OMPHALINA

ISSN 1925-1858

Newsletter of FORAY NEWFOUNDLAND AND LABRADOR

Vol. II, No 4
May 7, 2011

FORAY NEWFOUNDLAND AND LABRADOR

is an amateur, volunteer-run, community, not-for-profit organization with a mission to organize enjoyable and informative amateur mushroom forays in Newfoundland and Labrador and disseminate the knowledge gained.

Webpage: www.nlmushrooms.ca

ADDRESS
Foray Newfoundland & Labrador
21 Pond Rd.
Rocky Harbour NL
A0K 4N0
CANADA
E-mail: info AT nlmushrooms DOT ca

OMPHALINA *is the lackadaisical newsletter of Foray Newfoundland & Labrador. There is no schedule of publications, no promise to appear again. Its primary purpose is to serve as a conduit of information to registrants of the upcoming foray and secondarily as a communications tool with members.*

The content is neither discussed nor approved by the Board of Directors. Therefore, opinions expressed do not represent the views of the Board, the Corporation, the partners, the sponsors, or the members. Opinions are solely those of the authors and uncredited opinions solely those of the Editor.

Please address comments, complaints and contributions to Andrus Voitk, self-appointed Editor:

foray AT nlmushrooms DOT ca,

… who eagerly invites contributions to OMPHALINA*, dealing with any aspect even remotely related to mushrooms. Authors are guaranteed instant fame—fortune to follow. Authors retain copyright to published material, and submission indicates permission to publish, subject to the usual editorial decisions. Issues are freely available to the public on the FNL website. Because content is protected by authors' copyright, editors of other publications wishing to use any material, should ask first.*

COVER

"Mulched garden" morels in a municipal flower bed in Pasadena (NL, not California), found by Henry Mann. A huge crop apperared the year after the flower beds were put in, an ephemeral phenomenon not expected to be repeated in subsequent years—see "distress fruiting", discussed in the lead article.

Genetic studies by Kuo and others have identified at least 16 genetic morel species in North America. Only four of these have readily discernible macroscopic differences. The others split into groupings of indistinguishably similar species that may or may not be related. If morels follow the experience with other mushrooms, then it is unlikely that there are more than four species in Newfoundland and Labrador. Our distress fruiters are more plentiful and larger than our wild black morels. A genetic study is required to see what we have and whether they differ.

OMPHALINA
ISSN 1925-1858
Vol. II, No 4
May 7, 2011

CONTENT

Editorial 2
Foray Matters 3
Distress fruiting
Andrus Voitk 4
Mushroom caviar
Britt Bunyard 7
Alder Tongues
Tony Wright 8
Of alders and tongues
Henry Mann 10
Alder competition 12
Newfoundland chanterelles
Cassia Vilneff & Greg Thorn 13
Our alders
Andrus Voitk 18
Partners ..... inside back cover
Foray Notice ..... back cover

Message from the Editor

The objective of this issue is to alert you that morel season is upon us. Here in Newfoundland and Labrador we do not really have enough morels to speak of a "morel season", but 2010 was an exception, so that we may hope for 2011. Even here occasional bursts of "distress fruiting", as discussed in the lead article, are noted. We have seen two such episodes in 10 seasons, each reported to us by somebody else. Because of the hype surrounding morels elsewhere and because of the long hiatus from picking mushrooms, it is at least nice to look for this spring delicacy. Begin looking by the end of March, until June, just do not let me catch you looking in my patch!

The beauty of Mushroom Caviar, submitted by Britt Bunyard for the Empty Skillet, is that with even a few morels a small amount of caviar can be made.

Most heartening for an editor is to learn that somebody actually reads the publication. Therefore, it was a manyfold delight to receive from Tony Wright an unsolicited contribution, sparked by material printed in a previous issue. Through a felicitous coincidence, Henry Mann had prepared an article about the same organism for this issue. These have now become complementary companion pieces, Tony's dealing with the taxonomy of alder tongue gall fungus, and Henry's discussing its biology. It is great, when something goes well, albeit through no planning or effort of one's own. Henry's article is part of a series, "The plant galls of Newfoundland and Labrador", that he has undertaken together with Wade Bowers. Most of them have been designed for the Osprey, but since this was a mycological matter, Henry decided to offer this one to OMPHALINA.

The final article deserves especial mention. This is the first research paper offered to OMPHALINA, done on our Newfoundland chanterelles.

We gratefully note the contribution offered to Cassia's study by Ralph Jarvis, manager of Salmonier Nature Park. Not only did Ralph make available the Park's resources of food and housing for Cassia's investigations, pick her up and deliver her to the airport, host her in his home during transit, but also for the greater good of Science, he offered up his personal and very secret chanterelle patches to her investigation. The help of Ralph and Salmonier is an example of the best use of public resources to learn more about our natural heritage. These partners can be justifiably proud of the report published here.

Our forays are a pleasant experience thanks to the generous support of our partners, most returning year after year. While participants pay most of the direct foray costs, most costs of our Faculty Foray, Reception and "scientific efforts" are borne by our partners. Without them we would not have much to show after a pleasant weekend, and studies such as Cassia's would not be possible. In fact, it is but one of several research project in which we cooperate. This issue is dedicated to our partners, whom we list on the inside back cover.

Happy mushrooming!

andrus

Foray matters...

This newsletter began as a tool to communicate with participants about the upcoming foray. This page will be a regular feature immediately after the editorial, until foray time. The banner photo comes from Terra Nova Park in May. Imagine what mushrooms that mossy understory will produce by September! And according to Mac Pitcher, this lichen friendly habitat is ideal for the rare **boreal felt lichen** *Epiderma pedicellatum*, as well as the equally rare *Degelia plumbea*; both are listed as Species of Special Concern in Newfoundland and Labrador by COSEWIC (the Committee on the Status of Endangered Wildlife in Canada).

Registration fee

The Registration Form is confusing some members about the **FUNGI** deduction. If you are a member now and get **FUNGI** as part of your membership fee, you are not eligible for the deduction at registration. Your 2010-2011 membership lapses at the beginning of the foray, and when you register, you also renew it for 2011-2012. Part of your fee covers your subscription to **FUNGI**.

The deduction is for those registrants, who have an existing personal subscription to **FUNGI**, independent of FNL or the Foray. Of course, if they wish a second copy, this is possible by paying the full fee without claiming the **FUNGI** deduction.

Registrations

As we go to press, there are over one dozen registrants for the upcoming foray. The exact number is unclear at the moment, as with the extra cash flow our Registrar/Treasurer has gone off on a holiday. Hmmm…

Workshops

Unfortunately we shall not be able to offer a Medicinal Mushrooms workshop this time, as we had planned. Perhaps in the future. However, in addition to our regular workshops, we do have a Mushroom Cooking workshop. Details and notice in a future issue, once our master chef is back from holidays.

In addition we have an excellent Mushroom Dyeing workshop planned. For details, see notice in the Foray issue of OMPHALINA.

Fungal Arts

Please do not forget about our Tell and Sell Arts and Crafts display. See the Foray issue of OMPHALINA for details. Think about showing your mushroom art or craft product to the rest of us. Contact Urve Manuel <urve.manuel@gmail.com> if you would like to share anything with us (or sell us something).

Contest

PLEASE NOTE THE ALDER GALL COMPETITION, p 12 of this issue.

Distress Fruiting
—the desperate fruiting pattern of Morchella

Andrus Voitk

One May while visiting our grandchildren in Ontario, our eight-year old granddaughter, Triina, proudly showed us a spot by two pine stumps near her back yard, where she had picked a small bagful of morels. Indeed, we found a few more. This find prompted a discussion with the grandchildren. Yes, they had looked and no, they had not found any morels elsewhere on the 26 acre forested property. We listed things special to this particular spot: pines, piles of brush from the branches of the felled trees, large amounts of pine needles on the ground, possible sawdust from felling the trees and disturbance of the ground from the excessive activity associated with felling the trees. To check whether any of these factors was a stimulus for morel fruiting, we sought out several other spots with pines, or brush piles, or pine needles, or sawdust, or ground disturbance. No morels. Finally grandson Toomas asked, “What about the dead tree?” He knew that two other pines in other locations on the lot were taken down last year at the same time. Surprise! A search of these areas yielded a crop of morels around each stump as well.

In some respects morels behave like other mushrooms. They have their habitat requirements for temperature, light, moisture, substrate and plant associates. If morels have discovered a place where these are satisfied, they may fruit year after year for a long time, varying only as conditions vary. And, like most other mushrooms, DNA soil testing reveals that they live quietly in many other places without ever disturbing the terrestrial mycophile with the spectre of their sporocarps. Exactly like most other mycorrhizal mushrooms. How boring!

But morels also have other, much more peculiar fruiting habits. Consider the following:

1. Massive fruiting the first year after a forest fire.
2. In areas that still have them, morels are known to fruit around dead elms. Folks living in such areas claim that often the fruiting is around certain segments of the tree, not all around, changing over time. Further, most of these elms are not dead but dying, losing more and more with each year but still having a few leaf producing twigs.
3. Gardeners often report an unexpected morel crop in their garden. Veteran mycophiles can appear very wise in the ways of the world by saying without being told, that the involved beds underwent major

digging, fertilizing, mulching in the previous season. This turns out to be so, invariably. Veteran mycophiles can now inform the gardener that this is an ephemeral event, not to be repeated in future years. Invariably this disappointing information turns out to be correct and the mycophile's stock will rise in the gardener's evaluation, even if it takes a year.

What do the above three examples have in common with the pine stump morels? Death of a mycorrhizal partner. In the case of the felled pines and forest fires, this is obvious. In the case of the dying elm, it is dying piece meal, causing a shift in fruiting to last season's dead roots. As for the gardener, who always assumes the new manure and/or mulch to be the cause, if not the source of her morels, might it not be, instead, disruption of roots and/or mycelia, disconnection of mutualistic partners by the energetic digging that accompanies such enthusiastic revitalizing of flower beds?

Is it likely, at least possible, that Ms Morchella establishes a mycorrhizal partnership with her sugar-daddy tree, which allows her to thrive quietly in such bliss that she never feels the need to engage in the tedious practice of sex? Is it further possible that if her selected partner dies or the connection is forcibly severed, Ms Morchella, left without a ready source of succor, somehow senses it through her entire being as a threat to her survival? Is it possible that she is so programmed, that instead of weeping and throwing up her hands, filling the air with cries of "Alack!" and "Woe is me!", she instead regrets lost opportunities and unseized pleasures? Is it possible that her response to impending doom is to dust off her sexual urge and channel all her remaining energies into explosive orgiastic pursuits to produce a myriad of progeny around her deathbed, to whom she can give her last words: "Go forth and multiply"?

Farmers, woodsmen and other people close to nature often describe such a phenomenon: some organisms seem to react to the threat of imminent death by markedly increased reproduction. The teleological explanation proffered for this observation is that some organisms are programmed with such a response as an effort to save the species. The sound of the last knell spurs them to multi-

Two of the "yellow" morels found by Triina and Toomas around pine stumps. The fruiting is almost certainly related to the felling of the tree the previous year—morels did not reappear in these locations in subsequent seasons.

ply, so that should they die, the gene pool is preserved.

With respect to morels, this phenomenon has been thoroughly discussed by Michael Kuo under the heading, "We're outta here!", in his highly recommended book, "Morels"(1). I am not aware that the concept has been the subject of scientific inquiry. Is there a trigger? Is there a specific receptor? What is the mediator? Can agents be introduced that will trigger the receptors, regardless of disruption of mutualistic relationship? In other words, can we learn what is required to trigger fruiting and thereby "farm" morels pharmacologically? After loss of its mycorrhizal partner, does the organism establish other relationships with nearby trees? Or does it lie dormant, awaiting new mutualistic opportunities to present themselves? Or does it up and die?

Henry Mann in a typical Danger Boy morel pose, showing off three examples of the mulched-garden morel from the crop shown on the cover.

I have named this phenomenon "distress fruiting" (2) to distinguish it from "stress fruiting". The latter condition has been investigated by publicly funded biosadists, who study the effect of various stressors on an organism's subsequent fertility and ability to reproduce. Stressors include application of noxious stimuli, administering non-lethal doses of toxins, giving chemicals (e.g. salt) in excessive concentrations or temporary withholding water or other requirement of fruit production. Not unsurprisingly, this type of calculated torture almost always decreases fruiting, confirmed by myriads of grant-endowed papers studying tortured animals and plants. Distress fruiting, on the other hand, is fruiting in response to an impending fatal or potentially fatal event to the organism or its status quo. Proponents of this theory believe that faced with loss of continued existence and given an opportunity to set its house in order, most organisms do not make out a will, forgive their transgressors, make confessions or ask for absolution. No, they have a last great fling.

Go big and then just go.

References:

1. Kuo, M: Morels. The University of Michigan Press, Ann Arbor, Mich, USA; 2005.
2. Voitk AJ: Polyozellus multiplex—an example of our mycological ignorance. Osprey 37:20-22; 2006.

"Distress fruiting" of the same morels shown on the title banner and side bar. Found by Claudia Hanel and all consumed at the Humber Natural History Society AGM later in the same day.

The empty skillet

Maria Voitk

From the kitchen of Britt Bunyard, where he publishes and edits *FUNGI*, comes a recipe for MUSHROOM CAVIAR, from a favorite cookbook of his by Rita Rosenberg. The book is out of print, but sometimes used copies can be found on Amazon. Since we lack permission to reprint this recipe, Britt's is altered a little to avoid copyright infringement. The original recipe calls for mixed wild mushrooms, but Britt let me know that Rita had used dried black morels and black trumpets, mixed half and half, at one of the Telluride forays. Anybody who attended the Viking Foray last year will remember this caviar, made by Britt from mushrooms that he brought to our Quidi Vidi QuuQup (pictured on right). Since we lack black trumpets in the province, Britt's version, is with morels only, should you be lucky enough to find some. If not, remember that Rita Rosenberg's original recipe called for mixed wild mushrooms, so you can still try it.

MUSHROOM CAVIAR

BRITT BUNYARD

INGREDIENTS

¼ cup butter
½ lb fresh morels (or reconstitute 1 oz dried morels)
2 tbsp finely chopped shallots
2 tbsp lemon juice
1 tbsp Worcestershire sauce
2 tbsp mayonnaise
salt and freshly ground pepper to taste

PROCEDURE

In an empty skillet, melt butter and sauté the mushrooms over medium heat for 5 minutes.

Remove from heat. Cool slightly. Drain.

Place in blender with lemon juice, Worcestershire sauce, mayonnaise.

Pulse to a blended but coarse texture.

Add salt and pepper to taste.

Chill.

Enjoy on toast, bread or crackers.

Makes about one cup.

Danger Boy Bunyard showing two Wisconsin morels not found in Newfoundland and Labrador (yellow and half-free morel—we also do not have the free one).

ALDER TONGUES

by Tony Wright

I learned some ten years ago to recognize Alder tongues, the result of a strange deformation of female alder catkins so that purplish tongues stick out and then turn brown with age. I learned also that these tongues arise because an ascomycete fungus has been at work on the alder, and that the fungus is named *Taphrina alni*; *Alnus* being the genus of the Alder tree. After a little research it became clear that *T. alni* was the current name of an organism that had previously been known by other names, which were now largely discarded synonyms, including *T. amentorum, T. alnitorqua* Tul., and *T. alni-incanae*.

Most of my colleagues in the **Mycological Society of Toronto** were unaware of these tongues, or of their fungal origin, and accordingly I appointed myself as the public relations agent for this fungus species within our club. Spreading knowledge is one of our club's objectives, and I was immediately seized with the thought that I had picked up a little knowledge worthy of spreading.

On our regular spring and fall club forays I told myself that if I found an alder, I should look for the tongues evidencing *T. alni*, but I never found an alder on these forays, let alone the tongues. My luck changed, however, a few years ago, during one of our club's annual weekend Cain Forays near Huntsville, when I found an alder sporting my target tongues. I filled out the collection slip appropriately and proudly brought in the specimen and talked about my find of *Taphrina alni*. Every year since then I have brought in *T. alni* at our Cain Forays, but I do not tell everybody that the host alder is barely 30 feet from our sorting and display hall!

Even far afield I have been a public relations agent for *T. alni*, so I was closely examining the alders on that memorably blusterful day at L'Anse aux Meadows during Foray Newfoundland and Labrador's Viking Foray last year, when Andrus Voitk tapped me on the shoulder, somehow reading my thoughts and saying helpfully, "*Taphrina* does not trouble these alders, which are Mountain Alders; it grows on Speckled Alders which are not found around here". I redirected my efforts to be more productive elsewhere.

Imagine my surprise on reading Volume I, Issue 1 of OMPHALINA, to see a photo of MY Alder Tongues with a different name, *Taphrina robinsoniana*. What's going on here? I obviously have to do some more research, so I went to work in my amateur fashion searching for the answer.

After much head-scratching, I eventually realized that it is really quite simple; Note 36 explains everything. Which Note 36? Note 36 to the **Annotated Cumulative Species List for the 2003-2010 Newfoundland and Labrador Forays** which I accessed online. There it is boldly set forth that the name *T. alni* is that of a European species, while *T. robinsoniana*, a name which Giesenhagen documented in 1895, is the correct name of the species that grows on our North American Speckled Alder.

A very helpful prime reference source is "A monograph of the genus *Taphrina*" by A.J. Mix, describing 98 species, published in the University of Kansas

Science Bulletin of April 29, 1949, which is available online. Collections by P. Spaulding in 1928 from Spruce Branch and Harpoon River, Newfoundland, feature among those examined by the author for this work. The differences between the closely related *T. alni* and *T. robinsoniana* are spelled out here. Genetic work by authors including Fonseca and Rodrigues, published in 2003, has subsequently supported the distinct nature of each. This 61-year old monograph of 1949 includes the following very clear passage:

"American collectors have been slow to recognize the identity of Taphrina robinsoniana and many collections have been reported as T. alni-incanae (Kühn) Magn. [T. amentorum (Sadeb.) Rostr.]. Conners (1932) has mentioned this error in identification and has suggested the probability that Taphrina amentorum does not occur in eastern North America. Conners' suggestion led to the examination of a very large number of collections (listed above). All specimens proved to be Taphrina robinsoniana. Taphrina amentorum on Alnus rubra has been reported from Alaska (Ray, 1939)."

NAMA's Annual Foray species lists, from forays in New York, Minnesota and Idaho, have recorded *T. amentorum*, and more recently have used the synonym *T. alni*, but they have not yet recorded *T. robinsoniana*. I will try to get it on the record at this year's NAMA Foray in Pennsylvania.

Hats off to Foray Newfoundland & Labrador[1] for fast-forwarding us to catch up with a 61 year-old report of 79 year-old news about a "new" species described 116 years ago! Now all of us in the east can place the name *Taphrina robinsoniana* on the tips of our alder tongues.

[1] Parenthetically, doff those hats also to the **Rhode Island Natural History Society**, which recorded *T. robinsoniana* as one of the 40 fungi listed on its 2007 Bioblitz.

# of ALDERs & TONGUES

by Henry Mann

We have two alders in Newfoundland, the Speckled Alder (*Alnus incana* ssp. *rugosa*) and the Green Alder or Mountain Alder (*Alnus viridis* ssp. *crispa*). Both are common in the Humber Valley, but provincially Green Alder is the hardier species found throughout the Island and Labrador whereas Speckled Alder is more restricted to warmer valleys and sheltered microclimates on the Island and north to south-central Labrador. Where conditions for growth are very favourable, such as around Pasadena, Speckled Alder becomes the more dominant and abundant species often reaching small tree status. Mountain alder is a more shrubby species. Although casually very similar in appearance, the two species can be readily distinguished by their leaves, catkins and buds. Actually botanists have determined that our two alders belong to two slightly distantly related groups or sub-genera. Parasites are often very host specific and this feature is nicely demonstrated by our alders. The Woolly Alder Sawfly (*Eriocampa ovata* in the Latin tongue) has been ravaging and defoliating our Speckled Alders here in the Humber Valley for a number of years, yet the Green Alders remain untouched. Similarly, the Alder Tongue Gall commonly seen on our Speckled Alders is absent from our Green Alders. Both the fly and the gall fungus (*Taphrina robinsoniana* in the Latin tongue) can obviously readily distinguish these two alder species much more precisely than sometimes we humans do or can.

Figure 1. Speckled alder cones and galls in winter.

The Alder Tongue Gall is very common in the Pasadena area of the Humber Valley and has also been noted in central Newfoundland in the Grand Falls area and on the Burin Peninsula. Tough dark outgrowths (tongues or languets), often twisted and contorted, can be seen on the old seed "cones" (catkins) in winter (Figure 1). In spring, April to May depending on weather conditions, both the overwintering male and female catkins open their scales for pollination (Figure 2). Presumably, infection of the exposed tender female catkin tissues by the Ascomycete fungus occurs at this time. After pollination the catkin scales/bracts close together and the whole tiny female catkin will grow and enlarge into the cone-like structure bearing mature seeds in autumn. However in areas of fungal infection, the growing mycelium stimulates the plant tissues to proliferate and begin the growth of the abnormal structures known as Alder Tongue Galls. By mid-June the tongues be-

Figure 2. Male and female speckled alder catkins in spring at pollination time.

gin to appear as little green bumps pushing out from between the tightly appressed catkin scales. These bumps soon take on a reddish colour as they grow into the mature tongues which can reach several centimetres in length (Figures 3 & 4). In fall when the green "cones" mature, turn brown and open their scales to release the seeds, the galls dry, harden and turn brown to blackish (Figure 5). They and the dry catkins remain on the branches overwinter and often well into the next summer (Figure 1). The tongues are true galls, that is, they are composed mostly of plant tissues that were induced to proliferate by the infecting fungus. On the other hand, bracket fungi and other mushroom parasites or saprophytes on woody plants are not plant galls but fruiting bodies of the fungi totally composed of fungal tissue.

Interestingly, the Alder Tongue Gall also occurs in Europe on their native alders (*A. glutinosa* and *A.*

Figure 3. Developing female speckled alder "cones" with young emerging tongues, mid-June to early July.

Figure 4. Fully formed galls by early August.

incana ssp. *incana*). Photos of infected catkins look identical to ours. The scientific name given the European gall causer is *Taphrina alni*. At least one of the European alders (*A. glutinosa*) has been imported and planted throughout eastern North America and

Figure 5. By early September "cones" begin to turn brown and galls to dry and harden. (Note sawfly damage to leaves.)

records exist for Newfoundland as well. It therefore seems possible that both species of *Taphrina* (*robinsoniana* and *alni*) may occur in North America or some combination of the two. Our Speckled Alder is also much more closely related to the two European alders that also produce tongue galls than to our Green Alder. It would be interesting to know if the European *Taphrina* species/variety could infect our Speckled Alder, and vice-versa. Recent DNA studies have shown that the two fungi are so closely related that some taxonomic "lumpers" might even consider them just variants of the same species whereas the "splitters" would certainly insist to the death that they are "good" distinct species. Such is the nature of taxonomy; the fungi don't care what they are called either in the English or the Latin tongue, only the taxonomists do! In nature, groups within species are continually diverging, some continue diverging to become new species, others eventually recombine or retain the ability to recombine when given the opportunity, so the whole process is a moving target, a dynamic system that just sometimes will not fit into the neat fixed pigeonholes of our artificial man-made taxonomic categories.

Answering the question, "When is a group a species?" is sometimes easy, but often not.

Alder contest

If this were the **Journal of Wild Ungulates in Newfoundland and Labrador**, it would have one article about moose and one about caribou, and be done with it.

As if they were totally independent and free organisms!!!

The mycophile knows this just ain't so: we are all links in an interdependent chain that must remain unbroken. The two previous articles demonstrated clearly that identifying trees is just as important for the mycophile, as is identifying mushrooms. Many times, knowing the tree will identify the mushroom. Therefore, an article about trees is quite at home in a mushroom journal. Mushrooms are so interconnected throughout all of nature, that even an owl on the cover of a mushroom magazine would not surprise us. Anyway, never mind the owl, but on the last page (p. 18) you will find a summary of the differences between our two alders in the winter (from our 2010 Winter Foray Report). In the summer it is too easy. Once you learn to tell our alders apart, you will be surprised to find that very many fungi seem to prefer one or the other species, some exclusively.

Why? For many mushrooms the reason may not be immediately obvious. If you read the article by Henry Mann and then look at the differences between the species, at least one possible explanation might suggest itself for alder taphrinas.

We hereby declare open a contest. Suggest a possible reason for *Taphrina* to propagate on speckled alder, but not mountain alder. Send your answer to the Editor <foray AT nlmushrooms DOT ca>. Results will be announced at the 2011 foray and the first best answer will get a very, very incredibly coveted and valuable prize. If you suggest a method to test your hypothesis, even better.

Newfoundland golden chanterelles: examining their identity and regional levels of damage by slugs and fly larvae

Cassia Vilneff and R. Greg Thorn
Department of Biology, University of Western Ontario, London ON N6A 5B7
cvilneff@uwo.ca and rgthorn@uwo.ca

The most recent edition of the **Dictionary of Fungi** accepts approximately 97,000 species of fungi, however the British mycologist David Hawksworth (1991) estimated that there may be 1.5 million species worldwide. With such a discrepancy between what is known and what may exist, it is no surprise that many questions concerning fungi remain unanswered. Previously, mycologists identified and described species primarily based on morphological characteristics, visible with or without microscopy. Today, analyses of DNA sequence data are widely used to determine species as well as ancestral relationships among fungi. These studies have often shown that using morphological properties alone to determine species limits is insufficient, although corroborating morphological characters may later be found to support species detected by DNA data. Findings based on molecular analyses have shown that within the realm of mushrooms, things are not always what they seem to be. Mushrooms that look different are not always different species and, alternatively, species or individuals that appear similar are not always closely related. Consequently, many previously accepted species and ancestral relationships need to be critically re-examined.

Chanterelles are one of the most widely recognized and sought after wild edible mushrooms across the globe (Pilz et al. 2003). The common name chanterelle refers to species within the genus *Cantharellus*, particularly *C. cibarius*, the golden chanterelle and *C. formosus* the Pacific golden chanterelle. Chanterelles are ectomycorrhizal mushrooms, which means that they form mutualistic relationships with the roots of green plants (Pilz et al. 2003). Both the green plants and fungi depend on each other for health, growth and survival (Pilz et al. 1998). The mycelium grows through the soil, obtaining water and nutrients (such as nitrogen and phosphorus) that are exchanged for sugars from the host plants (usually trees). With enough water, energy (sugars), and other resources, mushroom fruiting bodies may be produced. A single ectomycorrhizal individual can become quite large and produce many fruiting bodies. This explains why golden chanterelles are typically found in patches.

Luckily for those who enjoy them, the removal of mushrooms does not seem to impact future harvests negatively (Arora and Dunham 2008). Chanterelles are highly prized and are subject to intensive harvests. Most species within the genus *Cantharellus* have vibrantly

coloured fruiting bodies ranging from red to yellow hues, which may fade with age. Golden chanterelles are orange to yolk yellow and have a pleasant odour that many describe as fruity, resembling either apricots or plums (Lamaison and Polese 2005). They are distributed throughout the temperate zone, growing in association with both deciduous and coniferous trees. The combination of growing in shady, moist places and commonly fruiting in moss or forest litter may conceal chanterelles despite their bright colouration (Lamaison and Polese 2005). Within Newfoundland, chanterelles are typically found during the late summer in mossy Balsam Fir forests.

Golden chanterelles the world over are renowned for having very few pesky insects or slugs consuming their fruiting bodies despite having a relatively long fruiting period. Of local interest is the question, why the mushrooms on the West Coast of Newfoundland appear untouched whereas those on the East Coast become infested with slugs and maggots (fly larvae). Newfoundland mushroomers have noticed this discrepancy for some time, without any explanation. This question was brought to the attention of the senior author (RGT) by Andrus Voitk during the summer of 2009.

The first author (CV) took on the preliminary investigation of this question, supervised by RGT at the University of Western Ontario. Goals of the project were to determine whether the anecdotal obser-

Figure 1. Chanterelles from western Newfoundland showing minimal damage (left) and from eastern Newfoundland showing substantial damage (right).

vations are real, and if so, whether the difference seems to be due to factors inherent in the mushrooms. If that were the case, there would be reason to determine whether East and West Coast chanterelles differ genetically.

A preliminary study, based in Salmonier Nature Park on the Avalon Peninsula, was done in August, 2009. With help of the Park Manager, CV collected samples of chanterelle populations from the East Coast, while West Coast chanterelles were picked simultaneously and delivered to Salmonier. Collections were done in two parts: a random collection to provide a "representative" sample of the population from each Coast, and 100 undamaged specimens (damage class 0) from each coast. It was immediately apparent on visual inspection that the randomly collected mushrooms from the West Coast appeared larger, brighter and markedly less damaged than those from the East (Fig. 1).

The 100 undamaged mushrooms from each Coast were tagged using random numbering to prevent observer bias, and laid out on moss under a Balsam Fir canopy similar to where chanterelles are naturally found (Fig. 2). After 60 hours all mushrooms were collected and scored based on their damage (from 0 for undamaged to 4 for completely damaged). Most mushrooms in both groups had suffered additional damage. Although there was a difference in damage class distribution between the two Coasts (Figure 3), using the Kolmogorov-Smirnoff test this difference turned out not to be statistically significant ($p=0.062$).

Although we confirmed to our own satisfaction that there was an "obvious" difference in the amount of invertebrate damage between the two populations, we had not quantified this. Because our findings encourage investigating the genetic relationship of the two populations, we decided to make a second trip to collect tissue for DNA studies, and use the opportunity to quantify the degree of damage in each population *in situ*.

Five patches from the Avalon and five from Western Newfoundland were assessed. Each patch was at least 100m distant from the closest other patch and contained at least 40 fruiting bodies. Without harvesting or selecting, 40 chanterelles from each patch were scored based on their damage (from 0 for undamaged to 4 for completely damaged). The protocol of scoring and collecting was repeated for all 10 patches. Statistical analyses of the data showed that both the mean damage and the frequency distribution of damage scores differed significantly on each Coast (Fig 4). The chanterelles of the East Coast did, indeed, suffer significantly greater invertebrate damage than did those from the West Coast, confirming our own previous unmeasured observations, as well as those of Newfoundland mushroomers.

Thus, both initial visual inspection and subsequent damage studies confirmed the anecdotal observations that West Coast chanterelles suffer less invertebrate damage than East Coast chanterelles. Exposing undamaged mushrooms from both Coasts to the same damage revealed a difference in new damage, which on testing had a 6.2% probability that the difference was due to chance alone. Such difference is traditionally considered not significant, increasing the likelihood that DNA studies will show both populations to

Figure 2. Chanterelles from eastern and western Newfoundland were individually numbered and laid out together in a moss carpet under balsam fir for 2½ days.

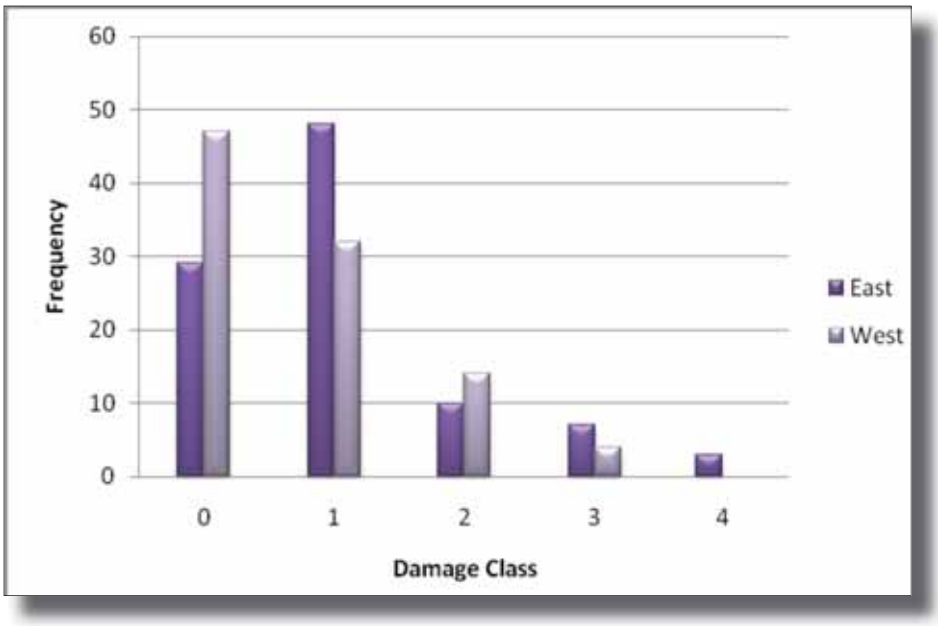

Figure 3. Bar graph showing the number of undamaged chanterelles from eastern and western Newfoundland in each damage class after being exposed in the woods for 2½ days (2009). Difference in distribution of damage recorded on East and West Coast chanterelles between damage classes was not statistically significant using the Kolmogorov-Smirnoff (KS) test (D= 0.01856, p = 0.062). However, the significance value is close and there seems to be a perceptible qualitative difference (See Fig. 1 and text).

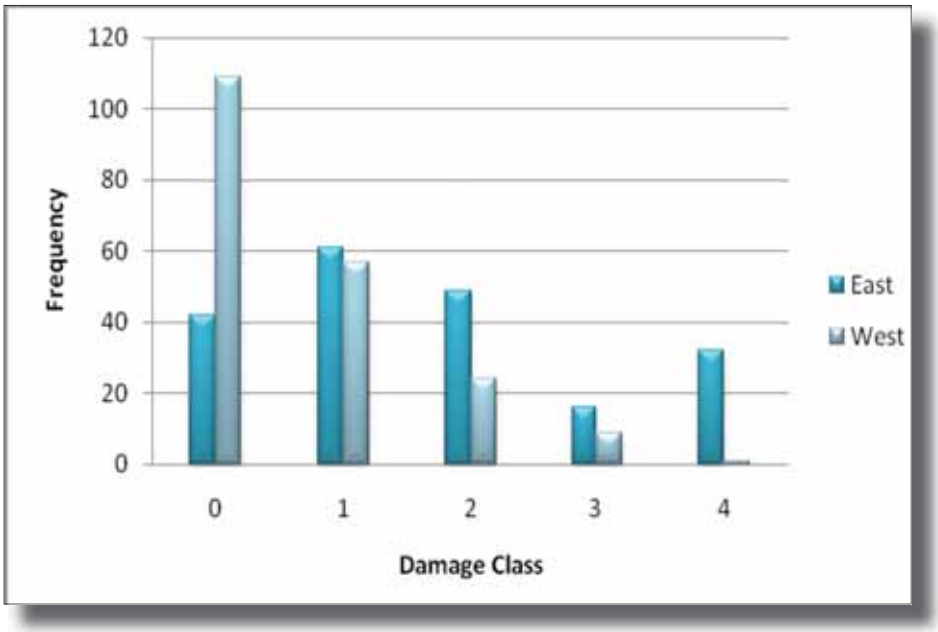

Figure 4. Bar graph showing the number of chanterelles from eastern and western Newfoundland sampled *in situ* in each damage class (2010). Difference in distribution of damage recorded on East and West Coast chanterelles between damage classes was statistically significant using the KS test (D= 0.3350, p = 0.000); there are more undamaged and far fewer heavily damaged chanterelles from western Newfoundland.

be conspecific. However, the probability that the difference might be due to other factors such as inherent differences in the mushrooms was still a respectable 93.8%, leaving room for the possibility of genetic difference in the two populations. We believe that this possibility warrants further scrutiny.

Following scoring, small samples of cap tissue were collected from every other fruiting body and stored in CTAB buffer. These samples can be used to characterize various regions of DNA (molecular sequencing) to determine whether there is a genetic explanation for statistical differences in the field observations. When done, this study will form part of another report.

Like other living organisms, chanterelles and the animals that eat them are influenced by both abiotic and biotic environmental factors. Some of the most influential environmental factors for fungi that live in the soil include: parent materials (the rocks on which soils are formed), the plant community (under which soils develop), organic content, and moisture. These and the climate, or daily and seasonal patterns of temperature, precipitation and humidity, are likely quite different between the West and East Coast of the island. All this may result in different physical traits (or perhaps different species) in chanterelles and different numbers and species of predators—slugs and mushroom flies.

Researchers in California are currently examining species boundaries within their local species of *Cantharellus*, with results that may have relevance to this project. Morphological and colour data were taken from numerous *C. cibarius* fruiting bodies within

a California woodland. In combination with DNA analysis (restriction fragment length polymorphisms) it was determined that three distinct species were present, two of which had been identified incorrectly as *C. cibarius* (Arora and Dunham 2008). Once the species were sorted out, ecological clues specific to each species, including host association and forest climate, were described to help future mycologists identify different species without DNA protocols (Arora and Dunham 2008).

Thus, the question remains: are there genetic differences in the chanterelles from eastern and western Newfoundland that result in varied predation upon them or is the difference in the environmental factors that influence the interactions between the mushrooms and their predators? Mushroom samples from both populations are now available for genetic comparisons at the species and individual levels. The results will determine whether the East and West Coast populations are the same or different species, and whether the populations are interbreeding and identical, or separate and genetically distinct. Should the results show that the two populations are distinct, this could explanation their difference in predation, and future research could look at the chemical make-up of both populations for an explanation. Alternatively, if they are all one species and genetically identical populations, it opens the door for future research to determine the cause for the varying degree of mycophagy at different sample sites.

Acknowledgements

We thank Andrus Voitk for the suggestion and outline of this project, for collection of chanterelles from the West Coast in 2009 and for assistance with locating chanterelles in Western Newfoundland in 2010; John Jenniex for transport of chanterelles from Corner Brook to Salmonier, where CV was working in 2009; and Ralph Jarvis, Manager of Salmonier Nature Park, and the Salmonier Nature Park for truly generous accommodation and logistic support in 2009 and for help in locating chanterelle patches in the Avalon in 2009 and 2010. An especial thanks also to Derek Vilneff, the first author's Dad, for assistance with location of chanterelle patches, acting as scribe and for general support during the second Newfoundland field trip.

References Cited

Arora, D., and Dunham, S.M. 2008. A new, commercially valuable chanterelle species, *Cantharellus californicus* sp. nov., associated with live oak in California, USA. Economic Botany 62(3): 376-391.

Hawksworth, D. L. 1991. The fungal dimension of biodiversity: magnitude, significance, and conservation. Mycological Research 95:641-655.

Lamaison, J., and Polese, J. 2005. The great encyclopedia of mushrooms. Konemann Publishing, Konigswinter, Germany.

Mui, D., Feibelman, T., and Bennett, J.W. 1998. A preliminary study of the carotenoids of some North American species of *Cantharellus*. International Journal of Plant Sciences 159(2): 244-248.

Pilz, D., Molina, R., and Liegel, L. 1998. Biological productivity of chanterelle mushrooms in and near the Olympic Peninsula biosphere reserve. Spec. Rep. N. 9. WA: U.S.A. The Biological, Socioeconomic, and Managerial Aspects of Chanterelle Mushroom Harvesting.

Pilz, D., Norvell, L., Danell, E., and Molina, R. 2003. Ecology and management of commercially harvested chanterelle mushrooms. Gen. Tech. Rep. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

OUR ALDERS

Alnus incana ssp. *rugosa*, SPECKLED ALDER

Alnus viridis ssp. *crispa*, MOUNTAIN ALDER

female cones	smaller, without stalks; new exposed; susceptible to *Taphrina robinsoniana*		larger, with stalks; new covered by bud; not susceptible to alder tongue gall (*T. robinsoniana*)
male catkins	dependent from outset, more advanced (bloom earlier, before leaves open)		initially erect, more closed (bloom later, when leaves open)
nutlet	narrow wings		wide wings
buds	blunt tips, 2 scales		pointed tips, 3-4 scales
branches	lenticles more evident		lenticles less evident
size	larger		smaller
habitat	lowlands		higher, even on mountain heath
frequency	commoner in sheltered valleys on Island and central Labrador		throughout Island and Labrador

OUR PARTNER ORGANIZATIONS

People of Newfoundland and Labrador, through
- Department of Environment and Conservation
  - Parks and Natural Areas Division
  - Wildlife Division
- Department of Natural Resources
  - Center for Forest Science and Innovation
- Department of Innovation, Trade & Rural Development

Parks Canada
- Terra Nova National Park
- Gros Morne National Park

Great Northern Peninsula Forest Network
- Model Forest of Newfoundland and Labrador
- Nordic Economic Development Corporation
- RED Ochre Develpoment Board

Sir Wilfred Grenfell College

Gros Morne Cooperating Association

Memorial University

Quidi Vidi Brewing Company

Rodrigues Winery

Follow our progress issue to issue. Confirmed Partners brightly coloured; those unconfirmed or to be approached pale. Look for results, additions, losses. And if you know a potential partner, please let us know.

LICHENS added this year!

FORAY NEWFOUNDLAND AND LABRADOR

2011 2011 2011
2011 2011
2011 2011 2011
2011 2011
2011 2011 2011
2011 2011
2011 2011 2011

Terra Nova National Park

Headquarters: Terra Nova Hospitality Home

September 9-11, 2011

GUEST FACULTY*

Teuvo Ahti
Renée Lebeuf
Donna Mitchell
Faye Murrin
André Paul
Bill Roody
Leif Ryvarden
Roger Smith
Greg Thorn
Zheng Wang

*tentative at time of publication

Please check our website in the Spring, 2011, for Information & Registration Forms:

<www.nlmushrooms.ca>