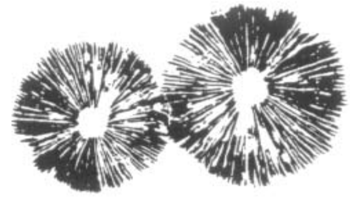
SPORE PRINTS



BULLETIN OF THE PUGET SOUND MYCOLOGICAL SOCIETY
Number 448 January 2009

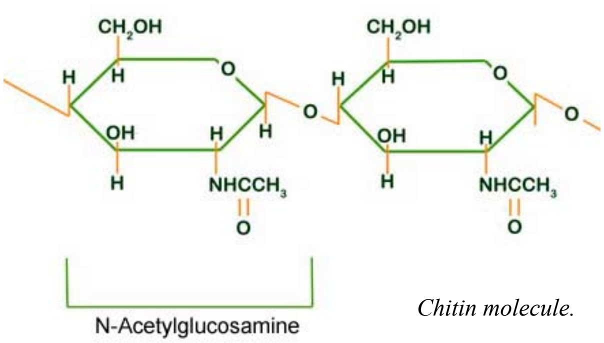
SHRIMP SHELLS, FUNGAL CELLS, AND JOINT PAIN

Brian Luther

The cell walls of higher fungi are composed mostly of *chitin*, (along with glucans and other polymers) which is a polysaccharide (literally: "many sugars") molecule constructed of long chain polymers of *n-acetylglucosamine*, connected by what in chemistry is called a beta-1, 4 linkage, so they connect end to end. Arthropod and crustacean (insects, shrimp, crabs, etc.) skeletons are also made primarily of chitin, and it's found in a variety of other invertebrates, such as earthworms. It's structurally sound and provides protection from the environment; it is pretty much impervious and is not digestible by most creatures. In its pure state, it is flexible and somewhat leathery in consistency. Depending on the other materials that fungi, insects, and crustaceans add to it, it can remain flexible or become rigid. It is quite durable.

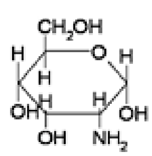
It's worth noting that two unrelated groups of organisms—fungi of the Kingdom Mycota and arthropods of the Kingdom Animalia (just to name a few)—would separately come to the evolutionary "conclusion," after hundreds of millions of years, that chitin was their best solution for a structurally sound material for cell walls (fungi) and for protective shells (arthropods).

Chemically chitin is very similar to cellulose, a related structural polysaccharide that's produced by plants, and differs by having only a few different atoms in the molecules.



Chitin molecule.

Recognize the *glucosamine* in the n-acetylglucosamine? If you chemically break down the long chains in the *chitin* polymer into smaller units then you get ***glucosamine.*** Glucosamine is basically a glucose molecule (basic sugar or monosaccharide) that has one oxygen atom replaced with a nitrogen atom, making it into an *amino sugar*. Glucosamine has a mild sweet taste (if you chew the pills), indicative of how close it is chemically to glucose (one atom different). It is digestible and widely used as a supplement by humans and in veterinary medicine to help reduce joint pain and inflammation. I'm guessing there are a lot of you out there who take glucosamine, in some form. It's a huge industry, with large numbers of brands and suppliers. The three most common glucosamine compounds consumed by humans are *glucosamine sulfate, glucosamine hydrochloride,* and *n-acetylglucosamine*. Glucosamine is a natural compound in the glycoaminoglycans found in the human joint cartilage matrix and connective tissues. It is produced by our bodies and is an important building block or precursor for the production of proteins necessary for cartilage formation.



Glucosamine molecule.

So, taking it as a supplement in some way encourages the natural cartilage-formation or development process, giving the positive effects that many people have experienced.

Most glucosamine produced for human consumption is processed from shrimp, crab, and lobster shells discarded from seafood processing plants, which is a cheap, abundant, and readily available source of chitin. The manufacturing process, simplified, takes raw crustacean shells and treats them with concentrated acids like HCl (hydrochloric acid), which breaks the chitin polymers down yielding as much as 80 percent or more glucosamine, which is then purified and mostly put in the form of pills. Presumably, large cultures of fungi producing vast amounts of hyphae could be grown and harvested for the chitin and processed in a similar way, but would obviously be more costly because the shrimp shells are just discard material anyway.

The subject of whether or not glucosamine taken as a supplement has beneficial effects is controversial. The Mayo Clinic website gives a favorable rating for glucosamine, especially as used for knee and general osteoarthritis pain. There is, however, considerable disagreement on whether glucosamine is beneficial or not, based on numerous medical studies. To play the devil's advocate, refer, for example, to the Quackwatch website for an article by Dr. Stephen Barrett: "Glucosamine for Arthritis: Benefit is Unlikely." There have been medical studies both in favor of and against its use. An excellent website that discusses both the pros and cons of glucosamine usage in detail and provides a huge list of scientific-

cont. on page 3

BOTANICAL ILLUSTRATION: ART MEETS SCIENCE

Kathy M Carr

An exhibit entitled "Botanical Illustration: Art meets Science" will be on display from January 6 through February 27, 2009, in Room 102 of the Suzzallo Library on the UW Seattle campus. The exhibit will feature illustrated botanical works from the collections of the University of Washington libraries and the UW Botanic Garden's Elisabeth C. Miller Library.

Included in the exhibit will be several examples of finely illustrated mushroom books from the collection of Dr. Daniel Stuntz, which were given to the UW Libraries after his death.

In conjunction with the exhibit, botanical illustrator and educator Louise Smith will be speaking on the history of botanical illustration on Friday, January 9, 2009, at 2 pm in the University of Washington's Odegaard Undergraduate Library, Room 220.

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PUGET SOUND MYCOLOGICAL SOCIETY

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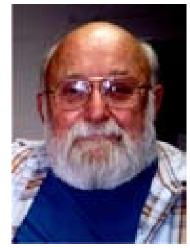
MEMBERSHIP MEETING

Milton Tam

Tuesday, January 13, 2009, at 7:30 pm at the Center for Urban Horticulture, 3501 NE 41st Street, Seattle.



Our featured speaker this month is Dr. James M. Trappe, who received both his undergraduate and Ph.D. degrees from the University of Washington. His talk will be on "Pacific Northwest and International Truffling." Dr. Trappe is currently on the faculty of Forest Ecosystems and Society at Oregon State University in Corvallis, and has been a consultant to the Australian government as a specialist in truffles and other forest fungi. Dr. Trappe is an authority on truffles, the underground fungi that are prized for their exotic aromas and flavors. His research interests include mycorrhizal ecology of subalpine and alpine ecosystems; mammal–truffle interactions; population ecology and functions of nonspecific biotrophic root endophytes; and taxonomy of hypogeous fungi. He is co-author of the *Field Guide to North American Truffles, Hunting, Identifying, and Enjoying the World's Most Prized Fungi*. He also co-authored *Trees, Truffles, and Beasts—How Forests Function*, a book that explores the complexity and interdependency of species in ecosystems from the microscopic to the macroscopic level.

Would persons with last names beginning with the letters L to Z please bring refreshments for the social hour?

CALENDAR

Jan. 13 Membership Meeting, 7:30 pm, CUH

Jan. 20 *Spore Prints* deadline
Board Meeting, 7:30, CUH Board Room

Feb. 10 Membership Meeting, 7:30 pm, CUH

CLIMATE, CREDIT CRISIS SPELL TROUBLE FOR TRUFFLES IN ITALY

Svetlana Kovalyova
Reuters, Nov. 19, 2008

SAN GIOVANNI D'ASSO, ITALY (Reuters Life!) - Nose to the ground, truffle dog Nice ploughs through fallen leaves in a Tuscan forest on a crisp November morning. But after hours of fruitless searching, Nice and her owner Massimo give up in yet another sign of trouble for the truffle industry in Italy.

Output of white truffles, the precious fungi with the delicate taste and strong aroma adored by gourmets, has fallen in Italy over the past few years. Climate change is a big culprit, bringing a damaging mix of drought and torrential rains. "In the past, in a good season, white truffle crops used to come up to 10 tons. Now it has halved," Giancarlo Picchiarelli, chairman of Citta del Tartufo, Italy's association of truffle diggers, told Reuters.

Output so far this year has fallen 20 percent to 30 percent from last year, said Luciano Tognazzi, secretary of a local association of truffle diggers, or tartufai, in the southern Tuscan province of Siena. Tight supplies of white truffles have driven prices above 4,000 euros ($5,050) for 1 kg (2.2 lb).

A giant 1.5 kg white truffle unearthed in Italy was sold for $330,000 at an auction in December 2007. But then came the global financial crisis. Even the wealthiest people have been trimming spending, and demand for the gastronomic luxury of white truffles has dropped. Picchiarelli said local restaurants, major consumers of white truffles, have kept purchases to a minimum, buying the rare tubers only if they have secured orders from clients. However, demand from foreign haute cuisine restaurants remained stable, he added.

Truffles, a luxury of the past?

Even if truffle diggers have not been earning as much money recently as they used to, they have no plans to give up hunting.

Said Massimo, a gray-haired tartufai who refused to give his last name and said he had been truffle hunting for 30 years: "It is a passion, not the way to earn a living. Though making some extra has never done harm to anyone."

HEALTH INSTITUTE INFECTS MALARIA-SPREADING MOSQUITO WITH FUNGI

Leonard Mwakalebels
Daily News online, Dec. 3, 2008

Ifakara Tanzania - The Ifakara Health Institute (IHI) has embarked on a research experiment of infecting mosquitoes with fungi with view to killing the insect and subsequently combating malaria disease. In an exclusive interview with the *Daily News*, the institute's Acting Director Dr. Salim Abdulla identified the fungi as *Beavaria bassiana* and *Metarhizium anosiplial*, which live in soil.

He said the experiment would take between one and two years and that preliminary findings had showed that the fungi kill mosquitoes. Dr Abdulla said house experimentation would be followed by village-wide experimentation before embarking on large-scale experimentation.

Shrimp shells, etc., *cont. from page 1*

medical references is www.lifescript.com/Health/A-Z/Alternative-Therapies_A-Z/ NaturalRemedies/G/Glucosamine.aspx. This is certainly not the "last word" on the subject, as the references on this topic are virtually almost endless.

I wanted this article about the relationship between fungal cells, chitin, and glucosamine to be informational. It was not my intention to turn it into a testimonial about glucosamine as a supplement. However, I must tell you that both my wife and I discovered glucosamine several years ago and from our personal experience it's been a huge help for our "creaky" joints. It clearly relieves joint pain and discomfort for us (especially noticeable in the knees). We've found that you have to keep the stuff in your system, and this is corroborated by several references that indicate you have to take it for a while, and keep taking it, for any positive effects. If you have severe joint deterioration due to osteoarthritis, it may not be much or any help for you at all, but if your joints simply show signs of aging, with more mild symptoms, then you are most likely to derive some real benefits from its usage. It's very apparent to us when we've forgotten to take it on a daily basis and this is not hocus-pocus, because the relief we get is genuine, noticeable, and quantifiable. Some studies indicate that since the compound is found naturally in our system only as glucosamine sulfate, that's the only form that would do us any good. We have not found that to be the case at all. The kind we currently use is glucosamine hydrochloride, and we've not noticed any difference between its effect and that of the sulfate form, which we have also used in the past. There is also information that indicates that taking glucosamine as a supplement may actually help prevent further deterioration of a joint affected by osteoarthritis, in addition to relieving pain symptoms. The literature on this subject is unlimited on-line and if you spend days and days, as I have, searching and researching and reading about this subject, there is a lot of conflicting information and volumes of medical studies to consult, as I've already mentioned in the previous paragraph. You decide, but the "proof of the pudding" is if it does, in fact, have some beneficial effect for you personally.

In the oceans there are bacteria, one example being *Vibrio furnisii*, that break down chitin as their food source, mostly from cast off arthropod shells, but many marine animals have chitin-decomposing bacteria in their digestive systems. There are also chitin-decomposing bacteria in soil. These bacteria release enzymes (chitinases) that break the chitin polysaccharide chain down into basic sugars. Without chitin-eating bacteria like these, the oceans would be piled high with accumulated arthropod shells and other chitinaceous debris, the same way the forests of the world would be with woody debris if it wasn't for white rot and brown rot fungi that break it all down and put it into a usable form.

Chitin has many commercial and industrial uses also, and we can thank the chemical engineers out there for figuring all this out. There's even a commercial or industrial trade society devoted exclusively to chitin: European Chitin Society (EUCHS) with an extensive website at www.euchis.org.

Another commercial substance that's produced from chitin is *chitosan*, which is n-deactylated chitin that has many chemical, industrial, and medical uses but is insoluble in water. It is offered as a supplement consumed by humans also, but it's not known to have any beneficial effect on joints or joint pain, as glucosamine does. Chitosan as a supplement is even more controversial than glucosamine, because it's claimed to have almost miraculous weight loss benefits, but unlike glucosamine use, there is little valid medical support for this. It is also produced in quantity from chitin, but by using strong alkalis to deacetylate the chitin molecule rather than the strong acids used for the commercial production of glucosamine. There is a wealth of information about chitosan on the Web as well, so help yourself if you want to learn more.

With the bulk of fungal cell tissue being made of chitin, humans do not possess the digestive enzymes necessary to break the material down, just as with plant cells that are composed of cellulose. This means that raw fungal cells pass through our digestive systems as "roughage," just like any other uncooked vegetable matter. So it makes sense that cooking edible fungi prior to eating would be beneficial for more than one reason. (1) Cooking breaks open the fungal cells that are protected by a cell-wall shield of chitin, more fully releasing, in mass, the fungal protoplasm or cell contents for our digestive systems to utilize, thereby getting more nutritional benefit from the food. (2) There is a significant increase in culinary or gastronomic appeal because after cooking an edible mushroom it is much more flavorful, compared to eating a raw or uncooked specimens. Compare, for example, the flavor of slices of raw *Agaricus bisporus* (button, Crimini, Portobello) to slices of the same mushroom sautéed. There is no comparison in flavor. The cooked specimens are much tastier and more appealing, even before adding butter, fresh garlic, olive oil, or herbs.

It is always advisable to cook mushrooms (or for that matter any food) not only for the two reasons given above, but for a third reason—cooking the mushrooms will kill any parasites (nematodes or pathogenic bacteria) that might be hiding there as well.

So, the next time you consume a dish with wild or cultivated mushrooms, remember the close connection between shrimp shells, fungal cells, and glucosamine. You'll be glad you did.

NATURE'S TEFLON FOR YOUR ARTERIES

http://seattlepi.nwsource.com/health/, Dec. 10, 2008

Some people think ordinary grocery-store mushrooms are nutritional nothings. But enlivening soup, salads, sandwiches, and anything else you can think of with these flavorful fungi could mean something big for your heart.

Mushrooms may be the top source of a compound called ergothioneine. That turns out to be a big word for healthy. In the lab, the substance reigned supreme in inhibiting adhesion molecules—the bad boys responsible for helping plaque-forming cells latch onto blood vessel walls.

Ergothioneine is found in other foods, too, including wheat germ and chicken liver. But the amount in white button mushrooms is four to 12 times higher, and meaty Portobello mushrooms have even more. Add to that the fact that Portobello 'shrooms—just 22 calories per raw cupful—often can stand in for fatty meat (far more than 22 calories per cup!) and contain a lot of magnesium, too, and you have a tasty recipe for younger arteries and maybe a smaller waistline.

Other reasons to choose mushrooms: In another study, the white button variety boosted production of natural killer cells in mice. If the same thing happens in humans, that's great news, because killer cells help defend against tumors and virus-infected cells. The biggest reason to pile them on wherever you can imagine: They taste great.

FUNGI—COMMON, RARE, AND IN BETWEEN

Bryce Kendrick

Botanical Electronic News, April 15, 2005

Introduction

Presumably, everyone has some idea of what he or she means when they use the words "common" or "rare." Surely, you may say, a common fungus is one we encounter often, and a rare fungus is one we find only occasionally (or may never have seen). But in saying this we are merely moving the argument back a level. What do we mean by "often" and "occasionally"? "Never" is unambiguous for any particular study, but proving actual total absence (as would be the case in extirpation or extinction) is extremely difficult.

Certainly, we can all think of macrofungi we consider rare. I have seen the stellar *Collybia racemosa* on only a few occasions. (How many other agarics bear visible anamorphs on their sexual fructifications?) I have found *Asterophora lycoperdoides*, which parasitizes other agarics, even less often, and I have encountered its congener, *Asterophora parasitica*, only once or twice. (Too bad, since these are amazing species in which the tissue of the mushroom cap becomes converted into asexual chlamydospores.) At the other extreme, *Stropharia ambigua* and *Pluteus cervinus* are seen in the woodlands near my home on a regular annual basis, as is *Russula brevipes*.

This raises the issue of geographical distribution. Some species which I remember as being "common" in Ontario are not found at all on the west coast (and vice versa). That is a valid biogeographical issue, but it is beyond the scope of this essay.

Here are a few other variables and factors not yet fully considered in studies of fungal occurrence in restricted areas:

Distribution

Of course, even at the local level, we can only expect a fungus to occur in the appropriate habitat. Ectomycorrhizal mushrooms can be anticipated only where their host trees flourish. Saprobic fungi may be more widely distributed, though some of them, such as *Strobilurus trullisatus*, which grows almost exclusively on decaying Douglas fir cones, are highly substrate-specific. This essay does not deal with that aspect of mushroom distribution. The assumption being made is that we are seeking the fungi in their normal haunts.

Fruiting season

The same kind of caveat applies to seasonality. No point in looking for most mushrooms in August along the east coast of southern Vancouver Island—it is simply too dry. So we must assume that the sampling is done at appropriate times of year.

Size of individual fruit bodies

The size of a mushroom may also be expected to have some impact on the number of basidiomata produced. For example, we are unlikely to find as many fruit bodies of *Russula brevipes*, a very large agaric with caps 80–200 mm in diameter, as of *Mycena aurantiidisca*, the caps of which are usually only about 10 mm wide, since the biomass of an individual basidioma of the former must be several hundred times that of the latter, therefore representing a much larger investment of energy on the part of the mycelium. (Though we may note that the *Russula* obtains most of its energy directly from a cooperative tree, while the *Mycena* must depend on its own enzymes to degrade tree litter into an assimilable form.)

Longevity

Not only the size, but also the longevity or persistence of fruit bodies will have an influence on the frequency with which they are recorded. There is some information on this, but it has yet to be compiled and consolidated, let alone factored into the equation that apparently needs to be attached to each taxon in this kind of study. Egli et al. (1997) found that monthly surveys recorded 31 percent fewer taxa than weekly surveys. This reduction clearly springs from the differential longevity of fruit bodies in different species.

Observer acuity

The size of basidiomata may also affect the likelihood of their being recorded. While *Russula brevipes* is hard to miss, tiny grey or brown *Mycena* species, unless present in numbers, can easily be overlooked, and there are much smaller "macrofungi" out there as well. Nevertheless, I have assumed that, for the purposes of the various studies quoted here, experienced eyes will miss very little.

Biological associations

It is clear that ectomycorrhizal fungi such as species of *Russula* persist for years or generations on and around the roots of their plant partners. This makes it obvious that in years when such fungi do not fruit they are not absent from the habitat. Nevertheless we must be allowed to make at least some judgments about rarity on the basis of what we find fruiting, and the prolonged reluctance or inability of many fungi to make fruiting bodies on an annual basis would seem to affect their potential for long-distance dispersal.

As an illustration, let me draw some perhaps instructive comparisons with plants. When looking for a plant, we can in many cases say that if after prolonged and extensive searching, we find it only in a few locations, it is rare. This will certainly be true of persistent plants such as trees or perennials. We cannot say exactly the same about ephemeral plants such as some small spring annuals which, if not sought at the proper time, will simply not be found.

A majority of fungal fruit bodies are similarly fugacious, and will not be found unless sought during their evolutionarily determined fruiting season. There is one important difference between ephemeral plants and fungi. The plants often persist only as seeds, while in many cases the fungi live on as hidden, though extensive, mycelia, which can now be detected by molecular techniques. It is far easier to see and identify the fruiting part of the life cycle, when it occurs. Nevertheless, molecular approaches may ultimately revolutionize our concepts of rarity, though that potential revolution still lies in the future.

Now we have clarified the conditions under which we are operating, we can proceed with the aim of the exercise, to devise useful (because partially quantified) definitions of "*common,*" "*rare,*" and intermediate categories, as they apply to fungi. This may help us in communicating about our collections, and may yield one or two generalizations about these matters. Fortunately, I am aware of some publications and databases which can be examined, and this paper will undertake a limited meta-analysis of these data, as well as of some unpublished data I have been involved in gathering.

There may be many different ways of defining common vs. rare in a quantitative manner, but I will concentrate on only two. The first method, on which we have the most data, is based on the frequency of occurrence of fungal fruiting bodies over a period of several to many years. It does not consider the numbers of basidiomata found in any single year, but simply whether a fungus has been recorded in a particular year (that is the only information available from most such studies). The second method considers the numbers of fruiting bodies encountered in a single excursion or season, and although detailed studies in Japan have followed the occurrence of *Matsutake basidiomata* over many years, few if any such studies have apparently been carried out on an all-taxa basis.

Method 1 - Extended linear studies

One thing that becomes apparent as soon as we begin to analyze the available multi-year databases is that although they can give us a handle of sorts on the matter at hand, their extended duration, although far beyond that possible in most grant-supported studies, is nevertheless not long enough to ensure a full accounting of all the fungi that have the capacity to produce fruiting bodies in the various study locations.

I'll begin by providing a few numbers from a study in which I was involved: a five-year macrofungal survey of Clayoquot Sound (Roberts et al. 2004). We recorded a total of 551 species, but only 28 were found in all years, and 310 were seen in only one year. On average we found over 100 newly encountered taxa each year. Although the study lasted for only 5 years, the results already suggest that:

There are few common fruiting macrofungi.

There are many rarely or occasionally fruiting fungi.

There is an ongoing influx of previously unrecorded taxa to the database.

These numbers—the continuing high level of novelty we encountered—led us to assume that this accretion of taxa could be expected to continue for many years. Other longer-term studies confirm this impression.

A fascinating study by Tofts and Orton (1998) points out that although they had collected agarics regularly in a particular woodland in Scotland for 21 years, and had recorded 502 species in that time, in each successive year they still found species they had never seen before. They collected for over 20 years, and still could not say that they had a proper handle on agaric biodiversity in that woodland. They suggested that at least 25 to 30 years of collecting, and possibly more, would be necessary before that goal could be attained. I think they were being conservative in this estimate. It also seems intuitively obvious that fungi which appear only after more than two decades must be regarded as rare, at least by some definitions. Yet it is entirely possible that such laggards will be locally abundant when, eventually, they do fruit.

A more recent paper by Straatsma et al. (2001) emphasizes many of the same points. They collected basidiomata weekly for 21 years (1975–1979 and 1984–1999), and recorded over 400 species in a 1500 m^2 plot. Yet only eight species (2 percent) were found every year. The number of species found per year ranged widely—from 18 to 194—and even in the last year of the study, 19 species appeared which had not previously been found. Clearly, the authors had not seen the full diversity of macrofungi that existed in their plot. Significantly, 37 percent of the taxa they recorded were found in only one year.

In Fall 2003 the Cascade Mycological Society held its 16th successive mushroom fair at the Mount Pisgah Arboretum just outside Eugene, Oregon. As a guest speaker for the society I was fortunate enough to be invited to participate in the collecting trips leading up to the fair. The fair is an exciting survey of the larger fungi because over 300 species are usually on display—bespeaking a huge effort on the part of many members. I was also fortunate enough to get my hands on the statistics for all 16 years. Over those years almost 700 species have been recorded from the extensive and diverse habitats sampled by CMS collectors. When we arranged the data according to the number of years in which each species had been collected, an interesting picture emerged.

Let us begin with the extremes. Only 37 species (5.5 percent of the total number) had been found in all 16 years. Equally thought-provoking was the fact that no fewer than 190 species (almost 30 percent of the total) had been recorded only once in those 16 years, and almost 100 more (nearly 14 percent) in only two of the 16 years. Table 1 and Figure 1 show the number of species versus years recorded.

Table 1

Species	*Years Recorded*	*% of Total Species*
37	16	5.5
44	15	6.5
31	14	4.6
24	13	3.6
13	11	1.9
20	12	3.0
18	10	2.7
18	9	2.7
22	8	3.3
22	7	3.3
22	6	3.3
41	5	6.1
29	4	4.3
48	3	7.1
92	2	13.7
190	1	28.3

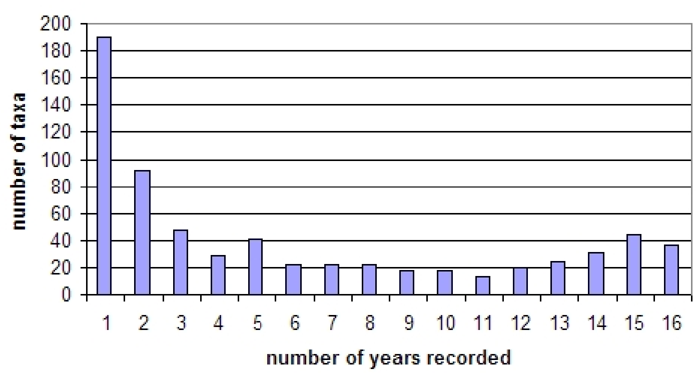


Figure 1

There are possible flaws in the data set. For example, some species may have been misidentified. But the general trends are obvious. A relatively small number of taxa will show up every year, or almost every year, while a larger number of taxa will be found much less often, and a very large number will be encountered only once every decade or so. How many more taxa will show up in the years to come? What is the full number of species that the Cascade group can expect to find if they keep at it long enough? If we may be allowed to take a quick look in the crystal ball, might we not forecast that after 50 years they will have found 1000 species fruiting?

cont. on page 6

Common, Rare, and In Between, *cont. from page 5*

This data set (for which I am indebted to the hardworking collectors and record-keepers of the Cascade Mycological Society) points up the necessity for very long-term studies wherever the diversity of fungi is to be fully explored, and calls for the accumulation of much concurrent data on weather conditions and other ecological factors if we are to understand why some fungi are so notably reluctant to fruit.

How are we to calculate common and rare in this case? It seems that we have no alternative but to make a few arbitrary decisions. For example, can a species be regarded as common if it does not occur every year? If we can countenance that concept, how many years of absence could be accepted for a "common" species? We must remember that seasons differ widely in the degree of encouragement they offer to the fruiting of mushrooms—too dry, too cold, even too wet are well-known situations. So it might be necessary to temper our purely numerical concerns with an injection of weather data. However, I do not have that information for any of the linear studies, and must leave it to their authors to provide such input, if they see fit.

My tentative, arbitrary, and open-to-debate conclusions from the linear Cascade Mycological Society study are as follows.

Ubiquitous or abundant: a fungus must occur in every year. Applies to about 5 percent of taxa recorded in the Cascade Mycological Society database.

Common: a fungus must be recorded 4 years out of 5. Applies to just over 10 percent of the taxa recorded in the CMS database.

Sporadic or occasional: taxa recorded in 2 or 3 years out of 10. Applies to about 35 percent of the taxa recorded by CMS.

Uncommon or infrequent: those taxa which occurred in only 1 year out of 5 or less often, down to 1 year in 10. Applies to about 20 percent of the taxa recorded by CMS.

Rare: those taxa that occurred less often than 1 year in 10. This applies to almost 30 percent of the taxa recorded by CMS.

To iterate: in the linear CMS study,

abundant — 5 percent,
common — 10 percent,
sporadic — 35 percent,
uncommon — 20 percent,
rare — 30 percent.

I believe that if the sampling is continued for another decade or more, the number of uncommon and rare fungi will increase substantially. This is a mathematical certainty, since no further abundant or common fungi could possibly emerge, while uncommon and rare fungi would continue to be added to the list.

To be continued.

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HEALING PROPERTIES OF *VOLVARIELLA VOLVACEA*

Mediatrix P. Cristobal
balita.ph/, Nov. 3, 2008

MANILA - An indigenous mushroom, found to contain properties that hasten the healing of a wound, has been successfully developed by Filipino scientists as a component in a woven bandage that would cater to the local medical industry.

Volvariella volvacea, locally known as kabuting saging or kabuting dayami, was found to be rich in chitin/chitosan which promotes the healing of wounds, Dr. Claro M. Santiago and Rhodora P. Flores from the Industrial Technology Development Institute of the Department of Science and Technology said.

Known to induce repair of tissues, chitin/chitosan is also present in the shells of crustaceans such as crabs, lobsters, and shrimps and in the exoskeletons of marine zooplankton. It is likewise found in the wings of certain insects, such as butterflies and ladybugs, and in the cell walls of yeast and other fungi.

In their study, Santiago and Flores found that using the mushrooms as a source of chitosan was reproducible and cheaper [than using synthetic materials]. And unlike synthetic materials, the thread derived from the mushroom could be knotted easily and was non-allergenic. The product was also non-toxic.

When bandages containing chitosan were used on patients' wounds, observers reported inhibition of microbial growth and re-epithelialization as early as day 1. In addition, the scientists also observed good oxygen permeability. The bandage was rated on a par with commercially available wound dressings treated with an antibiotic.

It is also relatively cheaper, being composed of about 50 percent agro-industrial wastes and 50 percent mushroom mycelium.

The innovation has been awarded the Utility Model certificate of registration by the Intellectual Property Philippines. This registration grants Santiago and Flores the exclusive right throughout the Philippines to make, use, sell, or import the utility for a period of seven years from the date of filing unless sooner terminated as provided for by law and the regulations. (PNA)

COURT ORDERS BURNING OF FUNGUS-INFECTED CHINESE GARLIC

thaindian.com
via **freshplaza.com/news_**, Nov. 27, 2008

NEW DELHI (IANS) - The Supreme Court has ordered that 56 tons of fungus-infected garlic imported from China be burned immediately as the central government felt that the fungus would spread in India and treatment of the consignment with fungicides would make it unfit for consumption. A bench of Justice Arijit

Pasayat and Justice Mukundakam Sharma Wednesday ordered the burning of the fungus-infected garlic, which was imported from China in early 2005. The consignment is presently rotting in a quarantined custom warehouse near Jawaharlal Nehru port in Mumbai.

After the consignment was found infected with *Embellisia alli* and traces of *Urocystis cepulae*, the customs authorities revoked the import permission given to Exim Rajathi India Private Limited, the company which brought the garlic from China.

This led the importers to petition the Bombay High Court, which ordered the release of the consignment to the importers after fumigating the same with methyl bromide.

However, dissatisfied with the high court order, the union government moved the apex court, contending that "there is a strong risk of this fungus, at present totally absent in India, affecting the future cultivation here for the reason that the scales of such infected garlic are peeled off for its use and thrown into dust bins as garbage and used as manure."

"This is one of the ways by which some other fungus got introduced in countries including India and elsewhere, and caused permanent damage to the crops which the agricultural experts found difficult to solve," the government told the apex court.

The government said that "in the present case, before the garlic was loaded in China for import to India, it was treated with methyl bromide fumigation." But it contended that methyl bromide is a treatment for killing insects and pests and not for killing fungi. "The methyl bromide fumigation treatment is not found to be effective against fungi as found on testing by Indian Agriculture Research Institute, New Delhi," it contended.

The government noted that fungi can be killed by fungicides, but if earlier treated with fungicides, food becomes harmful for human consumption.

Upholding the government's contentions, the court ordered the garlic be destroyed by burning in the presence of customs authorities.

MADAGASCAR HIT BY DEADLY VANILLA-KILLING FUNGUS

mongabay.com
Dec. 8, 2008

Madagascar, the world's largest producer and exporter of vanilla, has been hit by a deadly, incurable fungus that can kill vanilla plants before their pods reach maturity, reports The Associated Press. The development could have dire impacts for the country's vanilla industry which generates hundreds of millions of dollars per year for the impoverished Indian Ocean island nation.

Vanilla stamp, Madagascar.

"The situation is critical," Simeon Rakotomamonjy, a Malagasy government scientist and an author of a new assessment on the crop disease, told The Associated Press. "The disease now affects 80 percent of plantations around Sambava and Andapa," major vanilla-producing areas in the northeastern part of the island. Madagascar accounts for nearly 60 percent of global vanilla production, according to the U.N. Food and Agriculture Organization. In 2006 the worldwide vanilla trade was worth $422 million.

The researchers say a spike in vanilla prices ten years ago encouraged poor planting practices—including placing plants too close together—which have contributed to the spread of the fungus between plants. Vanilla prices tend to follow a boom-and-bust cycle, closely linked to crop production in Madagascar. Cyclones—which periodically affect the vanilla-producing region of Madagascar—and other disruptions drive prices higher.

Alain Paul Andrianaivo, a plant specialist, told the AP that fungal spores "attack a vanilla plant at the root, and a black rot spreads upward, often killing pods before they reach maturity." The disease is known only by its local name, bekorontsana, which means "falls to the ground often."

The researchers say that replanting affected areas with a fungus-resistant variety of vanilla could help the situation. However due to the long life cycle of vanilla—it takes at least five years before a vanilla orchid will produce beans harvested for extract—relief will be far from immediate for growers.

Traditionally, vanilla is grown in the shade of large trees found in the warm, humid forests of northeastern Madagascar. Vanilla plantations are meticulously managed by growers who often cultivate other crops including cloves, pepper, and rice on adjacent lands. So valuable are vanilla beans that some growers brand each bean with their mark to denote ownership.

Vanilla is a widely used flavoring in Europe and the United States. Best known for its use in ice cream, vanilla is also used in many deserts and beverages.

RUST FUNGUS USED TO ATTACK BLACKBERRIES

Fiona Allan
http://www.weeklytimesnow.com.au, Dec. 10, 2008

EAST GIPPSLAND, VICTORIA - For the first time, a new strain of leaf rust fungus is being released at sites across a whole region of Australia as part of a biological war being waged to keep invasive blackberries under control on both public and private land.

The rust release is still an experiment, but early results are proving to be a success, with parallel programs running in NSW and Tasmania.

Earlier this year, a small number of rust vials were introduced to fire- and flood-affected areas of public land in the North East, prompting the Department of Sustainability and Environment to fund a similar program in Gippsland.

Bairnsdale DSE field officer Brian Gustus said the department had already begun spreading the rust fungus in forests, parks, along rivers, and on private land. "The aim is to put it into the best places, not one category of land," he said.

"In remote areas we are targeting upstream of gorges and inaccessible or impractical country that is not able to be sprayed," Brian said. Other sites include areas where there is a danger that chemical sprays will drift onto adjacent crops and vineyards.

Blackberry leaf rust fungus is a defoliating disease that attacks the leaves, unripe fruit, and green parts of growing canes. The fungus is native to Europe where blackberries are the only known hosts. It has been fully evaluated as host specific and approved for release in Australia.

The rust appears as purple-brown blotches and yellow or black powder on the leaf. Heavily infected leaves turn brown, shrivel and fall from the canes. The fungus lives on actively growing

cont. on page 8

Blackberry Rust, *cont. from page 7*

blackberries, and over a life cycle of eight to 10 days, it produces fertile spores that are carried through the air to the next site.

Long-term monitoring shows steady reductions in the length of canes, reductions in biomass by more than 50 percent, and reductions in the number of daughter plants produced by up to 96 percent. It performs best in areas with a high rainfall or an average of more than 700 mm a year.

Brian said the rust would complement existing control techniques. The fungus weakens the plant over the long term, allowing other forms of control to be more effective, or the rate of spread considerably reduced.

He said different strains of rust had been tried in the past, and blackberries had developed resistance. "Some species aren't affected at all and that is why we have to do careful identification."

"There has been a lot of new research into choosing strains that target our most invasive blackberry species," Brian said. Eight new strains of rust are now available, with some of these targeting blackberry species that had proven to be rust-resistant in the past.

The application process is quite precise.

The rust comes in a release kit that contains one vial of rust spores, two 500 ml spray bottles, and 12 plastic bags. The spore vial needs to be refrigerated until release, but for a maximum of only two days. The spores are released in the late afternoon to ensure the sun is off the site.

Spray bottles are filled with un-chlorinated water and the rust vial emptied into one of them. The spores must be used within an hour of putting them into water.

The spray containing the rust spores should be sprayed on the underside of the first six to eight leaves on between 10 and 12 canes. The inside of a plastic bag should then be sprayed with the bottle containing only water and the bag placed over the sprayed blackberry cane and tied shut.

The bags are removed the following morning as early as possible before direct sunlight. Blue tags left on the cane act as markers.

Rust should appear two weeks after its release.

Brian said the rust vial was tiny and contained just 0.1 g of spores. "Because it is so small (the spores) take several weeks to gain momentum," he said.

YAHOO DISCUSSION GROUP

Want to stay in touch over the winter? The PSMS e-mail discussion group maintained by Yahoo Groups is an easy way to keep in contact with other members, circulate information about PSMS events, and post general mushroom information. To join, follow the directions on the PSMS website (http://psms.org/members/index.html) or on page 40 of the PSMS roster.

DUES ARE DUE!

It's time to renew memberships in PSMS. Unless you obtained or renewed your membership at or after the Annual Exhibit in October, it officially ended December 31, 2008.

To renew your membership, send your dues *now* to

Bernice Velategui, PSMS Membership Chair
2929 76th Ave. SE, #504
Mercer Island, WA 98040

Annual dues are $25 for single or family memberships or $15 for full-time students.

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