

# PLANT SCIENCE

## SAYS



Flowers grown by Deanna Nash

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### **International Team from Bayer Corp. Visits Montana's Cereal Pathology Program**

**By Alan Dyer**

On July 15<sup>th</sup> and 16<sup>th</sup>, an international delegation from Bayer Corporation visited the Montana State University campus for a small grain pathology workshop hosted by Alan Dyer. The 19 member delegation included toxicologists, plant pathologists, and product development managers from assorted countries throughout Europe, Asia, North and South America. They attended a two day workshop that started with a structured discussion of small grain production issues including economics, production practices and developing disease issues in the United States, mainly the Pacific Northwest and Montana. This discussion was led by M.S.U.'s own contingent that included Alan Dyer, Jack Reisselman, Bob Johnston, Andy Hogg and Jeff Johnston. On Wednesday, the delegation went to field locations in Bozeman to witness diseases common to Montana's cereal production systems and the environmental dynamics that play important roles in disease development. After their visit in Bozeman, the delegation flew to offices in Kansas for an in house discussion of topics covered during their Montana visit before flying back to their respective homes.

### **INTERNATIONAL SYMPOSIUM OF ARCTIC-ALPINE MYCOLOGY (ISAM) VIII, By Cathy Cripps, President of ISAM**

Arctic-alpine mycologists from 10 countries came together for the 8<sup>th</sup> International Symposium on Arctic-alpine Mycology (ISAM VIII) in August. For logistical and collegial considerations, participation is limited to 25 invited participants with a broad range of

experience in arctic-alpine mycology. The symposium consists of a series of field trips and presentations designed to discover and discuss the world's arctic-alpine Mycota. ISAM is held every four years at a field station situated near an Arctic or alpine field site. The scientific workshop is devoted to the study of taxonomy, ecology and physiology of fungi in cold-dominated environments. ISAM VIII was based at the Yellowstone Bighorn Research Association Geology Field Camp near Red Lodge, Montana from Aug 2<sup>rd</sup>-



10<sup>th</sup> 2008 and focused on the mycota of the Beartooth Plateau. The Beartooth Plateau is part of the Beartooth-Absaroka mountain complex, which contains one of the most extensive alpine areas in North America. It is one of 12 alpine plateaus that comprise the Beartooth Mountains and supports many high alpine lakes, peaks over 12,000 ft, persistent snowfields, and one of the richest floras of any mountain range in North America. Hosts for the workshop were Cathy Cripps (current ISAM president), Egon Horak (a past ISAM president), and Bob Antibus (early researcher on the Beartooth Plateau). The event was preceded by a presentation (Cripps) at the

Red Lodge Museum for local residents and a rain shower during the event portended good collecting for the following ISAM week. It also resulted in a lightning-ignited wildfire near Red Lodge that was thankfully contained just before ISAM. The smoke-filled skies cleared upon the arrival of participants at the Billings International Airport (a smaller airport than



### ***Snowbank collecting***

most mycologists expected). The late snow pack on the plateau resulted from the most significant winter snow accumulation in 32 years and the cold spring weather delayed the fruiting season, but we managed to “thread the eye-of-the-needle” between snow and fire for one week of decent alpine collecting on the Beartooth Plateau. Typically the alpine collecting season on the plateau runs from the 3<sup>rd</sup> week in August to mid-September and the short season can be truncated by dry conditions and/or early snow. This makes collecting conditions in the alpine much more “risky” than in relatively reliable arctic habitats. The alpine wild flowers were spectacular at their peak during the event due to the delayed season.

The YBRA Geology Field camp was selected as a base camp because of its historical academic atmosphere (initiated by Princeton University) and its convenient access to both the Beartooth Highway and the International Airport in Billings. There are few field stations in the lower US that offer easy access to alpine habitats. The geology field camp provided “rustic” cabins for participants, two large work rooms (up-graded to

accommodate us), and regular meals (thanks to our wonderful cook Jeanette!) that were announced by the ringing of the camp bell. Mycological highlights at the camp were *Calvatia booniana* (a giant specimen of the western puffball fruited near the cabins) and *Cryptoporus volvatus* on conifers, neither of which occurs in Europe. The wildlife of chipmunks, ground squirrels, deer, and at higher elevations marmots, pikas, and mountain goats were also of interest to our visitors. Grizzly and black bears are occasionally sighted near Red Lodge but are not a problem in the alpine zone. The camp is located in the montane zone and vans deposited us in the alpine zone in less than an hour for daily field trips. Collecting could initiate almost immediately on stepping from a vehicle, or with short walks through alpine terrain off the paved highway. A few of our participants coming from Arctic regions needed time to adjust to the higher elevations above 10,000 feet. The latitude of 45° N was the lowest many had encountered alpine fungi, since most participants typically collect above the Arctic Circle or in the Alps. Our (Cripps and Horak) field sites in the Rocky Mountains extend south to latitude of 36° N, almost unheard of in the Arctic-alpine mycological arena.

The habitat requirements for ISAM locations in addition to being situated in the true alpine above treeline or within the Arctic Circle are the presence of particular vegetation types. A significant portion of the arctic-alpine mycota (over 50%) is associated with *Salix*, *Betula*, *Dryas*, and bryophytes, as mycorrhizal mutualists, parasites, saprophytes, and basidiolichens. Therefore, alpine areas consisting exclusively of high grasslands, meadows, and turf are not sufficient for ISAM purposes. This necessitates including collecting areas of extensive dwarf (alpine) and shrub willows and mountain avens (*Dryas*) located in wetlands, cirques, below snow banks, and along water courses and not just on dry uplands. The Beartooth Plateau meets these requirements with extensive areas of dwarf and shrubby willows, *Dryas octopetala*, and at least one birch shrub in wetland thickets. Granitic rock with intrusives is prevalent on the plateau and the preferred wet limestone areas are rare. The fungi are

adapted to the cold conditions and cold rain or light snow during this time can stimulate fruiting.



### **Amanita**

Typical arctic-alpine Basidiomycota with circumpolar distributions were recorded at several sites, including: *Russula nana*, *R. norvegica*, *Lactarius nanus*, *L. salicis-reticulatae*, *L. lanceolatus*, *Amanita nivalis*, *A. cf. groenlandica*, *Entoloma alpicola*, *Cortinarius favrei*, *C. absarokensis*, *C. hinnuleus*, *Hebeloma alpinum*, *Inocybe subbrunnea*, *Galerina atkinsoniana*, *Omphalina rivulicola*, *Rickenella fibula*, *Arrhenia lobata*, *Mycena citrinomarginatum* and *Psilocybe chionophila*. Many of the macromycetes were discovered in excellent willow habitat below a (thankfully) persistent snow bank many meters wide and high. A limited number of Ascomycota were collected as well, some of the most interesting being those on the catkins or wet debris of willow or mosses, including *Ciboria amentacea*, *Croicreas amenti* and *Tapesia fusca* (this requires slopping around in submerged vegetation). Rusts were collected on *Salix* (*Melampsora* spp) and on *Polygonum*, *Caltha*, *Potentilla* and *Ranunculus* species. Nivicolous myxomycetes recorded from the foray are *Diderma alpinum*, *Didymium dubium* and *D. niviculum*. New gasteromycete records will also result from this workshop, including some rather large specimens. In all, more than 90 species (many more collections) were identified and about half are new records for the area, which reflects both the number of eyes searching for fungi (38), the expertise of

those involved (19), and the reasonably favorable fruiting conditions. The week following the ISAM workshop was dry and fruiting conditions deteriorated rapidly.

Daily field trips were followed by a regimen of description, identification, and preservation of specimens destined for herbaria world-wide. These sessions in the work rooms often lasted late into the evening and beer was also consumed on more than one occasion which facilitated interaction among the international mycologists. "Red Lodge" beer was a requirement however "Moose Drool" was considered the overall favorite.

At the Friday night business meeting led by Egon Horak, participants discussed and voted for the next ISAM (IX) venue. The arrangement when ISAM was initiated was that they should alternate between Arctic and Alpine regions and between continents. Past symposia were held in Barrow, Alaska (1980), Fetan, Switzerland (1984), Svalbard, Norway (1988), Lanslebourg, France (1992), Labytnangi, Russia (1996), Kangerlussuaq/Sisimut, Greenland (2000), and Finse, Norway (2005). At the Finse Field Station climatic conditions are a combination of those found in the Alpine and Arctic. North America was the next logical choice for ISAM 8, and the Rocky Mountain region was selected for the high alpine elevations and continental climate. For ISAM 9, proposals were presented for Austria, Northern Italy, Finland, France, the Tatra Mountains and Japan. A majority selected the field station at Keivo, Finland for ISAM IX in 2012. Esteri Ohenoya and Annu Ruotsalainen will negotiate the logistics with additional Finnish mycologists. Congratulations to our Finnish Colleagues!

On Saturday, symposium participants presented formal talks on arctic-alpine fungi which included: Arctic-alpine Mycology study before 1900 (E. Horak), Observations on Arctic-alpine Fungi (R. Antibus), Overviews of AA fungi in the Rocky Mountains (C. Cripps), the Carpathians (A. Ronikier), the Canadian Arctic (E. Ohenoya), Finse, Norway (P.A. Moreau), plus phylogenies of circumboreal species (M. Ronikier) and more specialized data on AA *Inocybe* (E. Larsson), AA

*Hebeloma* (H. Beker), AA Gasteromycetes (T. Kasuya), AA mycorrhizae (A. Ruotsalainen), and AA enzymes (M. Sasa). Also attending were mycologists H. Knudsen, S. Elborne, M. Nauta and L. Jalink. Additional logistical help was received from D. Bachman, A. Horak, J. Antibus and P. Trusty. According to the by laws, all ISAM participants are required to make a written contribution to the proceedings and ISAM VIII's will be published as a special issue of *North American Fungi*. Past proceedings are Arctic-Alpine Mycology 1-7, 1982-2008, published in book format or as a special issue of various journals (see references).

The final meals on Saturday included elk and bison sausage and well-walked beefsteak for a "cook-out" at the Lodge; this was geared to match the fare of previous ISAMs which offered muskox, seal, whale, reindeer, goat, roe, and rabbit. A healthy portion of Mission Mountain (Montana) wine and American sour mash whiskey was also enjoyed during the evening festivities which included a final rainstorm complete with thunder and lightening that blocked out the awaited Perseids meteor shower.

#### The importance of Arctic-alpine mushrooms in the larger scheme of things

"Arctic-alpine mushrooms" constitute a particular group of fungi adapted to cold climates. ISAM mycologists focus primarily on Northern Hemisphere fungi, but several of our members have made visits to Antarctica (few fungi), Chile, and other Arctic-alpine regions in the Southern hemisphere. While much is known of the Arctic-alpine fungi in Europe, Iceland, Greenland, Scandinavia, and to some extent Alaska and Canada, little was known about these fungi in the Rocky Mountains before our (Cripps and Horak) alpine studies began with an NSF grant in 2000. Since then we have cataloged and published on almost 200 species from the Beartooth Plateau in MT/WY and the Front Range and San Juan Mountains in Colorado. The fungi we are finding are primarily those that occur in other higher latitude Arctic-alpine habitats. It has been exciting to collect certain species on the high passes of Colorado and then fly across the continent to Greenland and continue collecting the same

fungi (although given the price of plane fares, one might question the necessity).

Arctic-Alpine fungi are important in terrestrial ecosystems as saprotrophs, parasites, and mutualists which include mycorrhizal fungi on roots and those in basidiolichens. Recently fungi have been considered as an interface between geological and biological process. Their ecosystem services include enhancement of nutrient uptake and drought tolerance in plants, nutrient recycling (even in thin alpine soils), mobilization of N and P from organic polymers, breakdown of rock, release of nutrients from mineral rock, aggregation of soil, promotion of water-holding capacity in soil, and carbon sequestration. These in turn can affect larger ecosystem processes such as erosion and water-shed dynamics. We now know that many of these fungi can even function below the snow surface in winter and spring.

Basic information on the biodiversity of Arctic-alpine fungi and their enzymes is an important contribution to Arctic-alpine ecology and as a benefit to society in terms of gaining knowledge on industrial enzymes that function at low temperatures. Several of the participants are from companies that bioprospect for cold-adapted fungal enzymes on a global scale. Knowledge of the unique mutualisms between plants and arctic-alpine fungi is also useful in high elevation reclamation, particularly in Europe where slope stabilization is required such as at ski areas. Several high-elevation fungi have been used for this purpose. In addition, large dwarf willow and *Dryas* mats (in some cases with their associative fungi) are currently being used as model systems to monitor climate in arctic situations. There is still much to discover in Arctic-alpine systems and probes have shown the activity of unknown fungi under the snow and ice. The ISAM expeditions of mycological explorers search to discover more.

#### References

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Cripps, C.L. & E. Horak 2008. *Sommerfeltia* 31: 101-121.

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Ectomycorrhizal fungi at alpine treeline in the Rocky Mountains: Baseline data and a review in the context of climate change. MTNCLIME, June 9-12. Consortium for Integrated Climate Change Research in Western Mts.

### Samples and Hornets

Gary Strobel was invited to Australia as a CSIRO senior scientist from July 18-August 8<sup>th</sup>. Strobel gave the plenary lecture at the International Conference on Biofumigation held in Canberra and then travelled on to Melbourne. At the Division of Primary Industries at three locations in this city, Strobel lectured on his work at MSU. He also presented a seminar at LaTrobe University at the center on Plant Molecular Biology under the direction of Dr Herman Spangenberg. He and a group of Australian scientists made collection trips to the Victorian coast country, the eastern ash forests of Victoria and Australia's Northern territory. When in Darwin, Strobel spoke to a group of students and government scientists at Darwin University, the only university in the NT.

Collecting plant samples in Victoria was a pure delight since so many interesting natural things common to Australia abound. For instance, near Apollo Bay along the Victorian coast at the newly created national park called the Great Otway National Park, temperate rainforest locations were picture perfect with representative ancient beeches (*Nothofagus cunninghami*) and fern trees such as *Dicksonia antarctica* so common to temperate rainforests in the southern hemisphere..

On the return back to Melbourne we were advised by the chief ranger of the Otway's , Peter Burns, to stop at the Kenneth river area. Wow what a surprise! As we pulled up to the river area to have lunch at a little sandwich place we were each given a handful of seed. What, is this lunch for us? Nope, said the owner wait for the birds. Eventually,

they came in droves to eat our seeds. The king Parrot was one of the most beautiful birds that came.



*Also wanting seed were the Rosellas*



Eventually, the store owner told us to go up along the road to see the koalas in the trees. We spotted 5 and one had her babe with her. These were the first wild Australian bears that I had ever seen.

On the second week end we headed for Marysville in the Mountain Ash forests of Victoria to collect plants. The Mountain Ash a eucalyptus sp – *Eucalyptus regnans* is the tallest flowering tree in the world. Although many have been harvested in the past, now

many areas represent national parks wherein the trees are saved from the woodsman axe.



***Mountain Ash forest east of Melbourne in Victoria, Australia.***

Then we flew across the red center of Australia on to Darwin in the Northern Territory. Unlike the cooler days in the wintry south of Australia with 32 in the mornings warming to 50-60 by midday, Darwin was on the warmish side with temps hovering around 85 each day. Our purpose there was to collect as many unique plants as possible. The first day we headed out the gun point peninsula east of Darwin on the coast of the Arafura sea. The first tree sampled was loaded with green ants that weren't happy to have their home taken so several of us were bitten by these well disguised creatures. However, this was nothing compared to our



next sampling of a terminalia tree. Scott Mattner was the first to approach it –lifting a small limb he exclaimed, “I think it is a hornet’s nest” and then all hell broke loose. Those angry creatures came at all of us with a vengeance. One hit Scott right on the eye ball and one got me on the lip. Glasses,

books, back packs, and samples went flying.



***The hornets and Ian Porter making a vain attempt to recover Scott's \$700 pair of eyeglasses that ended up not being found.***

It was the hardest collecting day of my life. Of course, this is not to mention the crocodile lying in the creek bottom among the fresh water mangrove roots waiting for lunch.

I must say that being with a government official during a plant collecting trip is quite nice since we had permits to collect plant parts in national parks. Time will tell if the collecting part of the trip was worthwhile; certainly, the opportunity to develop a set of colleagues in Australia who share an interest in the biology of endophytes was worth the trip.



***Certainly one of the most impressive sights in the NT are the innumerable termite mounds and artesian streams and waterfalls.***



up on the East Coast, and received my Bachelors in English from Lake Forest College in Illinois, followed by four years of graduate studies in Landscape Architecture from the Masters Certificate Program at UCLA Extension. I have two young children attending Irving School in Bozeman and have enjoyed getting to know the area and the outdoor opportunities it offers. We moved to Montana with our children and pets, which includes the chickens we brought from California along with many other two and four-footed creatures. I am pleased to be here in Montana, and look forward to sharing my experience and knowledge of Landscape Architecture with my students and peers.

**Towne’s Harvest Garden Luncheon  
By David Baumbauer**

Towne’s Harvest Garden staff hosted the 2<sup>nd</sup> Annual ‘President’s Luncheon at the Horticulture farm on August 18<sup>th</sup>. Joining President Gamble were Dean Jeff Jacobsen, and E,H&HD Associate Dean Jill Thorngren, Department heads Sherwood, Maxwell, and Dunnagan. Faculty included Bill Dyer and Allison Harmon (H&HD). Vegetables and eggs served were from the farm and the other ingredients were from local sources. After lunch, the group toured the farm.



**New Graduate Students  
Lindsay Elmore (Mike Giroux)**



My name is Lindsay Elmore. I grew up in a small mountain town in Colorado called Eagle. I enjoy skiing, biking, hiking, and almost everything else done outdoors. I came to Bozeman in the fall of 2003 to begin my undergraduate education. I bounced

around in a few majors before settling with Plant Biotechnology. I graduated in May and immediately began working for Mike Giroux. Half way through the summer I decided to continue my education with Mike by going for a masters degree.

**Ross Winton (Mike Ivie)**



I recieved my B.S. in Fish and Wildlife Management from MSU in 2005. My research in Entomology under Mike Ivie will be focusing on tiger beetles (Coleoptera: Carabidae: Cicindelini) and their response to

ecological change, specifically sandhill stabalization by vegetation. I will also be

**New Employees  
Page Huyette**



My name is Page Huyette (pronounced Hyatt) and I have recently joined the PSPP Department as an Adjunct Assistant Professor in the area of Landscape Design. I’ve just relocated to Bozeman after living in California for the last twenty plus years. I grew

examining the phylogeography of the species *Cicindela formosa*.

### Jay Kalous (Luther Talbert)



My name is Jay Kalous. I was born and raised on a small family farm and ranch in Brush, CO. I graduated from high school in 2004 and attended Colorado State University where I received my

Bachelor's degree in Soil and Crop Science. Now I'm here at Montana State working towards a Master's degree in plant sciences with Dr. Talbert.

My wife Danielle and I enjoy being outside paddling and hiking.

### Publications

Malvick, D.K., Grunwald, N. J. and Dyer, A.T. 2008. Population structure, races, and host range of *Aphanomyces eutieches* from alfalfa production fields in the central USA. *Eur. J. Plant Pathol.* DOI 10.1007/s10658-008-9354-6.

Schepetkin I.A., G. Xie, L.N. Kirpotina, R.A. Klein, M.A. Jutila, M.T. Quinn. 2008. Macrophage immunomodulatory activity of polysaccharides isolated from *Opuntia polyacantha*. *International Immunopharmacology* 8: 1455-1466.

Zadegan, R. Yousef, Bridget K. Behe, and Robert Gough. 2008. Consumer Preferences for Native Plants in Montana Residential Landscapes and Perceptions for Naturalistic Designs. *J. Environ. Hort.* 26(2):109-114

Mitchell, A.M., Strobel, G.A., Hess, W.M., Vargas, P.N., and Ezra, D. (2008) *Muscodor crispans*, a novel endophyte from *Ananas ananassoides* in the Bolivian Amazon. *Fungal Diversity*. 31: 37-43.

Note; Angie Mitchell is an undergraduate student who accompanied Strobel and the Yale students to the Ecuadorian amazon in March of this year. This is her first

independently written and published scientific report.

Nancy M. Heidlebaugh, Brian R. Trethewey, Aravind K. Jukanti, David L. Parrott, John M. Martin and Andreas M. Fischer (2008) Effects of a barley (*Hordeum vulgare*) chromosome 6 grain protein content locus on whole-plant nitrogen reallocation under two different fertilization regimes. *Funct. Plant Biol.* 35, 619-632. doi: 10.1071/FP07247.

### Strobel Documentary

The television piece on "MOLDS and FUNGI" filmed in the Plant BioScience Building, in part in July, will air on the history channel, Modern Marvels, on Sept 15<sup>th</sup>.

### Time to Fertilize the Lawn? By Cheryl Moore-Gough



Just as we must absorb nutrients from our food to maintain strong and healthy bodies, your lawn grass must do likewise to look nice and out-

compete weeds and other pests. Most lawns in our region are composed of mixtures of cool-season grasses. These make their best growth during spring and fall, and normally go dormant or "brown-out" in the summer heat. Don't fertilize these grasses in summer since that will stimulate foliage growth and deplete the root systems of nutrients. Both weaken the grass.

Most cool-season grass blends need three to four pounds of actual nitrogen per one thousand square feet of turf per year. The right choice is a complete fertilizer with a 3-1-2 or 4-1-2 ratio, and with half the nitrogen in a slow-release form.

Make your first application after you've mown the lawn a time or two in spring. Fertilizing very early in spring encourages excessive top growth and nearly constant mowing. Make the second application around Labor Day after the summer heat has passed, and the third application around Columbus Day or about a month before the ground freezes. The timing varies with location. Grass roots store those nutrients for use early next

spring.

Turf researchers suggest increasing the level of potassium in the fertilizer for the October application. Higher potassium helps the grass plants get through the winter in better shape. It decreases winter damage and makes the grass less subject to pest damage next year. But all the fertilizer in the world does no good unless it dissolves in water.

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### Bob's Byte

By Bob Johnston (Irene Decker Filling in)

Telephone tips:

- To pause during the playing of a voice mail, press # and then press 2 to continue



-Press 1 to skip backward in the message 5 seconds at a time

-Press 3 to skip forward 5 seconds at a time

-Press 72 to hear a more detailed description of the message

-Press 4 to go to the previous message

### Recipe of the Month

#### Peach Pie Smoothie

2 fresh peaches, pitted and sliced

1 cup low-fat vanilla frozen yogurt

1/4 cup low-fat milk

2 teaspoons honey

1/2 teaspoon vanilla extract

1/8 teaspoon ground cinnamon

2 vanilla wafer cookies, crumbled



Blend together peaches, low-fat frozen yogurt, and honey. Pour into two chilled glasses and sprinkle crumbled vanilla wafers on top.

### September Birthdays

Tracy Dougher	1
Katreena Kluck	1
Irene Decker	5
Oliver Neher	13

