Nameko

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Nameko (*Pholiota nameko* [T. Itô] S. Ito & S. Imai) is a small, brown gelatinous mushoom that is one of Japan's most popular, cultivated varieties. The name means "viscid mushroom."

The mushroom is rapidly gaining popularity in North America, where it is sometimes known as "butterscotch mushroom." It is grown on various soft and hardwoods and more widely available on this continent the past few years. Organic sawdust spawn is available from a few suppliers. Conifer sawdust fruiting is possible with the addition of 15% bran (McCoy, 2016).

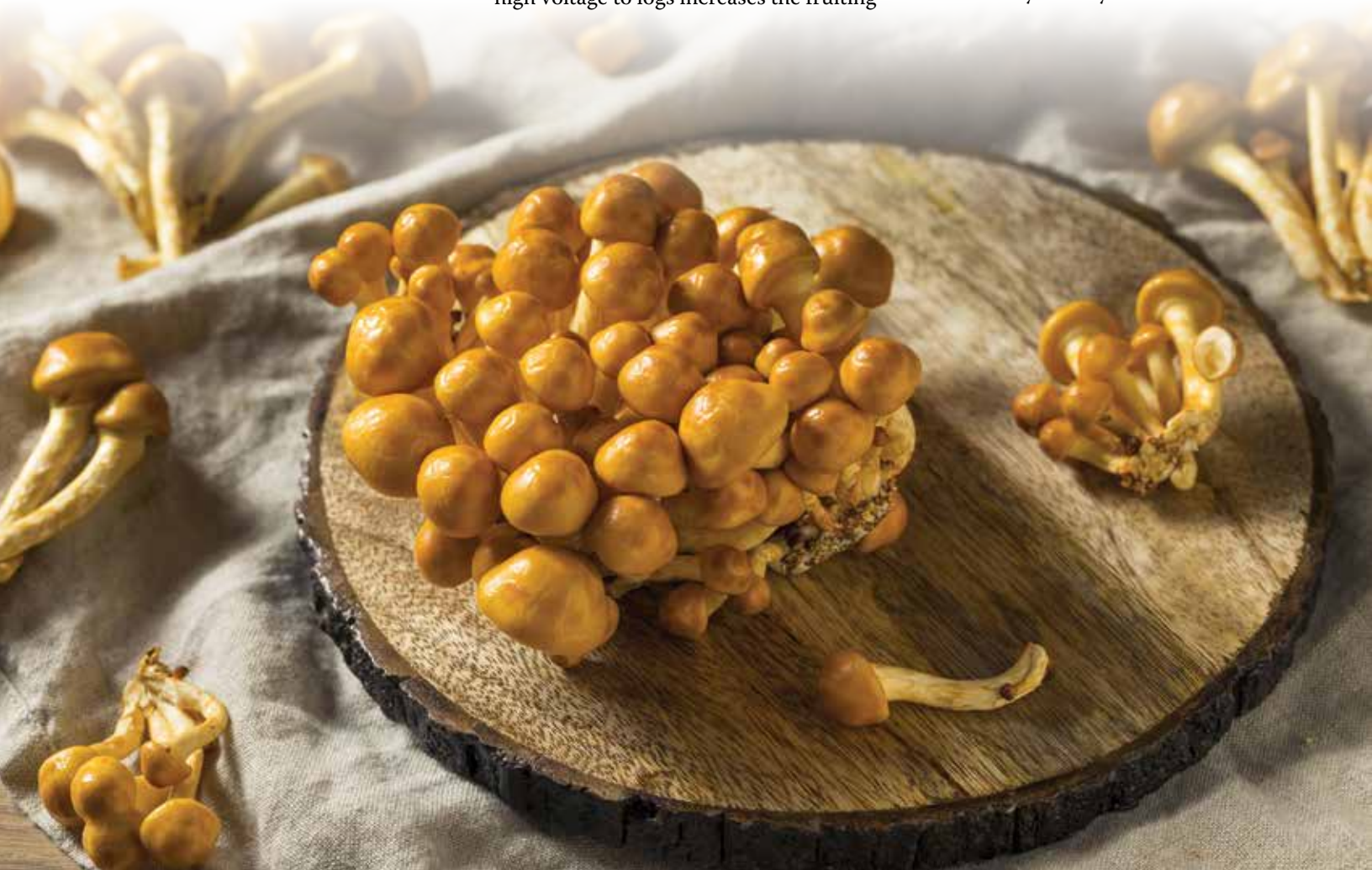
An excellent short video on growing Nameko outdoors with Tradd Cotter (2014) is found on YouTube. His book is a personal favorite on organic cultivation of mushrooms. They are extremely easy to propagate, indoors or out, depending upon the climate in your area; for greater, in-depth detail on cultivation, see Chang and Hayes (1978). At one time, it was believed lightning and thunder improved fruiting yields. Research shows that, curiously, pulsing high voltage to logs increases the fruiting yield by 50% (Takaki et al., 2009).

The mushrooms contain nearly 21% protein and are popular in Japan when added to miso soup, steamed in a pipkin, cooked with grated daikon radish, or stir-fried vegetable dishes. In China, the Mandarin name in Pinyin is: huá gu or huá zi mó.

Not only is the fresh mushroom delicious, but also rich in medicinal benefits. I caution readers to purchase only certified organic fresh and dried mushrooms, and even then to be careful with product from some countries. The fresh are far more delicious than the re-constituted dry, fruiting bodies.

Just a few years ago, when finishing my book (Rogers, 2011), there was not a lot to share about the health benefits of this delicious fruiting body. In the 1990s, most of the information was related to hypersensitivity and pneumonia, from the spores, associated with cultivation (Inage et al., 1996).

Since that time, there has been much new research. Li et al. (2010) studied the polysaccharide content, and the cytokine response in blood serum of healthy volunteers. The results found they possessed significant anti-inflammatory activity on both innate



and adaptive immune function, as well as hematopoietic stem cells. The latter reside in the bone marrow and give rise to different blood cell types in the range of 10^{11}-10^{12} new cells daily. Both in vitro, and in vivo anti-oxidant effects of intracellular polysaccharides were confirmed by Zhang et al. (2015). Novel anti-tumor proteins were identified by Zhang et al. (2014) and found to induce apoptosis (self-programmed death) in vitro against human breast cancer (MCF7) and cervical cancer (HeLa) cell lines. Activation of caspase-9 and caspase-3 imply intrinsic signal pathway is involved.

An area of increasing interest is modification of the substrate, to change or enhance myco-availability of trace nutrients and minerals. In work by Zheng et al. (2015), the transformation of zinc by mycelium polysaccharides, led to a product that is a natural antioxidant that slows, in vivo, the progression of ageing. Enrichment of medicinal, edible mushrooms with selenium, chromium and other important trace minerals is coming. The zinc-rich mycelium polysaccharides may also be effective in lowering cholesterol and protecting against high-fat diet-induced hyperlipidemia and non-alcoholic fatty liver (Zheng et al., 2014). The latter condition is rapidly rising in North America, due in part to the consumption of high fructose corn syrup and trans-fatty acids. Work by Diyabalange et al. (2009) tested lipid soluble extracts of nameko, shiitake, and oyster mushroom fruiting bodies for peroxidation. Nameko was the most active, with inhibition of 81%; inhibition of COX-1 and -2 enzymes, suggesting anti-inflammatory activity, was noted. Early laboratory work by Li et al. (2010) on hyperlipidemic Wistar rats, at different rates, given orally, found amelioration of pathological changes in coronary arteries and significant suppression of hyperlipidemia. The polysaccharide supplementation also lowered body weight and visceral weights of heart, liver and kidney, but not lungs.

The fruiting bodies contain various water-soluble proteins. Work by Qian et al. (2016) found an anti-oxidant protein that exhibits anti-tumor activity against breast cancer (MCF7) cell lines, by inducing apoptosis. Nameko may be useful in various auto-immune conditions such as multiple sclerosis, Crohn's disease, and rheumatoid arthritis. The polysaccharides stimulate the production of more cytokine IL-10 and less IL-2 and TNF-alpha (Li et al., 2014). The former inhibits synthesis of pro-inflammatory cytokines made by macrophages and Th1 T cells. Lower levels of IL-10 are found in patients diagnosed with multiple sclerosis, resulting in TNF alpha rising and creating inflammation (Brennan et al., 2008). It also functions as an immune-modulator in the intestine. Patients suffering with Crohn's disease are helped by interleukin-10 producing bacteria in the gut (Bratt et al., 2006).

One of the advantages of medicinal mushrooms, in general, is the ability to modulate the immune system. An important part of this self-regulating system is dendritic cells. Note that this is different than dendrites, which play a role in nerve transmissions. The formation of dendritic cells is fascinating. Their shape is perfect for what they do. When one looks at the various immune cells, only a dendritic cell can go from the outside of the colon to the inside. It slips one of its tentacle-like arms in between two colon cells to start its exploratory adventure. When its arm reaches the layers of mucus, it dives through, like a periscope on a submarine, and surfaces inside the intestine. This arm then collects antigen from the colon lumen or mucus and leaves the way it entered. Dendritic cells have a special molecule that resembles a flagpole rising out of the mucus membranes, or mesothelial surface. They run antigen up the pole for display and information purposes. This explains how the two arms of the immune system communicate with each other, to address pathogens and inflammation. Both T cells and dendritic cells have a common language called antigen.

We tend to think of dendritic cells in the colon, but they actually are found in any area of our bodies exposed to the environment, such as the skin, lungs, and vagina. Dendritic cells are not just explorers but cruise our body with antigen to show T cells, that are birthed in the thymus gland. They cruise the body and the spleen and lymph nodes where they meet up with dendritic cells and their antigen load. When they find each other, a T cell is formed, usually in childhood, but anytime really, and stick around for life. This means they play a role in both innate and acquired immunity.

Two types of T cells, regulatory T cells (Tregs) and Th17 (named for the interleukin 17 cytokine they secrete) protect us in ways different from killer T cells, that are activated by dendritic cells. The latter attack pathogens and cancerous tumors. Instead, they carry out the day-to-day duties of regulating inflammation in our body. Tregs (including IL-10) reduce inflammation and Th17 cells increase inflammation. In people with optimal immune function, these two play a perfect role of balance. But if there is an imbalance of Th17, the pro-inflammatory cells, an auto-immune condition can result.

At one time, not that long ago, it was assumed that dendritic cells could only display antigen made from protein. This has been proven wrong! Dendritic cells run polysaccharide antigens, suggesting the variety and shape of these carbohydrates play a key role in immune health. And the main reason water-soluble compounds, such as beta-glucans, in both mycelium and fruiting bodies, are of great influence and importance. Healthy bacteria and fungi in our guts are commensals that help regulate inflammation. They help fine tune the inflammatory response to avoid the host developing chronic inflammation, and yet allow pro-inflammatory cells to be trigger-happy when pathogens appear.

Recent work by Ray et al. (2018) found evidence that the splenic anti-inflammatory pathway signals are transmitted via a novel neuronal-like function of the mesothelial cells. These cholinergic signals are disrupted by anti-cholinergic OTC medications, as mentioned in a previous article in FUNGI (10[3]:36-40). Li et al. (2018) identified a polysaccharide that down-regulates the NF-kappa B signaling pathway via the toll-like receptor 2. This helps to mediate the production of cytokines involved in efficient immunity.

Ethanol extracts showed significant inhibition of inflammation associated with a hyper-sensitive immune system (Sano et al., 2002). The mushrooms are an excellent source of extractable bioactive compounds, including potential pre-biotic activity (Rodrigues et al., 2017). A controlled study from

1998-2002 (Ikekawa, 2005) on the reduced risk of stomach cancer in people eating Nameko mushrooms found a significant benefit. Those eating no mushrooms less than once a week were given an odds ratio (OR) of 1.0 (of cancer risk), while those individuals eating Nameko more than once a week had an OR of 0.56, suggesting a nearly 50% reduction in cancer risk for those eating Nameko.

It is certain the Nameko mushroom will soon take its rightful place in the Fungal Pharmacy, as a choice edible, with added medicinal benefit.

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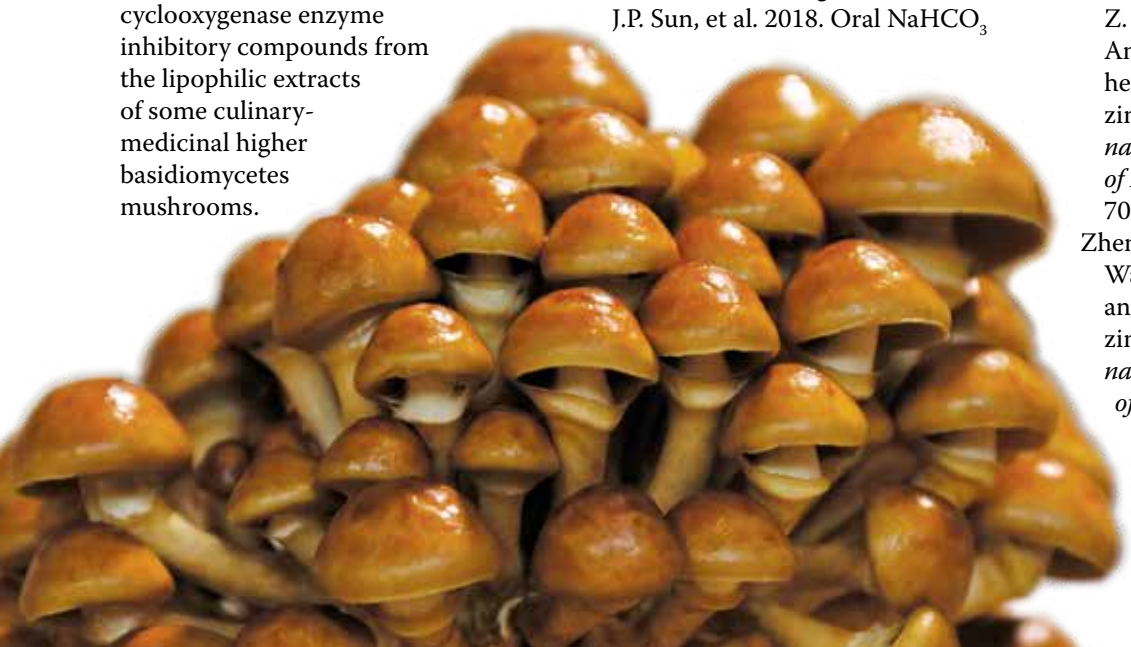

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