

Speaker for
November 21
MSSF Meeting



Ralph Metzner, Ph.D.

Sacred Vine of Spirits and
Sacred Mushroom of Visions

Ayahwasca and the *psilocybe* mushrooms are two shamanic entheogens that have entered underground, like illegal immigrants, into Western societies in the late 20th century. Their use has spread, vine-like and mycelium-like, through the psychedelic subculture of individuals and groups interested in consciousness expansion, psychospiritual healing and growth, and the restoration of a more direct relationship with the sacred dimensions of the natural world.

Dr. Metzner will present the findings regarding these two mind-assisting medicines, and how they relate to psychotherapy, shamanic journey practices and alchemical divination.

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Mycena News

The Mycological Society of San Francisco November, 2006, vol 57:11

Mycodigest: Termite Balls and Cuckoo Eggs

Else Vellinga

Relationships between fungi and insects come in a wide array of forms. Some old-world termites and some new-world ant groups grow mushrooms as a food crop, *Cordyceps* species parasitize and kill caterpillars and grow bizarre and beautiful fruitbodies out of the insect bodies, the Laboulbeniales make microscopic structures of extraordinary beauty on insects without killing them. Then there are the many fungi which depend on insects for spore dispersal; stinkhorns are a good example of this group.

A Japanese termite researcher stumbled on a different living-together of fungus and insect.

Reticulitermes are termites that make their nests in rotting wood of conifers, and are found all over the Northern Hemisphere. The species *R. speratus* forms subterranean nests in which a few queens lay the eggs. The eggs are then piled up with care and tended by workers. These worker termites are blind, but can feel what they are doing, viz. piling up oval eggs. They grab the egg by the small side, and schlepp it from one place to another. But, among the oval translucent white eggs, the researcher found many round brown balls. The number of those balls varied from nest to nest, from a few to over 800, and there could be way more balls than eggs.

The first question to address was of course, what are these balls? Cutting them open shows that they are made up of a dense mass of fungal material. It is a sclerotium! This is a fungal resting body, that can endure periods of unfavourable conditions to sprout when things get better. Ergot is an example of a sclerotium former – its sclerotia stick out of the ears of barley and other grasses. Sequencing the balls showed that the fungus is an *Athelia* species. These are saprotrophic basidiomycetes that form white thin crusts on wood, like icing. Quite a few species are known for their sclerotia. Some are only known from a vegetative state (so-called anamorphs), and in that case they get the genus name *Fibularhizoctonia*. Under what circumstances *Athelias* make sclerotia, is not known.

The second question is why are the termites piling them up, can't they tell that this is something else? In the first place, the termite workers are blind, so they cannot see the difference, and as they handle the eggs by the small side, they do not distinguish between oval and round. But, they do have a feeling for size. Dummy eggs that were introduced experimentally and are too small or too big are rejected. These dummies were relatively heavy beads but weight plays much less a role than size. Feel must be important. The surface of the termite eggs is extremely smooth, just as smooth as the surface of the sclerotium, and much smoother than those of

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MycoDigest is a section of the *Mycena News* dedicated to the scientific review of recent mycological information.

MycoDigest: Termite Balls Continued from page 1

related *Athelia* species. And one factor is puzzling. The eggs are coated with a special wax, and apparently the termite balls have got it as well. Whether they make it or pick it up from handling by the workers is a mystery. Dummies have to be coated with this stuff, otherwise the termites will not touch them at all.

The biggest question is, who is profiting, the termites, the fungus, or both perhaps? The termites do not eat the sclerotia, they just pile them up, and tend them with their eggs. And tending eggs means keeping fungal foes at bay. The workers do that by putting their faeces on the eggs. The faeces contain anti-fungal agents which do not actively harm the sclerotia, but do prevent germination. Only when the sclerotia are put on the termite's garbage dump can they sprout. Till then, they are in a protected environment, but the protection thwarts them as well. On the other hand, the presence of the fungus does not increase nor decrease the viability of the eggs. So, there does not seem to be any benefit for the termites, and perhaps a little bit for the fungus.

This symbiosis has of course been compared with the nest parasitism of cuckoos – Mrs cuckoo lays her egg in the nest of a songbird, and her egg resembles that of the song bird in question. Different cuckoo individuals (of the same species) lay their eggs in the nests of different birds, and each is a perfect match in egg coloration and patterning. The little song bird tends the clutch of eggs, the eggs hatch, and the stranger which is bigger than the little bird's chicks, pushes these out of the nest, begs and begs and begs for food and grows bigger and bigger with the host parents feeding the interloper into adulthood.

But there are many differences with the fungus-termite symbiosis. In the cuckoo case, there is clearly a huge benefit for the cuckoo, and a big loss for the songbirds. Also, there is a distinct beginning of the relationship: the cuckoo lays her egg in the nest of another species. The fungus does not put its sclerotia among the termite eggs. How they end up there anyway is one of many remaining questions.

Some last information on the system: the fungus is widespread, and its sclerotia have been found in nests of three termite species in total, two in the USA, and one in Japan. Closely related termite species that do not have those sclerotia in their nests handle them like pros when they are put there.

Such perfect mimicry, and yet, no clear profit for either fungus nor termite. We must be missing something

Other questions that remain are how the sclerotia are formed and what does the free living form of the fungus look like (and whether it exists), do the termites seek out wood already infected with the fungus to make their nests, and how widespread is this phenomenon?

The full story of the egg-mimicking fungus can be found in the following articles:

Hospitality Committee Update

The new Hospitality Committee met on October 12th to formulate strategies (listed below) to help make visitors and new members feel welcome. The current members of this committee are Liana Hain, George Willis, Bailey Smith, and Lou Prestia, however, anyone in the MSSF can join at any time by contacting Liana Hain at liana.hain@ucsf.edu or (831) 227-4588.

Refreshments will be provided at the General Meeting during the 7:00pm to 8:00pm Mushroom Identification Hour, which takes place in the Buckley Room at the Randall Museum. Hospitality Committee members will be calling MSSF members to get volunteers to take turns bringing refreshments to this meeting. Refreshments can be as simple as jugs of juice, cups and boxes of cookies, or elaborate as something homemade that can serve about 15 people. We will solicit two volunteers, to cover refreshments for 30 people, for each General Meeting. A Hospitality Committee member will staff a "Hospitality Corner" in the Buckley room, greet members, and get to know new folks during this hour. The "Hospitality Corner" will also provide stick on name tags for attendees.

Finally, the Hospitality Committee requests that all Council Members wear your name tags at every MSSF function. Please contact Liana Hain if you need a replacement nametag.

Functions of the Hospitality Committee

1. Arrange refreshments for the General Meeting
2. Meet new people at all functions and make them feel welcome
3. Make First Contact with new members by email/phone and welcome them into the organization
4. Be an information resource for new members to help match them with their special fungus interests
5. Provide permanent name tags for all Council members and Hospitality Committee members
6. Provide stick-on name tags at the General Meetings and Culinary Dinners
7. Formulate, produce and distribute an MSSF information card

Matsuura, K., 2005. Distribution of termite egg-mimicking fungi ("termite balls") in *Reticulitermes* spp. (Isoptera: Rhinotermitidae) nests in Japan and the United States. *Applied Entomology and Zoology* 40: 53-61.

Matsuura, K., 2006. Termite-egg mimicry by a sclerotium-forming fungus. *Proceedings of the Royal Society B* 273: 1203-1209.

Matsuura, K., C. Tanaka & T. Nishida, 2000. Symbiosis of a termite and a sclerotium-forming fungus: Sclerotia mimic termite eggs. *Ecological Research* 15: 405-414.