

MATSIS AND WANNABEES: A PRIMER ON PINE MUSHROOMS

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Summary:

Pine mushroomや「マツタケ」（もしくは親しみをこめたニックネームである *matsi*）と呼ばれる *Tricholoma magnivelare* が、世界でもっとも賞賛されるきのこであることに疑いはないであろう。欧米人にとっては好き嫌いはあるが一度好きになると病み付きになる味であり（私個人的にはとても好きである）、日本人にとってはまさに「きのこの王様」で、最高級品には驚くほどの値が付く。毎年、日本人のマツタケ通は、最高品質のマツタケに1本あたり50-100ドル（USドル）を費やすが、その数倍もの価格が付くことも珍しくない。日本でのマツタケの需要は供給よりもはるかに上回るため、採取業者は毎秋、金を掘り当てるかのごとくの希望をもって北アメリカ（特に太平洋岸北西部）に押し寄せる。商業面では、ブリテッシュコロンビアでは、Pine mushroomの輸出量が非木材林産物（NTFPs）の中で最も多い。

いわゆる「マツタケ」

は、*Tricholoma* 属のキノコのうち、北半球に分布する種の総称であり、その菌糸は針葉樹または広葉樹と独特な外生菌根関係を築く過程で、「シロ」と呼ばれる広範な白色領域を形成する。スパイシーで有機的なにおいが特徴的で、外観は白地に茶がまじっており、ややけばたってよごれた感じである。菌摺は白く、胞子紋は他のキシメジ科のキノコと同じく白色を呈する。

DNA配列解析により、北半球には主に、北米西部に分布する種、メソアメリカ地域に分布する種、そしてアジア、ヨーロッパ、北アフリカ及び北米西部に広範囲に分布する種の3つのマツタケ種が存在することが確認されている。

If you reside in Canada you likely call them pine mushrooms; in the USA, most refer to them by their Japanese name, matsutake. Is it *Tricholoma magnivelare* or *T. matsutake*? And what about those other matsi lookalikes? Some smell remarkably similar to the “provocative compromise between red hots and dirty socks” that Arora



Figure 1. Three matsutakes? Look again. These three *Tricholoma* species were collected by John Sparks in New Mexico and growing within 100 feet of one another. From left to right, *Tricholoma focale*, *T. caligatum*, and *T. magnivelare*. Identifications were confirmed with DNA analysis by Dr. Clark Ovrebo. Photo courtesy of J. Sparks.

described (Arora, 1979). And what of rumors that we have the “true” matsutake of Asia in parts of North America?

Whether you call it pine mushroom or matsutake (or simply the more affectionate nickname “matsi”), there can be no question that this mushroom is one of the most highly prized in the world. It can be an acquired taste to Westerners (I personally love them!); among Japanese this mushroom is king, with prices for top specimens fetching kings’ ransoms. Annually, Japanese matsutake mavens will spend US\$50-100 for a single top quality specimen and prices many times this are regularly reported. Because the demand far exceeds the supply in Japan (97% of matsutake mushrooms consumed in Japan, annually, are imported, according to the Japanese Tariff Association [Ota et al., 2012]), commercial pickers descend upon North America (especially in the Pacific Northwest) every autumn with hopes of striking gold. Commercially speaking, in British



Figure 2. *Catathelasma imperiale* from Vancouver Island, British Columbia. Photo by B. Bunyard.



Figure 3. *Amanita smithiana* from Oregon. Photo by B. Bunyard.



Figure 4A.

Figure 4. Matsutakes from western and eastern North America. A) A large pine mushroom button from Vancouver Island, British Columbia; photo courtesy of K. Trim. B) A nice basket of Maine matsutakes; photo courtesy of D. Spahr.

Columbia pine mushrooms are the leading non-timber forest product export.

“Matsutake” refers to a loosely defined circumboreal (northern hemisphere) species complex in the genus *Tricholoma* whose mycelia form an extensive “white domain,” or “shiro” as they establish a unique

ectomycorrhizal relationship with conifer and broadleaf trees (Yamada et al., 1999). Matsutake shiroes comprise large contiguous areas of fungal mycelium growing on or under the surface of the sandy/flakey soil; shiroes are usually distributed in clusters on the narrow mountain ridges and south-facing slopes. Oftentimes the fruitbodies do not push up through the

and a third, widely distributed group in Asia-Europe-North Africa-eastern North America. Of course, all this is not quite so cut and dried; there are some smaller subgroups in each region and some interbreeding seems to be occurring as well.

These three groups do not coincide with currently used nomenclature. Most mycophiles still use *Tricholoma magnivelare* for all North American matsutakes, but it is doubtful the name is accurately applied to western and Mesoamerican populations. Charles Horton Peck coined the name *Agaricus ponderosus* in 1873 (and later *A. magnivelaris*) for matsutakes collected in New York. Along the way, they became *Armillaria* and finally Scott Redhead made the transfer to *Tricholoma* in 1984. Northeastern matsutake collections are generally made under jack pine (*Pinus banksiana*).

As mentioned above, the data suggest specimens from the Northeast are distinct from those of the West; northeastern matsutakes are more similar to those of Asia and Europe identified as *Tricholoma matsutake* (the “true” matsutake of Asia). *Tricholoma nauseosum* (the name given originally to European matsutake has fallen out of favor; Chapela and Garbelotto show they’re the same as the Asian species). Furthermore physical features (for example, more brownish



Figure 4B.

forest floor duff, instead all you see are “mushrumps” sticking up—a telltale sign that a matsi may be nestled beneath. With a matsutake mushroom in hand, identification is made easy by the spicy, organic (not earthy or mushroomy) smell; the mushrooms are white with brownish areas making them look almost dirty and slightly shaggy; gills are white and as with all *Tricholomas*, the spore print is white.

In 2004, Chapela and Garbelotto sought to resolve the origins and distribution of the matsutake species complex collected from around the world. Their findings show three main groups of matsutake mushrooms in the northern hemisphere (see map): western North America, Mesoamerica,

caps versus more whitish caps) do not really correlate with significant genetic differences. Physical features, plus odor, plus host tree can help narrow down your species, but several lookalikes can occur in very close proximity to one another—and look surprisingly similar (Fig. 1). *Tricholoma focale* (= *T. zelleri*) may look similar to matsutakes (I think it’s actually much prettier), but would not likely be mistaken for the real thing as it has a foul smell of rancid flour; I’m told the flavor matches the odor. *Tricholoma caligatum* smells weakly of matsutakes and indeed is often collected and eaten as such.

Based on their extensive sampling and DNA sequence analysis, Chapela and Garbelotto (2004) infer patterns of



The current idea of the global distribution of three different matsutake “species” based on Chapela and Garbelotto (2004). Western species (*T. magnivelare?*) in red; yellow is considered *T. matsutake*; and in blue a third, undescribed Mesoamerican *Tricholoma* species. Image concept by B. Bravi and A. Voitek.

migration and propose Eocene origins for the group of pine mushrooms in western North America by a transfer from an angiosperm-associated ancestor to an increasingly specialized conifer symbiont. From these origins, matsutake appear to have followed migratory routes parallel to those of coniferous hosts from Asia and through Beringia. They reject some earlier theories of migration, both the possibility that migration into Europe and Asia occurred through Atlantic bridges and the connection between matsutake populations in the Mahgrebi Mountains (Africa) and those from Europe. Instead, African and European matsutake appear to be the most recent ends of a westward expansion of the domain of these fungi from North America.

Besides *Tricholomas*, there are other lookalikes out there to know—some that are suitable for the table, others that will get you into trouble. *Catathelasma* species (*C. imperiale* and *C. ventricosum*) and *Amanita smithiana* are easily confused with matsutakes; they have a similar overall appearance, occur in similar habitat and at the same time of the year, plus they have white gills and white spore print. Missing is the characteristic matsi odor. A key character of identification for *Catathelasma* and mentioned in pretty much all guide books (but that is often not easy to see)

is the *double ring* on the stem (Fig. 2). *Catathelasma* species are edible and I find them to be very tasty; some authors are of a different opinion; the genus produces some of the largest gilled mushrooms in North America, hence the common name “big cat.” *Amanita smithiana* presents a much different story. Also huge and white, and forming “mushrumps” under the forest duff, nearly every year mushroom pickers collect one of these in haste, mistaking it for a matsutake. Although very pretty (Fig. 3), this mushroom is a member of the highly toxic section *Lepidella* (within the genus *Amanita*) and is responsible for numerous hospitalizations and causes severe kidney damage. When picking mushrooms for the table, always be certain of your identification.

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