay.

Mushrooms and other **Fungi** of *Tafea* Province



Diverse is one word that can be used to describe the islands of Vanuatu, as they possess one of the highest densities of languages in the world. The diversity of each island is also reflected in the large numbers of distinct plants, fungi and other organisms that make up these unique environments. Like the neighboring countries of Fiji, New Caledonia and the Solomon Islands, Vanuatu is considered a hotspot for high levels of biodiversity. Despite this, many of the organisms that call these islands home have remained undocumented and understudied by scientists. Since

2014, a team from the New York Botanical Gardens (NYBG) has dedicated their efforts to studying the plants that occur throughout the southern Tafea Provincial islands of Aneityum and Tanna. To do so, they have worked side by side with local communities and the government, focusing on the linguistics, uses, distribution, and diversity of these plants. Thanks to recent funding from the U.S. National Science Foundation the project has continued to grow, increasing the number of participating institutions and expanding this research to other organisms. We are scientists from California State University East Bay, who specialize in mycology, the

study of fungi. To document and study the mushrooms and other fungi that inhabit the islands of Tafea Province, we have been working alongside the NYBG team and our collaborators from the University of Hawai`i at Manoa, Swarthmore University and the University of the South Pacific in Fiji.

When people think of a fungus the image that typically comes to mind is a mushroom, much like one you might purchase at a grocery store to cook up as part of your meal. The mushroom however is only half of the story, and fungi themselves are so much more. A mushroom is to a fungus what a mango

Previous page: Anthracophyllum species.

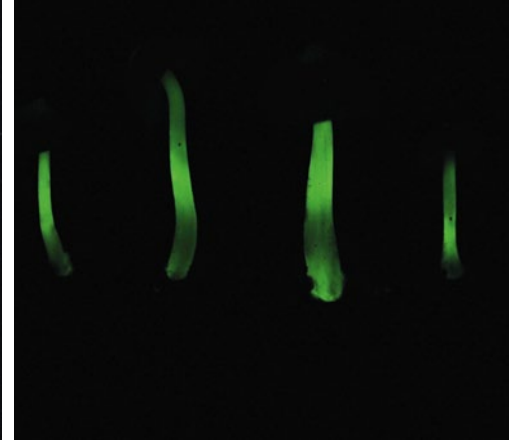
This page: Hypocrea species.

is to a mango tree. In other words, just as a mango is a fruit that contains the reproductive propagule (the seed) of the mango tree, the mushrooms we are all familiar with are simply the reproductive structures of these organisms. The remainder of the fungus is spread throughout the soil or other substrate upon and throughout which the fungus is growing. Due to the fact that they do not slither, run or fly, fungi were treated as plants by the scientists of old, and were often included in botanical collections. In *Species Plantarum*, Carl Linnaeus (the father of modern taxonomy) acknowledged them rather briefly, referring to them as merely lower forms of plants. Today of course we know that fungi represent their own unique kingdom (Kingdom Fungi), and that they are indeed more closely related to animals than they are to plants!

Mycologists believe that the diversity of fungi found on planet Earth is strikingly rich, with estimates of the total number of species ranging from a conservative 1.5 million up to a generous 5 million. For some environments, it is thought that fungal species probably outnumber plant species 6 to 1! Fungal species are being discovered and described at a growing rate of nearly 2,000 per year. However, with only 144,000 species formally described by scientists thus far, the vast majority of fungi (90-97%) likely remain undocumented. One explanation for this striking diversity is the myriad different roles fungi play in our ecosystem. Along with bacteria, many fungi are considered nature's great recyclers because they decompose the organic material that makes up all living organisms, once these organisms have died (think of the leaves and sticks that decay in your garden soil). Other fungi dwell within leaves and other plant tissues as small clusters of microscopic cells, producing compounds that have been found to boost immune response and may protect their plant hosts from pathogens and insect invaders. And still other species of fungi form symbiotic associations with the roots of trees and other plants, increasing the uptake of water and nutrients by the plant roots in return for simple sugars the plant produces. Then of course there are the parasitic and pathogenic fungi that attack plants, animals and other organisms. While these species may seem macabre, they too are part of a healthy, functioning ecosystem.

The fungus itself is mostly a mass of filamentous thread-like cells called 'hyphae,' which are collectively referred to as 'mycelium.'





Top from left to right: Pleurotus species. Mycena species (in the light). Mycena species (in the dark). Bottom: Marasmius species.

While a mushroom may be the image that first comes to mind for many of us when thinking of fungi, it is actually only a small percentage (10-15%) of fungal species that produce these structures. The majority of fungi do not produce structures we can see without the aid of a microscope, and for this reason often go unnoticed. These fungi are microscopic in nature, but are surrounding us at all times in both natural and human-made environments. For those species that do produce mushrooms as their reproductive structures, these come in an endless variety of shapes and sizes. Many fungi come in colors that go beyond the drab brown, gray and white of our supermarket varieties, and display an impressive sampling of nature's palette. From textures and aromas to patterns and silhouettes, fungi are emblematic of the variation the natural world yields. In Vanuatu, there are multiple species we've found that even exhibit bioluminescence, and are quite the eye-catching spectacle as they illuminate the forest

floor at night. On a trip to the island of Tanna, we witnessed such a sight, which was very familiar to the local people working with us. We were told that in the Nafe language, one of many spoken on Tanna, the multitudes of glow-in-the-dark species were called ser-ser. We were taught that a specific variety of ser-ser has medical applications. It is believed that by placing and wrapping one of these mushrooms over an open wound for an entire day, this will cleanse the wound and alleviate any pain. Given that the people of Vanuatu are so tuned into the natural world and have many uses for the plants that surround them, it is no surprise that fungi also have traditional uses.

In addition to medicinal applications, a number of fungi in Vanuatu also serve as a source of food. Schizophyllum commune is a notable edible species on the islands of Aneityum and Tanna, which in Nafe they call kamiah-miah. People from both islands easily identify the mushroom by sight and its tendency

to grow on the wood of mango trees (*Magnifera indica*). This fungus has also been reported as edible or having medicinal value in many tropical countries such as India, Malaysia, Vietnam, Mexico, the Philippines and Thailand. On Tanna, kamiah-miah can be prepared in a variety of ways. One way is to place it on the large leaves of *Macaranga* or the banana leaves (*Musa* sp.) typically used in making lap-lap, the national dish of Vanuatu. Once wrapped together and knotted with a rope made from the *Pandanus* plant, the mushrooms are roasted over a fire for 3-4 minutes. Other edible species include members of the genus *Pleurotus*, called kroupous, which many people know as oyster mushrooms in other countries; members of the genus *Lentinus* known as karing-apa, and a likely undescribed species of *Polyporus* they call karing-muroup. On Tanna these mushrooms can be prepared for a meal in various ways, but most methods share similar themes. A modern take is simply slicing them into pieces and



Top: Marasmiellus species. *Middle:* Puffball species.
Bottom: Pleurotus species

cooking in a saucepan with coconut milk, or frying in oil. The traditional (or kastom) ways these mushrooms are cooked is similar to the method used with Schizophyllum commune. Pleurotus and Lentinus mushrooms can both be sliced into pieces and placed in the large leaf bundle for roasting, however these species are then topped and mixed with fresh coconut shavings before being cooked over the fire.

Unfortunately, the knowledge of many fungi and plants is being lost to the younger generations. In many regions throughout Asia species of Auricularia are common edibles. On many of our visits we've asked locals about these fungi. In Nafe they are called kawun-kawun which translates to 'rat's ear', due to their rubbery wrinkled appearance and often brown or gray coloration that bear a strong resemblance to the ears of those rodents. When inquired if it was commonly eaten, we were often met with surprise or a resounding no. It wasn't until a later trip to Kwamera in South Tanna did we learn from elders that this fungus was eaten at all. Kawun-kawun is cooked by simmering in coconut milk until it is brought to a boil. Knowledge regarding the edibility of this species has apparently not been successfully passed on the younger generation in some areas of Vanuatu, suggesting that the loss of such information can be swift. Many livelihoods in Vanuatu are dependent upon the forests and the products they provide. Information regarding the fungi that occur in these ecosystems, including which species are edible, can be an important resource for a population that becomes increasingly dependent on the convenience of imported foods that may not always be available.

As the influences of globalization inevitably arrive and lifestyles in Vanuatu begin to reflect those of other countries rather than tradition, there is a significant risk of alienation from nature. The diverse elements found throughout the islands, from the languages spoken to the organisms that thrive here, are a precious part of the Vanuatu heritage. There is an urgency to document this information and continue passing on this knowledge. Ultimately, this fate is in the hands of those that live here. To date we have made nearly 400 mushroom collections during our trips, which likely represent more than 200 distinct species. Of these, we expect that many will represent species that are new to science and many that are unique to the islands of Vanuatu. Our time in Vanuatu however is limited, and the work we have done so far is just the beginning. Many more species remain to be documented and studied, and we are hopeful that as part of our project we can train local citizens who can carry on this work after our project comes to an end. Our time spent working in the forests and with the local communities has always generated great interest from people of all ages, as these fungi we collect are both familiar to them and in many cases quite new. We've especially witnessed excitement among young children who want to know more about these fascinating organisms and who have an uncanny talent for finding mushrooms of all shapes and sizes. Perhaps in these youngsters we are witnessing the first steps in the birth of a generation of Vanuatu mycologists.

