
Mycena News



The Mycological Society of San Francisco February, 2012, vol. 63:06

Daniel Winkler: Flavorful, Foul and Far Fungi

In the February 21 general meeting Daniel will share his stunning images and entertaining and educational stories from his journeys to far flung places. The hunting grounds range from dark mountain forests and vast alpine meadows, to village markets, restaurants and home kitchens. You will encounter many famous and familiar mushrooms in exotic places you never expected. The fancy flavorful mushrooms will be accompanied by fascinatingly odd fungal fellows, some of them stinky, slimy and incredibly beautiful, others eerily strange and more precious than gold.

Daniel's mushroom photos are from places as diverse as Tibet, Bhutan, China, Peru, Ecuador, Austria, Switzerland, Germany, Canada and the US (Hawaii, Alaska, and also Colorado, California, Oregon and his resident state, Washington).

Daniel Winkler is the author of [A Field Guide to Edible Mushrooms of the Pacific Northwest](#). He grew up collecting and eating wild mushrooms in the Alps and has been foraging for 15 years in the Pacific Northwest and working as mushroom educator and guide. He has been researching Tibet's ethnomycology for over 10 years. He organizes and leads several mushroom-focused eco-tours to Tibet and South America annually.

Mycodigest: Mycoheterotrophy in Orchids

By Thomas Madsen



Mycoheterotrophic protocorms of the spotted lady's slipper orchid (Cypripedium guttatum) are hosted by an unidentified strain of Tulasnella. Photo by Thomas Madsen.

Mycoheterotrophy, where plants acquire energy from fungal hosts as an alternative or a supplement to photosynthesis, is a strategy that has evolved independently in a number of plant lineages. With at least 20,000 species, the *Orchidaceae* is the largest family of mycoheterotrophic plants, although to the casual observer, most species may not appear as such. The majority of orchids are mycoheterotrophic only at the seedling stage, remaining dependent on fungal carbon for just a few months to a year. Such seedlings of California species are difficult to find in the field, as mycoheterotrophic development occurs underground in most terrestrial orchids. Eventually, the seedlings produce green, photosynthetic leaves and appear no different from surrounding autotrophic plants.

The most readily observable evidence of mycoheterotrophy in most orchids is actually the morphology of the seed. Like other mycoheterotrophic angiosperms, orchids are capable of acquiring fixed carbon from fungi during and after seed germination. This ability has apparently rendered energy storage largely unnecessary in seeds of mycoheterotrophic plants, because most, including the orchids, produce extremely small and poorly-endowed seeds. These "dust seeds"

Continued on page 4

President's Post

Sorry to have missed my post last month. We had such a tremendous contribution by all our great volunteers I was happy to see the space filled with JR's heartfelt thanks to all of you that helped. In addition to all the other volunteers I also want to thank JR personally for his tireless work on this and for his work putting on yet another great MSSF Fungus Fair.

January started off with a bang in the form of an amazing culinary group dinner prepared by Tom Sasaki. The menu was Japanese themed and excellent from the matsutake soup at the start to the agar-agar dessert at the end. Our general meeting in January featured Anna MacHugh talking about her radio documentary on mushrooms and the people who collect them. Her presentation included some outtakes that did not make the final piece. As some of you know Anna attended our fall Mendocino camp in 2010 to research and gather much of the content for the documentary through interviews with various people at the camp.

As I write this I am happy to note that we are finally getting some rain. I trust everyone is getting out and making up for lost time this season. Although it has only been a few days I am already seeing and collecting several species at locations which had early fall-like conditions just a week ago. Keep an eye on the MSSF online calendar since we have not been scheduling trips without rain but will now start to post forays since the weather is cooperating.

For my monthly discussion about volunteering I want to let you all know that the librarian position on the MSSF council will soon be vacated. Will Nicholls has done a great job of getting the library organized so that members can check out books electronically then pick them up and return them at general meetings. His proximity to the books also allowed him to help several people to purchase books at meetings. Will is moving out of the area soon so please contact me if you would like to volunteer to fill this important position.

We also need a new archivist. I am happy to keep the archives at my house but if you have access to a quality flatbed scanner you could do the Society a great service by scanning in the archives so that we can share them online. If you have interest in this please contact me. I will personally give a volunteer or volunteers complete lessons on how to scan and archive these materials. This training might prove useful if you have other materials you've been planning to scan and archive.

In closing I wish you all happy hunting in the rain! As always I hope to see you at an MSSF event soon.

Thanks for your support.

-Lou
president@mssf.org

Culinary Corner

January was an exceptional foodie month. I was in SF for a long weekend working the Fancy Food Show. I also attended the Good Food Awards. Congratulations to MSSF member and recent guest speaker, Connie Green, for winning a Good Food Award for her Elderberry Shrub! The strangest thing I sampled was Black Truffle Honey. I am known to be a staunch truffle devotee – but why...!

I rarely get to attend the general meetings these days, but the last one was an epicurean enchantment. Alvaro Carvajal (MSSF "uber" volunteer and generous donor of most of the mushrooms) and Toni Kiely (who opted for another meeting that evening) slaved all afternoon preparing miso/shitake soup, porcini spread on crackers, and stuffed baby portabellas. Kudos to Stephanie, Kim and Lisa G. for helping lay the spread out!

The next culinary group dinner will be February 6, and the theme is Hungarian – perfect for a winter month. The planned menu is:

Cauliflower soup
Chicken paprikash with porcini mushrooms
Fresh, buttered egg noodles
Braised cabbage
Green salad
Walnut torte

For details and online registration go to [the MSSF Calendar](#). Attendance is limited to 60 so register early. You can contact Bill & Carol Hellums at 415-347-7444 for more information, but they request that you make your reservation online if possible.

To volunteer with preparation, setup, and cleanup, e-mail team Captains David Eichorn & Jeanette Larsen at larkhorn@att.net.

The menu for the Japanese New Year dinner in January was a delightfully light, post-holiday-indulgence. Many hands made it possible: THANK YOU Tom Sasaki and Team!

Sake
David Eichorn
Matsutake Soup
David Campbell, Mark Lockaby, and Miyuki Irie
Cucumber Namasu
Lisa Bacon
Spinach with Tofu Sauce
Morgan Evans, David Gibson, Tom Sasaki and Mary Foote
Black mushrooms
Morgan Evans and David Gibson
Inari Sushi (seasoned rice stuffed in fried tofu sacks)
Mark Baugh-Sasaki, Sara Singer, Nathan Heilman, Toni Kiely (and Shelia ?) and Tom Sasaki
Terayaki chicken
Toni Kiely, Jeanette Larson, David Eichorn, Andrew Still, Liann Finnerty and Alvaro Carvajal
Tuna sashimi
Tom Sasaki
Shrimp cooked in sake
Tom Sasaki
Dessert: Kantan (agar agar) with layer of sweetened red beans and layer of green tea
Monique Carment and Honoria Sarmento.

-Lisa Bacon

WANTED! VINTAGE MSSF T-SHIRTS

Attention all MSSF members! Wanted! Your old MSSF t-shirts and other mushroom related t-shirts. If you attended the most recent MSSF fungus fair at the Lawrence Hall of Science you may have noticed the mushroom t-shirt quilt displayed behind Curt Haney's, "Just Mushroom Stuff" vendor booth. The plan is to collect as many old MSSF t-shirts as possible and have a mushroom t-shirt quilt made to raffle off at next year's fungus fair as a fund raiser. If we receive enough donations, we will have two quilts made, one for the raffle, and one to display in the future at MSSF fungus fairs as a work of art. Please look through your dressers and closets for old MSSF t-shirts, or any other t-shirt with mushrooms on them to donate to the cause. T-shirts in any condition will be accepted; stains and holes are ok and will not affect the quality of the quilts. Get your t-shirts to Curt Haney at a general meeting, mail them to him, or drop them off at the address below. If you have a large number to donate, arrangements can be made to pick them up from you. All donated t-shirts are needed not later than 1 May 2012 in order to have time to make the quilts and start selling raffle tickets at the first general meeting in September 2012. Thank you all for your generosity in making this request possible.

Curt Haney, 150 Sadowa St. San Francisco, CA 94112 (415)333-8820

MSSF ANNUAL HOLIDAY DINNER 2011

The annual MSSF holiday dinner was a great success! It was held on 12 December 2011 at Nick's Restaurant on Rockaway beach in Pacifica. The dinner this year was attended by 55 society members, most of whom arrived prior to dinner for no-host cocktails and socializing. Nick's did a great job of decorating the banquet room for us at no extra charge, and the dinner selections were delicious. Most attendees selected the prime rib of beef or the roasted whole half chicken for their main course. A selection of Shiraz and Chardonnay wines were also included with the cost of the dinner selections. Curt Haney donated wild fire morels and forest porcini mushrooms to the restaurant which they turned into fabulous sauces for our dinner. I want to thank Carol Reed for making the 120 candy cap mushroom biscotti cookies that went well with the ice cream for desert. (She also picked the mushrooms used to make the cookies).

Plans have not yet been made for next year's holiday dinner, but the council has suggested that we alternate the location between North, South, East, and West of San Francisco each year. The East and West were used over the past two years, anyone in the North or South ready to step forward to organize next year's holiday dinner? If not, an organizer from the East or West is welcome to step forward as well. Anyone who is interested in organizing the holiday dinner and a location for it next year, please contact Lou Prestia, (President@mssf.org) or any of the society's council members. Thank you all and I look forward to seeing everyone at the 2012 holiday dinner.

~ Curt Haney



February 2012, vol. 63:06

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Mycena News is the members' newsletter of the Mycological Society of San Francisco, published monthly from September to June.

Please e-mail photos, comments, corrections, and correspondence to mycenanews@mssf.org.

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contain a minute, undifferentiated embryo and lack endosperm tissue. Orchids have transparent seed coats and the lone embryo is readily observed with a dissecting microscope or even a hand lens. Due to their extremely limited energy reserves, the seeds are capable of minimal development on their own and therefore do not make significant growth until they are colonized by a compatible host fungus.

Mycoheterotrophic seedlings of most orchid species are hosted by saprotrophic/pathogenic fungi in the genera *Ceratobasidium* (including *Thanatephorus*) and *Tulasnella*. Both apparently lie within (or close to) the Cantherelloid lineage, although the placement of *Tulasnella* is still somewhat uncertain. The genus *Sebacina*, an early-diverging basidiomycete lineage, is also an important host of certain terrestrial orchid taxa, primarily within Australia. While a few species in *Tulasnella* and *Sebacina* are known to produce showy, resupinate fruiting bodies, fruiting in *Ceratobasidium*, *Tulasnella*, and *Sebacina* is usually inconspicuous and rarely observed. Prior to the late 1960's, when J.H. Warcup identified the perfect states of orchid host fungi in culture, the identity of such fungi was hidden behind the veil of the morphologically-defined genus *Rhizoctonia*, an assemblage of unrelated taxa for which fruiting bodies were unknown. Though shy to fruit, *Ceratobasidium* and *Tulasnella* often produce distinctive chains of moniloid (bead-like) cells in snowflake-like arrangements after growing in culture for a few weeks. In some cases, the proliferation of moniloid cells may eventually result in the production of sclerotia 1-2 mm or more in diameter.

Orchid-fungus interactions have been studied since 1904, when Noel Bernard reported that fungi were necessary for seed germination and seedling growth of the European bird's nest orchid (*Neottia nidus-avis*). Like most mycoheterotrophic plants, orchids exhibit specificity toward their fungal hosts, though the degree of specificity varies from one orchid species to another. While some orchids specialize on narrow fungal lineages, compatibility with multiple lineages of *Ceratobasidium* and/or *Tulasnella* is not uncommon. However, compatibility with strains of *Ceratobasidium*, *Tulasnella*, and *Sebacina* has only been observed in species of *Microtis*, a genus of Australian terrestrial orchids.

Interestingly, while horticultural interest in orchids has generated a great demand for propagation, it has done little to promote the study of fungi, at least until recently. Lewis Knudson's discovery (published in 1922) that non-symbiotic orchid germination and seedling development are possible on sugar-enriched agar media provided a convenient avenue by which orchid growers could bypass the fungi altogether. As a result, symbiotic orchid propagation has largely remained in the domain of hobbyists and academics rather than commercial growers. In many cases, symbiotic propagation is easily accomplished by sowing seeds on cultures of compatible fungi (typically with starch or cellulose as the fungal substrate); however, there are some recalcitrant orchid

taxa (e.g., *Cypripedium* and *Platanthera*) that appear quite sensitive to the substrate and/or growing conditions.

A formerly common misconception among horticulturists is that terrestrial orchids remain highly dependent on fungi as adults and therefore cannot be successfully cultivated. In contrast, recent isotopic investigations have revealed that most terrestrial orchids do not continue to receive fungal carbon as adults - some species even reciprocate by giving carbon back to the fungus! The reason for past difficulty cultivating terrestrial orchids is likely due, in short, to their sensitivity to root damage. Terrestrial species often do not respond well to the same non-symbiotic media used to propagate epiphytic species, and as a result, most plants in cultivation were formerly wild-collected. Many such plants died quickly from root damage sustained during collection, and those that survived often eventually succumbed to root rot due to the overly compacted and anoxic conditions of growing in pots of soil. Many terrestrial orchids are now propagated and cultivated quite successfully as potted plants, provided that the soil is heavily amended with porous, inorganic components and the plants are not over-watered.

There is, of course, a relatively small but highly charismatic group of terrestrial orchids which remain mycoheterotrophic throughout their lives. The most obvious are the strikingly-colored, non-photosynthetic species, such as the coralroots (*Coralorhiza* spp.) and ghost orchid (*Cephalanthera austiniiae*) native to California. Other species, such as the introduced helleborine orchid (*Epipactis helleborine*), are photosynthetic as adults, but continue to exploit fungal carbon as well. The latter species takes so much fungal carbon, in fact, that one can occasionally find albino mutants that grow to maturity, flower, and set seed without being able to carry out photosynthesis at all. Interestingly, the switch from seedling mycoheterotrophy to lifelong mycoheterotrophy is almost always accompanied by a switch away from "conventional" orchid host fungi to various genera of ectomycorrhizal basidiomycetes (and occasionally ascomycetes). It should be noted, however, that ectomycorrhizal strains of *Tulasnella*, *Ceratobasidium* and *Sebacina* are known, and such strains of the latter two genera have been identified as orchid hosts.

It should also be noted that while the orchids' "conventional" symbiosis with *Ceratobasidium*, *Tulasnella*, and *Sebacina* is highly unusual, it is not unique. The liverwort family *Aneuraceae* also associates with *Tulasnella* and *Sebacina* (but apparently not *Ceratobasidium*) in a way that appears cytologically identical to the orchids. In both groups of plants, the fungi form characteristic coils (or peletons) within the plant cells that break down and collapse over time. At least one species within the *Aneuraceae*, *Aneura mirabilis*, is known to be mycoheterotrophic. Peletons are easily observed by making hand sections of liverwort thalli

or orchid roots and examining them under the compound light microscope (no staining necessary). In the Bay Area, the helleborine orchid is a good target for such examination, as sampling this introduced species is not ecologically harmful.

Much more remains to be discovered about this interesting group of plants and their host fungi. Given the difficulty in obtaining mycoheterotrophic seedlings, the host fungi of most of the 20,000 known orchid species have not yet been identified. Given the scarcity of useful morphological characters within *Ceratobasidium*, *Tulasnella*, and *Sebacina*, most of the known fungal hosts do not yet have species names. A most interesting question is whether orchids and liverworts may actually be compatible with some of the same strains of fungi. Given recent advances in culturing techniques, particularly via "baiting" for host fungi - sowing seeds in the field in retrievable mesh packets, or sowing seeds in the lab on field-collected soil samples - it is likely that more data will be available in the near future.

Further Reading:

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Hynson, N.A., Preiss, K. & Gebauer, G. (2009) Is it better to give than to receive? A stable isotope perspective on orchid-fungal carbon transport in the green orchid species *Goodyera repens* and *Goodyera oblongifolia*. *New Phytologist*, 182, 8–11.

Ligrone R, Pocock K, & Duckett J.G. (1993) A comparative ultrastructural study of endophytic basidiomycetes in the parasitic achlorophyllous hepatic *Cryptothallus mirabilis* and the closely allied photosynthetic species *Aneura pinguis* (*Metzgeriales*). *Can J Bot* 71:666–679

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About the Author:

Thomas Madsen studies mycoheterotrophic interactions between plants and fungi, particularly those involving liverworts, orchids, and basidiomycetes, and is a PhD student in the Mishler Lab at UC Berkeley. He also enjoys music and

currently serves on the Board of Directors for the NorCal Theatre Organ Society.

Correction:

In the caption for Figure 2 on last month's MycoDigest feature "Hotlips' on the Beech" we accidentally elided the caption to read "Figure 2 (Top to bottom, left to right) Michael Kuo, Michael Kuo, Brandon". It should have read "Figure 2 (Top to bottom, left to right) Michael Kuo, Michael Kuo, Brandon Matheny, Mike Wood." We regret the error.

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Since 1950 the Mycological Society of San Francisco has been an innovative, cultural, and educational icon in San Francisco, the greater bay area, and beyond. Would you like to see this great educational organization thrive for many years to come? You may have assets to donate that can help ensure the long term future of this great organization. The Mycological Society of San Francisco has enriched the lives of thousands of Northern Californians. Your gift can help to sustain MSSF's contribution to our city, and the future of the entire bay area community for many years to come. Remember, MSSF is a 501(C) (3) non-profit organization, so all contributions in support of this great organization are tax deductible as allowed by law. Please remember the Society in your living will or trust.

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February, 2012, vol. 63:06

MSSF Calendar February 2012

February 2 nd :	MSSF Council Meeting
February 6 th :	February Culinary Dinner
February 21 st :	General Meeting
March 13 th :	MSSF Council Meeting
March 20 th :	General Meeting

Volunteers Needed

Mycena News Editor

The MSSF is looking for an editor to collect, edit, and lay out the pieces that make up the 10 issues across the year. Ideally you'll have some background in editing and layout but anyone with aptitude can be trained. Email max@maxgarrone.com

Librarian

Help organize and distribute the MSSF's printed resources. Email president@mssf.org

Archivist

The society still needs to scan its archives in order to share them online. Email president@mssf.org

Check the MSSF online calendar at:
<http://www.mssf.org/calendar/index.php>
for full details, latest updates and schedule changes.

The submission deadline for the March, 2012 issue of
Mycena News is February 19th.
Please send your articles, calendar items, and other
information to: mycenanews@mssf.org