SPORE PRINTS

BULLETIN OF THE PUGET SOUND MYCOLOGICAL SOCIETY
Number 483 June 2012

STUDY SUGGESTS DEATH CAP MUSHROOM POISON ARRESTS PANCREATIC CANCER IN MICE

ScienceDaily.com, April 2, 2012

The mere thought of an identification error sends a chill down the spine of any mushroom lover. The death cap mushroom (*Amanita phalloides*), which resembles the common white button mushroom, contains one of the most deadly poisons found in nature, α-amanitin. This substance kills any cell without exception, whether it be healthy or cancerous. At the German Cancer Research Center (Deutsches Krebsforschungszentrum, DKFZ) and the National Center for Tumor Diseases Heidelberg, immunologist Dr. Gerhard Moldenhauer, jointly with biochemist Professor Dr. Heinz Faulstich, Max Planck Institute for Medical Research, has now developed a method for destroying cancer cells using the dreaded fungal toxin without harming the body.

The trick to accomplish this is to deliver the poison directly to the right address in the body using something that virtually serves as a cab. In this case, the cab is an antibody whose highly specific arms attach to a cancer-typical cellular surface protein called EpCAM. The fungal toxin is linked to the antibody in a stable chemical conjugation.

In the culture dish, the poison-loaded antibody arrested the growth of pancreatic, colorectal, breast, and bile duct cancer cell lines. In mice bearing transplanted human pancreatic cancer, a single antibody injection was sufficient to inhibit tumor growth. Two injections of higher doses of the antibody even caused complete tumor regression in 90 percent of the animals. Even the higher doses did not cause any poison-related damage to the liver or other organs of the animals.

EpCAM, the protein chosen by the Heidelberg immunologists as the tumor cell recognition structure, is a characteristic membrane protein of epithelial cells. This type of cells lines all inner and outer surfaces of the body. Most malignant tumors originate from such epithelial tissues. Many of these, such as pancreatic cancer, breast and ovarian cancers, bile duct carcinomas, and tumors of the head and neck, produce too much EpCAM—and this is frequently associated with an extremely poor prognosis of the disease. EpCAM is therefore considered a suitable target structure for attacking tumor cells.

"Treatments with unconjugated antibodies against EpCAM have already been tested in clinical trials such as for breast cancer. They were intended to attack the cancer solely with the weapons of the immune system, but they turned out to be clinically ineffective," said Gerhard Moldenhauer. "However, our amanitin-conjugated antibody has a much greater potential for killing cancer cells."

Each antibody is linked to between four and eight toxin molecules. Amanitin is regarded as very suitable for this purpose. It is small enough not to be recognized as foreign by immune cells, while it is also robust enough to lend itself to chemical conjugation. "When developing toxin-conjugated antibodies you have to take an awful lot of things into account," Moldenhauer explains. "The cancer cell has to regularly take the target molecule including the attached antibody into its interior, for this is the only place where the poison can act. In the cell's interior, the poison needs to detach from the antibody or else it will not be effective. At the same time it is absolutely vital that it does not get lost while it is being carried through the body, because this could cause severe adverse side effects."

The dosage of the amanitin antibody needs to be determined with the utmost care. One problem is that liver cells are extremely sensitive to the fungal toxin; another is that other healthy cells carry the EpCAM molecule as well and are therefore endangered. However, the results obtained in mice give reason to be optimistic, according to Gerhard Moldenhauer: "Even at high doses we have not detected any organ damage in the animals. We therefore expect that there is a sufficient therapeutic window for a dosage that kills cancer cells while leaving healthy tissue unaffected."

Moldenhauer, who has many years of experience in developing therapeutic antibodies, already has plans for amanitin-conjugated guided missiles against other cancers. In particular, certain types of leukemia and lymphoma cells also carry highly specific surface molecules which lend themselves as target structures for poison-loaded antibodies.

ANCIENT PLANT–FUNGAL PARTNERSHIPS REVEAL HOW THE WORLD BECAME GREEN

Phys.org/news, May 15, 2012

Prehistoric plants grown in state-of-the-art growth chambers recreating environmental conditions from more than 400 million years ago have shown scientists from the University of Sheffield how soil dwelling fungi played a crucial role in the evolution of plants.

This ground breaking work provides fundamental knowledge of how plants colonized the land before roots evolved and the co-evolution of one of the most ancient relationships between fungi and early plants that played a founding role in the evolution of Earth's ecosystems.

The research highlights the importance of mutually beneficial plant–fungal relationships prior to the evolution of roots, whereby plants gain growth-promoting soil phosphorus from the fungi in exchange for sugars fixed by the plant through photosynthesis.

The study compared the efficiencies of plant–fungal relationships in land plant species spanning more than 400 million years of evolution under both modern day atmospheric conditions and CO_2 concentrations on Earth at the time plants first emerged onto the land.

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Spore Prints

is published monthly, September through June by the

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Annual dues: single or family **$30**; full-time students **$20**

CALENDAR

June 8	Field Trip (see website)
June 12	Membership Meeting, 7:30 pm, CUH
June 18	Board Meeting, 7:30 pm, CUH
July 16	Board Meeting, 7:30 pm, CUH
Aug. 20	Board Meeting, 7:30 pm, CUH
Aug. 21	*Spore Prints* deadline

BOARD NEWS — Denise Banaszewski

To confirm that PSMS is doing everything correctly on taxes, we had an accountant prepare our 2011 tax return. All is in order. Now that our website makes it easier than ever to sign up for events (which is a good thing), we need a cancellation policy with cancellation fees to cover charges we incur (e.g., Paypal charges). Look for a cancellation policy on the website in the event description—it may differ depending on the event. Milton Tam gave a very thoughtful presentation to the Board that came out of the Strategic Planning Retreat, which summarized and proposed recommended committees (and their tasks). There are some exciting opportunities on these committees; we'll just need to figure out how and when to staff them. Danny Miller is our new librarian. Welcome and thank you in advance, Danny! And last, but certainly not least, Dr. Ammirati has decided to step down as scientific adviser to PSMS. At his request there will be no formal announcement. However, we very much thank Dr. Ammirati for everything he has done for PSMS over the years and wish him the best!

MEMBERSHIP MEETING

Tuesday, June 12, 2012, at 7:30 pm at the Center for Urban Horticulture, 3501 NE 41st Street, Seattle.

Our speaker for June is Dr. Melissa Poe, who will present "Urban Understories: Subsistence in a Diverse Ethnoecological Community." Come hear about the social, cultural, and economic importance of urban foraging, the practice of gathering plants and mushrooms in the city for food, medicine, and materials.

Dr. Poe is an environmental anthropologist with the Institute for Culture and Ecology, where she is currently leading a project on urban foraging practices. She is a long-time Seattle resident and a member of PSMS. In her spare time, Melissa gardens, collects wild foods, and explores plant-based crafts. Melissa works with diverse communities in urban and rural landscapes to better understand traditional, cultural, and subsistence-based resource practices, with a particular focus on wild plant and mushroom harvesting. Melissa spent eight years studying with wild mushroom gathering communities in the forests of Oaxaca, Mexico, and, more recently, led one of the first ethnographic projects on urban foraging, with a case study based in Seattle. At the June members' meeting, Melissa will share findings from the Seattle Urban Gathering project, including a catalogue of over 50 fungal species gathered by mycophiles in Seattle.

Will members with last names beginning with the letter A–K please bring a plate of refreshments to share after the meeting.

FIELD TRIP REPORT, MAY 4–6 — Brian Luther

I counted about 14 cars in the parking lot when I arrived early Saturday morning with a load of firewood from Eagle Creek. Sue Lynette and John Hall were busy with hosting preparations and had an admirable spread of delicious morning goodies and extra good hot coffee ready for our eager members. Man, what a wonderful way to start the day! You out did yourselves, John and Sue, and we all appreciate your time and attention to detail. Thank you!

Fifty-two members signed in. The weather was great during the day but hovered just above freezing at night for the campers. After a few hours I led a group out to the big burn site nearby. Several members found small morels in the burn, but we were clearly early by a few weeks for the big flush. Jo Ann Henderson lost her camera in the woods and searched for it unsuccessfully. But it just happened to be her lucky day because Hans Drabicki found it while wandering through the steep woods in the burn—what a stroke of fortune! *Verpa bohemica* was the most frequently found fungus because of the abundance of Cottonwoods throughout the campground. Because it was so common, several members tried it for the first time. Some of the pretty Discomycetes found included *Peziza praetervisa* (purple when young), *Caloscypha fulgens* (bright yellow-orange with green tones), and *Geopyxis carbonaria* (brownish-orange), which was everywhere in the burns.

A phenomenal potluck ended the day on Cinco de Mayo. Several foods prepared for dinner reflected this Mexican holiday. Teddy Basladynski had made the mistake of telling me the weekend before at Rasar St. Park that his birthday was this weekend. As a surprise I baked him a German chocolate cake and we lit a candle and sang happy B-day.

I had to bail out early, after potluck, because of Mushroom Maynia at the Burke Museum the next day. This made for a very hectic weekend.

Everybody seemed to enjoy getting out for the hunt, the good food, and the friendship.

FIELD TRIP REPORT, MAY 12 — Brian Luther

Ron Post and Wren Hudgins volunteered to get there a couple of days early to reserve our favorite spots. They also brought two 10-ft. canopies and set one up. Thanks for your help!

I brought a load of wood from Eagle Creek at 7:45 am, Not long afterward our hosts, Teri and Robert Stephens, rolled in. They had stayed in a motel in Cle Elum and pre-ordered the morning's goodies from the Cle Elum Bakery. What a treat! The great hot coffee and breakfast goodies Robert and Teri prepared kept us going for a long time and gave us all the energy to focus on mushrooming. Extra special thanks, Teri and Robert, for all your work. It was appreciated.

It was a gorgeous day, and 60 members signed in. Only a few verpas and morels were found, along with small collections of oyster mushrooms, so edible pickings were pretty slim, overall. Ron and Wren took a group out, and new members Carolyn and Bill Hart found several *Calbovista subsculpta* in prime condition (all white inside). Once home, they prepared it as I had suggested (slice about an 1/8 inch thick, dip in beaten egg or egg substitute, roll in bread or crackers crumbs, and sauté in oil or butter). Unfortunately, it did not agree with Carolyn, giving her some gastro upset, but Bill had no problem eating it. She's going to try peeling the peridium (thick rind) off first next time, to see if that makes a difference. A nice selection of twenty or so spring fungi was displayed on a table, along with wildflowers and other plants. The 4:00 pm potluck was really good, as usual, and everybody seemed to have a fun day.

WORKSHOP ON COOKING AND PRESERVING WILD MUSHROOMS — Patrice Benson

What to do with the Mother Lode of Wild Mushrooms that you finally found? Join this workshop for slides, cooking demonstrations, tasting, and preserving directions. This workshop includes recipes, instructions, and lots of show and tell about cooking and preserving your foraged or cultivated mushrooms. Basic techniques and recipes as well as some exotic preparations will be demonstrated and shared. Some hands-on experience will be available to the willing! Instructor Patrice Benson has been collecting, cooking, and eating mushrooms for 35 years and still lives to tell about it!

When: June 24, 2012; 10 am – 2 pm.
Where: Douglas Classroom at CUH
Cost: $30.
Requirements: Membership in PSMS & advanced registration

Seating is limited.
Fun and enjoyment are unlimited.

EVEN THOSE WITHOUT AN EYE FOR THE ELUSIVE MOREL CAN ENJOY THEIR SEASON

Ellen Creager

abstracted from the *Detroit Free Press*, May 13, 2012

It's great to build a weekend vacation around hunting morel mushrooms—but if you think someone's going to reveal their secret spot, you're crazy.

"Morel hunters are worse than fishermen," says Brian Lawson, spokesman for Crystal Mountain Resort and Spa. "The CIA can't keep secrets that well." Morel hunting is similar to searching for a lost silver mine.

Even so, there is a way to have a fun fungus vacation:

Cheat.

Go on a guided hunt. The National Morel Festival in Boyne City, Michigan, for example, offers three sponsored morel hunts, including a guided hunt for novices who don't know a morel from a mousetrap. Morel festivals also have the added benefit of providing luckless morel hunters with something less frustrating to do, such as riding the tilt-a-whirl.

Break down and buy morels, then tell your friends back home you found them in the woods. If morels are plentiful, they're about $20 a pound. In a bad year, they may go as high as $80.

Try your luck at winning morels in a raffle.

Surround yourself with lucky morel souvenirs. You can buy morel-themed T-shirts, embroidery kits, socks, clocks, mouse pads, magnets, mugs, posters, hats, mesh hunting bags, and books. You also can boost your morel mojo by buying morel-themed artwork.

Get yourself a pal who lives in morel country,

MAN FORGETS DRUGS, ASKS POLICE FOR THEM BACK

http://www.femalefirst.co.uk/bizarre/ , 23 May 23, 2012

A US man forgot his bag of drugs at a local grocery shop and asked police for it back.

According to Peters Township Police, Joseph Moody accidentally left his marijuana and hallucinogenic mushrooms at the store, so the shop owners contacted police and handed the contents over to them.

When the 31-year-old man called the store to find out where his drugs had gone he was told to get in touch with the officials, so he went to the police station to retrieve the substances.

Moody was then taken into custody and booked into Washington County Jail.

THE EARLIEST POSTAGE STAMPS WITH FUNGI

Brian S. Luther

This is the first of a series of articles devoted to fungi shown on international postage stamps or on related paper ephemera. New issues are appearing regularly from around the world.

The formal scientific study of fungi is called *Mycology*, and stamp collecting is called *philately*. Thus the subject of collecting postage stamps illustrated with fungi is called *mycophilately*. I've been collecting, photographing, studying, and researching international postage stamps, old postcards, and other paper ephemera illustrated with fungi since about 1980, and I have given slide lectures and written articles on the subject in the past.

As an introduction to mycophilately, there are three basic categories of fungi on stamps that people collect. However, many collectors have particular interests and are very selective on the specific topics they collect, so these are just trends that I'm mentioning below.

Categories of Stamps with Fungi

1. *Fungi as the main illustration*.

The fungi may be the only subject depicted on a specific stamp or they may be the most prominent subject shown with other background subjects. Also a sheet of different stamps may contain mushrooms as well as other subjects, but on separate stamps. The fungi are always obviously the primary illustrations and usually (but not always) are labeled with a scientific or common name. This category also includes microscopic views of fungi, such as plant or animal pathogens. You may not normally recognize them, but as long as they're the principal illustration on the stamp, they fit into this category. The first United States postage stamp with a fungus as the main illustration, for example, showed a microscopic image of the mold *Penicillium* (Luther, 2000).

2. *Mushrooms in the design of the illustration, or MIDs*.

The main illustration on the stamp is always something besides a fungus. The fungi on MIDs can be very obvious or very obscure, hiding in the background or border of the main illustration, or even on the selvage (in which case they're not actually part of the stamp). An example of a stamp not actually having a mushroom on it, but collected the same way, is a sheet with a large continuous panorama scene with individual stamps perforated here and there on small portions of the overall illustration; the mushrooms could be in the scenery but not actually on one of the stamps. Another example is fungi on the outside of a stamp booklet cover but not actually on the stamps themselves. These are still very collectible by mycophilatelists, if they become aware of them.

3. *Stamps depicting or relating to Dr. Alexander Fleming*, who is given credit for discovering penicillin and shared the Nobel Prize in physiology or medicine in 1945 for his work. There were, in fact, many contributors to this research, but Dr. Fleming got a significant part of the credit. There are many beautiful stamp issues from around the world on this theme. Besides having a picture of Fleming, they also often illustrate either a microscopic view of *Penicillium sp*., show a Petri plate with the mold growing on it, or have mushrooms some place on the stamp.

One mycophilatelic catalog (Gerlinger, 1991) also lists stamps showing Linnaeus. McKenzie (1997) also lists lichens, but these are not mainstream for collectors interested in fungi. People collect every imaginable variation, such as certain genera or certain species of fungi. Topical stamp collecting often also includes covers (envelopes) such as FDCs (first day covers), postal cards, and similar items.

Here in North America we mostly use the Scott Catalog as our reference numbers, but there are other worldwide stamp documentation catalogs. The *Stanley Gibbons* catalogue is used by Great Britain and most all Commonwealth nations, *Yvert* is French, *Michel* is German, and *Domfil* is Spanish (but is also in English).

The value of stamps depends on their rarity, denomination, and condition. In general, stamps that are in mint condition and unused or in mint condition and have never been attached to a stamp collection sheet with a stamp hinge are the most valuable. This is called mint never hinged (MNH) and can be determined by looking at the gummed surface for any imperfections. Stamps that have been hinged, or used, or cancelled to order (CTO) are far less valuable, unless they're rare to begin with.

The most important mycophilatelic references include Weber (1983–1994), Gerlinger (1991), Meixner (1995), McKenzie (1997), Casciera & Ultee (1997), and Gimeno (1999–2000). Selected articles can also sometimes be found in the journal *Biophilately*. All list stamp issues with fungi as the main illustration, and some also record the more common MIDs and Dr. Fleming issues; but none provide a thorough or complete coverage of MIDs.

The First Five Postage Stamps Depicting Fungi

I've limited this article to just the first five sets of stamps issued that have fungi on them. These are all MIDs. They're listed in chronological order below as they were issued. The numbers directly after the country refer to the Scott Postage Stamp Catalog numbering system.

1. *China 16* -1 candarin value, issued November 19, 1894. Three basidiocarps of *Ganoderma lucidum* (a polypore) are shown in grass at the bottom of the stamp. This is the *very first* stamp ever issued that illustrates a fungus. This is a beautiful salmon-red-orange stamp and is part of several issues belonging to what is called the Dowager series. This was the 16th stamp issued by the Empire of China (according to the Scott Catalog). Few collectors know this stamp has a fungus on it. In fact some of the specialized mushroom stamp catalogs in my references do not even mention it. It was overprinted with a surcharge as 29, 39 & 66. In 1896 the Chinese postal authority changed from the candarin to dollars and cents, and large sheets of already printed stamps were overprinted with the new denominations. The color is close to Cornelian Red in Ridgway (1912). *Ganoderma lucidum* is known as Lingzhi, Ling Zhi, or Reishi to the Chinese and is highly regarded in traditional medicine. It has been used for thousands of years. Its overall shape can be found decorating ancient artifacts and in works of art.

China 16.

Overprint of China 16.

B. Luther

China 16. Close-up showing Ganoderma *in grass at bottom.*

2. *China 20* - 5 candarin value, January 2, 1897. This stamp is light yellow-orange-brown, and shows the *Ganoderma* fruiting bodies in grass at the top of the stamp rather than at the bottom as in China #16. It also has a slightly different design in the center, with carp. It is also surcharged as Scott 32 & 51. The closest color match is Mars Yellow in Ridgway.

B. Luther

China 20 with Ganoderma at the top of stamp.

B. Luther

Overprint of China 20. Ganoderma most visible at top around overprint.

These two stamps are rare and very collectible. My experience with these old Chinese stamps is that the color and definition of different individual stamps vary quite a bit. After all, they are well over a hundred years old. On China 20 it's harder to see the *Ganoderma* because the basic stamp color is much lighter and there's not as much contrast as in China 16. I always shop around for the stamps with the brightest and darkest imprint because they're the easiest to see the illustration of the *Ganoderma* on. Also, on those that are overprinted with a surcharge I look for stamps where the overprint has not obliterated the fungus, if possible. The overprinted issues on China 16 tend to completely obscure the fungus at the bottom with the "cent" of "1 cent," but the overprints on China 20 normally allow you to see most of the *Ganoderma* at the top of the stamp.

3. *Hungary B79* - 1000 korona value, 1924. This is part of a three stamp set B77–79, with the main illustration being an archer teaching his son. This is what I call a 1/3 MID, meaning only one of the three stamps has a fungus on it somewhere. Look very closely (using a hand lens of some sort) and you'll see one mushroom in the lower right-hand corner, almost directly above the A in KORONA. Under magnification it's really quite clear.

B. Luther

Hungary B79.

Hungary B79 close-up showing single mushroom in lower right-hand corner.

B. Luther

4. *Japan 416* - 5 yen value, September 14, 1948. This depicts an alcohol (ethanol) distillation plant, but if you look very closely at the bottom of the stamp you'll see two lines of budding yeast cells on either side of the denomination. This is the yeast *Saccharomyces cerevisiae*—the bread, beer, and wine yeast. Again, this is best viewed under magnification, unless you have excellent myopic vision. This is the first microscopic illustration of a fungus put on a stamp and is what the yeast cells actually look like when viewed under a compound microscope at 1000x magnification.

B. Luther

Japan 416.

Japan 416. Close-up showing budding yeast cells on both sides of value.

B. Luther

5. *Yugoslavia 400* - 10 paras value, 1954. This stamp features a male Red Deer (*Cervus elaphus montanus*), but on the right in the background is a tree that clearly has a polypore conk on it (unidentifiable to species). This is one of a twelve-stamp set (Scott 398–409) with only this single stamp showing a fungus, so following my terminology mentioned above, it's 1/12 MID.

B. Luther

Yugoslavia 400.

After these first five MID sets, thousands of mushroom stamps from different countries all over the world have been issued. Of the specialized mycophilatelic

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ANCIENT PLANT–FUNGAL PARTNERSHIPS

cont. from page 1

Lead author Dr Katie Field, of the University's Department of Animal and Plant Sciences, said: "Our research shows for the first time how Earth's terrestrial ecosystems were initiated in partnership with soil-dwelling fungi nearly half a billion years ago and how these fungi played a crucial role in enabling plants to diversify into fantastically rich and biodiverse modern floras.

"The earliest land plants not only faced ever-increasing competition for light with the evolution of new, taller species of plants, but also experienced reduced fungal symbiotic efficiency and subsequently lower total capture of phosphorus as global atmospheric carbon dioxide levels fell.

"In contrast, the fungal symbiotic efficiency of the more sophisticated, recently evolved land plants with complex organs such as leaves and roots increased as CO_2 levels decreased. This would have given them a significant evolutionary advantage and has led to their dominance of world ecosystems today."

ZOMBIE-ANT FUNGUS HAS ITS OWN KILLER FUNGUS

Sindya N. Bhanoo

The New York Times, May 7, 2012

Now, a new study reports that the zombie-ant fungus itself faces attack by another fungus.

This secondary attacker, a white fungus, is "looking for its own lunch, and it thinks this dead ant is a nice thing to eat, along with the fungus that's eating the ant," said David Hughes, a disease biologist at Penn State and one of the authors.

This attack prevents the spores of the zombie-ant fungus from spreading and infecting other ants in the colony, Dr. Hughes said.

Zombie ant fungus being attacked by another fungus.

"Looking at the colony, it's a good thing for the ants," he said. "The enemy of my enemy is my friend."

It takes about three to nine days for ants to die after the zombie-ant fungus attacks. A month or two later, the white fungus might come along and attack the parasite growing from its remains, Dr. Hughes said.

He and his colleagues studied carpenter ants in the rain forests of Brazil and southern Thailand. There are more than a thousand species of carpenter ants throughout the world.

The intertwined lives of the fungi and the ants illustrate just how complex relationships are, Dr. Hughes said.

This may be particularly true in rain forest settings, since there is no winter season in which food sources might diminish.

"So life just becomes a nonstop hunt for lunch," Dr. Hughes said. "We really haven't gotten to the bottom of the complex interactions that are going on there."

The study appears in the journal *PLoS One*.

STAMPS, *cont. from page 5*

references I list, the Domfil Catalogue (Gimeno, 1999–2000) is the most current, but is still very out of date.

MIDs, in particular, are fun to look for and even more fun to discover on your own. How do you go about discovering them? Well, first of all, it takes a lot of patience going through hundreds of stamps that lend themselves to being MIDs. This usually involves going to stamp shows and looking at issues provided by a dealer or buying likely issues and studying them closely under magnification. For example, complex sheets that show many detailed wildlife scenes or natural panoramas with different habitats are often a good bet to start looking at with a hand lens, jeweler's loupe, or under a dissecting microscope to see if you can find any fungi that were included in the illustrations, either on or off the stamps.

The first postage stamps with fungi as the main illustration did not appear until 1958. This may be the subject of a future article.

For a discussion specifically of United States postage stamps illustrated with fungi (both main illustration and MIDs), please refer to Luther (2000, 2005, 2010, & 2011).

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SNIFFER DOGS SUCCESSFULLY DETECT SICK TREES

Kuo Chu-chen and Nell Shen

http://focustaiwan.tw/, May 23, 2012

Taipei (CNA) - Sniffer dogs trained by a university in southern Taiwan successfully sniffed out brown root rot disease in trees Wednesday, a feat that the trainer described as unprecedented anywhere else in the world.

Brown root rot disease, caused by the fungus *Phellinus noxius*, was reported to be affecting trees in Chung Shan Park, Pingtung

County, in the south of the country. The park officials then asked National Pingtung University of Science and Technology to use its trained dogs to help find out exactly how many trees were infected.

Chi Wei-lien, the dogs' trainer, brought two beagles to the park that morning and led them around each tree. When the dogs detected a sick tree, they would sit down on the infected roots and wait for Chi to give them food treats as a reward.

"Within only six seconds, the dogs were able to sniff out the location of the brown root rot," Chi said, adding that there have been no reported cases from abroad of using sniffer dogs to detect brown root rot disease.

He explained that the idea came from the dogs used by truffle hunters to sniff out the valuable underground fungus. From this, he correctly inferred that every type of fungi, including *Phellinus noxius*, has a distinct scent.

He then started training three beagle bitches aged around five, using *Phellinus noxius* grown in the lab. Vigor and a fondness for eating are the basic requirements for selecting dogs suitable for the task, he said.

With over 1,000 trees in the park, Chi said he expected to take about three days to finish examining all the trees.

Pingtung Magistrate Tsao Chi-hung also went to the park to find out how many trees were infected with the disease. He noted that the sick trees must be brought down in case they collapse suddenly upon people using the park.

Officials from the county's Public Works Department expressed hope that the dogs will help them find out which trees are infected before the disease runs rampant in the park.

Chi Wei-lien with beagle doing her thing.

SOME FUNGAL-FARMING ANTS ARE LOYAL TO THEIR CROPS

Wynne Parry

Science on msnbc.com, May 15, 2012

A group of fungi-farming ants are not only loyal to particular species of fungus, the relationship is so close it appears the ants and the fungus may be evolving together, a new study indicates.

Each species of farming ants exclusively grows a particular species of fungus to feed their colony, even when the ants' nests are spread as far apart as Costa Rica, Panama, or Ecuador, said the researchers, who calculated that the oldest of these relationships traces back more than 5 million years.

This dedication was surprising; previous work on other groups of fungus-farmer ants had suggested more diffuse relationships, with multiple ant species cultivating multiple fungal species.

The close relationships between these ants and fungus have important implications for their evolution; the results of the new study suggest that when ants switch crops, they diverge into a new species.

"That is probably the most intriguing part of all this, it was driving speciation," said Ted Schultz, a research entomologist with the Smithsonian Institution and an adjunct professor at the University of Maryland. Speciation refers to the formation of new species.

Fungus for life

About 240 species of fungus-farming ants have been described, with the most high-profile ones being leaf-cutter ants that collect leaves to feed a fungal crop that cannot survive without the farmers (likewise, the ants can't survive without the fungal food). Leaf-cutter ants belong to a group that evolved from ants that practice what entomologists refer to as a lower agriculture, growing fungi that can also survive alone, without attention from the farmer ants.

This study focused on a group of ant species named for the first species identified, *Cyphomyrmex wheeleri*, which belongs with the lower fungus-growing ants. Even so, *C. wheeleri* is fairly closely related to the higher fungus-growing ants.

"We wondered, 'Could what fungus you grow have anything to do with speciation?'" Schultz said, referring to the emergence of new species.

Ants rely on odor to identify potential mates from their own species, so it is possible male and female fungus-growing ants choose mates in part by recognizing the odor of the fungus with which the potential mate grew up, Schultz said.

Ant speciation

To test the hunch that the evolution of ant species was tied to the species of fungus they cultivated, the research team, led by Natasha J. Mehdiabadi of the Smithsonian Institution and the University of Maryland, analyzed DNA (deoxyribonucleic acid, the code that makes up genes) from 138 individual ants and 405 fungal samples taken from 88 nests in Ecuador, Panama, Costa Rica, California, and Texas. They also incorporated genetic data from other, related ant and fungal species into family trees they reconstructed for both the ants and the fungi.

"Contrary to expectation, we found that each ant species has been exclusively associated with a single fungal cultivar 'species' for millions of years—even though alternative cultivars are readily available," the team writes in research detailed Tuesday in the journal *Nature Communications*.

While each species of ants appeared loyal to a particular fungus, the fungi themselves were not as loyal, sometimes serving as a crop for more than one species of ant.

Even so, the relationships appear to have affected the evolution of the fungi as well, since they, too, appear to have diverged from their ancestors starting when they were first farmed by the ant ancestors of the *C. wheeleri* species, Schultz told LiveScience, adding that none of these current fungal groups is known to have free-living forms.

Alex Wild

Cyphomyrmex wheeleri *ants in Texas tend their fungus garden. The garden consists of a particular fungal species that the ants and their ancestors have continuously cultivated for more than 5 million years*

CISPUS FORAY

Ron Post

About 90 people scattered to the four winds and brought in a variety of spring mushrooms during the Joy Spurr Memorial Foray at the Cispus Environmental Learning Center May 18–20. A variety of mushrooms appeared at the identification table although morels were lacking in abundance this year. Yet there was plenty to do and the food provided was fresh, delicious, and filling. A Sunday morning nature walk hosted by PSMS Identification and Field Trip Chair Brian Luther was attended by some 20 people.

Foray speakers included Dr. Joseph Ammirati, Dr. Steve Trudell, Brian Luther, Patrice Benson, and Dr. Denis Benjamin. Brian Luther and Danny Miller were assisted in identifying by Noah Siegel and others, and the dye workshop (Alyssa Allen) and cultivation session (Milton Tam) were well attended. Thanks to Patrice for organizing the successful affair in honor of one of our most active charter members.

Cispus photos by John Goldman

This will be the last Spore Prints *until September.*
Have a great summer!

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Thank you to guest editor Ron Post, for putting together the April and May *Spore Prints* issues.