OMPHALINA

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Newsletter of FORAY NEWFOUNDLAND AND LABRADOR

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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.

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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.*

Issues of OMPHALINA *are archived in:*

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COVER

Happy Halloween!

Background, October night sky with full moon over the Blowmedowns. Shade of witch made up of fungi: hat *Hygrocybe conica*, broom from real *Melampsorella caryophyllacearum* witch's broom on balsam fir, etc. As the lead article explains, witches sprinkle rusts onto all they fly over. Hence it is no wonder that the Halloween moon under the flying witch is crawling with orange teliospores, basidia and basidiospores of *Gymnosporangium clavariiforme*. See inside for more on this genus.

The moonshot by Henry Mann, nightshot by Urve Manuel, cobbled together by unnamed peons in the editorial suites of OMPHALINA in a more puerile moment than usual. Same peons also chimærated the witch.

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CONTENT

Message from the Editor

Happy Halloween!

There is not much to say, and this space was going to be empty. After all, we only have two articles (OK, one in three parts) and one ad.

But we did bump up against a small problem. Normally, when we write articles of a technical nature about things we know nothing about, we have them reviewed by experts before publication. We thank Nina Zitani for comments about the worms and Peterjürgen Neumann for reviewing the *Gymnosporangium* trilogy. However, while he is an expert in phytopathology, Peterjürgen does not claim expertise in *Gymnosporangium* identification. Unfortunately our requests to two such experts went unanswered, and we lost track of it until now, publication time. Well, Halloween is upon us, and it is too late to change the whole concept and content of this issue. As a result, you get a virginal article of field identification of our *Gymnosporangium* species, totally unsullied by the least smattering of knowledge or expert opinion.

As with all Omphalina articles, mail correcting our mistakes welcome!

Meanwhile, enjoy Maria's picture of two old guys rooting about in public gardens for juniper galls to fill the Halloween issue…

Happy mushrooming!

andrus

FORAY MATTERS…

Farewell Foray 2012

As you see from the fading title banner, the 2012 foray is beginning to recede into history. It will be forever remembered for its mycoabundance, a complete opposite to the year before at the same location.

Fogo

Even before the 2012 foray, the Board began work on the Fogo Foray of 2013—see the back cover. Right now we are wrestling with the cost. If we can gain the upper hand with it, and it looks as if we are close, details will follow.

Meanwhile, a few 2012 hangovers:

GPSs & Radios

We are missing a few radios and GPS units from the foray. If you mistakenly left one in your pocket, please get in touch about returning same. This has happened for the last two years, but each year to date the missing units have been found and returned, so that our total has remained the same.

Lost and found

A special thank you to the five people who wrote asking whether Judy's car keys were found. It is very gratifying to know how many care. Actually, they were found by me in my backpack! There is a story there, but not interesting enough to tell. They are now safely back in Judy's possession, she's home, as is her car.

We also have a small GPS/cell phone/camera case that may be claimed. If you find other items, please let us know, and we shall try to reunite them with their owners.

Debts and obligations

Anybody who has made bona fide or authorized expenditures on behalf of the foray, please notify us as soon as possible, if you have not already submitted your claim. We are approaching bankruptcy, so soon it will be first-come-first-served at the trough.

Foray Report

Because we have our own journal, starting this year, the Report will become a special issue of OMPHALINA, published in November. Because of prior commitments, The December issue will become the Report Issue for this year. For that issue, Marian Wissinck, Editor of the Report, will be the guest editor of OMPHALINA, getting her Report out between new covers.

Mushrooms and Halloween

Jim Comish

It's Fall!

Short days, wet weather and cool temperatures are transforming our pine-clad hills into the hues of autumn and mushrooms are popping up just about everywhere. Many years ago, the spontaneous appearance of fungi this time of year seemed strangely out of place. It was as if nature was making one last attempt to recreate the lush growth of spring. But instead of green leaves and colourful flowers, these "plants" were bare, unfamiliar in shape and growing in unusual patterns on dead or dying trees as well as on the cold damp earth surrounding them.

Fall also brings Halloween, a celebration second only to Christmas in exciting the young and young at heart. We know there is a connection between mushrooms and Christmas [Omphalina, 1(7)] but is there one between mushrooms and Halloween? Not unlike mushrooms and Christmas, the answer lies deeply rooted in European paganism and folklore and in the modern version of a harvest celebration older than Christmas itself.

Photo: Andrus Voitk

Photo: Andrus Voitk

Halloween was originally an ancient Celtic new years celebration called Samhain (pronounced Sow-in) meaning summer's end. The Celts believed that on new years eve (October 31 on our calendar), the "veil" separating the worlds of the dead and living became so thin and unguarded that ghosts could cross and torment their living descendants. To hide their identity from these ghosts, the Celts disguised themselves in animal skins. To appease the ghosts, they left food (treats) outside their homes. When the Romans invaded Europe, they combined Samhain with the festival of Poloma, their own late October tribute to the dead. In the 8th century, Christians tried to ban these pagan practices but had to settle for adding some parts of Samhain to their own All Saints Day, a Christian holy day also honouring the departed, especially martyrs for the cause. The name was changed from Samhain to Hallowmas (hallow being the archaic English word for saint), All Hallow's Eve or Hallow Even, hence Halloween. For people who practice Wicca (a modern pagan religion created around the 1950s), Halloween is still a religious celebration tied to its pagan roots. For the rest, at least in North America where it is largely celebrated, Halloween has become a secular mishmash of occult-like beliefs

from many cultures and a commercialized part of pop culture.

A long-held and continuing belief in the supernatural is probably the oldest connection between mushrooms and Halloween. To understand the seemingly spontaneous appearance and proliferation of fungi, especially around Samhain, the Celts and other Indo-European cultures turned to supernatural explanations. Since mushrooms showed no obvious way of reproducing, the pagans thought they were created by supernatural beings. This is evident in the common and scientific names given to some mushroom. A few of these names go back hundreds of years. Others are more recent additions, likely a result of links between the sinister vernacular of Halloween, modern books and movies and the persistence of mycophobia, especially in Anglo-Saxon cultures, where Halloween is mainly celebrated.

A notable ancient reference to the supernatural and fungi is the fairy ring mushroom. The pagan Celts believed these mushroom circles appeared overnight where elves, pixies and fairies had gathered to dance and play. Mushroom rings were also considered portals to elfin and fairy kingdoms. Germanic pagan cultures attributed the rings to lightning strikes (not that far fetched given their influence on spurring some plants to rapidly generate fruiting structures), witches, dragons and toads. Either way, fairy rings were best avoided; step inside one and you could be transported to other worlds and even other times. Our most common fairy ring mushroom is *Marasmius oreades*, the specific name oreades means fairy. The ever widening circle of *M. oreades* shows on the surface the path saprophytic mycellia take as they spread outward, consuming organic matter buried in the substrate as they go. It took many centuries before that bit of natural history was discovered.

Another mushroom with supernatural connection is elfin's saddle, best represented in Newfoundland by *Helvella lacunosa*. The mushroom's saddle-like cap propped on a ribbed and holey grey stem was believed to be ridden by elves, hence the name. Its ghoulish appearance resembles the end result of an experiment gone horribly wrong, a theme befitting any Halloween story. The poor elves can only be pitied for having to ride such an horrible looking steed.

Halloween and mushrooms share several iconic characters. The most famous (or infamous depending on your point of view) are the witch and *Amanita muscaria*. The word witch comes from the pagan Saxons and means wise one, in this case a healer and spiritual counselor. Witches were known to combine *A. muscaria* with a few plant extracts and grease to create a special ointment. Rubbed on the skin, it made them feel lightheaded, like they were flying. When initiated into a coven (a witch fraternity), new witches were often blindfolded, smeared with the ointment, placed on a broomstick and told they were flying over water and


Photo: Andrus Voitk


Photo: Andrus Voitk


Photo: Andrus Voitk


Photo: Andrus Voitk

land. The giddy flying feeling created by the laced ointment made the experience seem quite real. When ingested, *A. muscaria* is reported to have made witches cackle and dance, creating the modern stereotype of a witch as a villainous old hag, Samantha Stevens of Bewitched fame excluded. *A. muscaria* was also combined with *Panaeolus campanulatus* and their toad and frog companions, to create spell casting brews and decoctions. Today, a hag on a broomstick or a witch stirring a bubbling cauldron are among the most recognizable characters of Halloween. Adding an *Amanita muscaria* would certainly complete the picture.

In fantasy literature, *A. muscaria* is a classic symbol of enchanted forests- the kind of places where other Halloweeny characters, like fairies, gnomes, hobgoblins and brownies are known to dwell. Given the importance of *A. muscaria* in pagan medicines and celebrations, it is easy to image the Celts' hallucinating that the dead move among them, especially on a foggy All Hallow's Eves.

The word witch has been included in the common names of a variety of mushrooms. According to folklore, witch's broom, a fungal infection that leaves a broom-like mass on some trees (*Melampsorella caryophyllacearum* on balsam fir in this case), was believed to appear where witches flew over the forest on their way to their sabbats or secret meetings. Blaming witches for such deformities in nature and the general misfortunes of daily life was commonplace after the 14th century and lead to the demonization of witches well into the 1800's. Unfortunately, similar attitudes formed around mushrooms, particularly in parts of western Europe.

A group of fungi linked to Halloween are the jelly fungi commonly called witches butter. According to Celtic legend, witches were notorious milk and butter thieves. The sudden appearance of jelly fungi marked where they had dropped or stashed some of their creamy loot. Finding this mushroom near one's home meant the house was hexed. The only way to remove the curse was to prick the mushroom to drain its gel. This caused the thieving witch such pain, she was forced to appear and remove the spell. In Scandinavia, witches butter was believed to be vomit from a witch's cat gorged on milk and food.

One of the most recognizable characteristics of a witch is her conical black hat. Originally a symbol of humiliation and shame, the pointed hat with the wide brim was added to the witch wardrobe in Victorian era writings, not as a fashion accessory but as an antenna to channel spells. The typically conical capped mushroom *Hygrocybe conica*, has

an uncanny resemblance to a witch's hat minus its brim. Initially red to orange in colour, the mushroom turns black with age and when touched. Spoooooky!

The ascomycete side of the fungal kingdom isn't without its Halloween references. Some lichens have common names linking them to fairies and witches. *Icmadophila ericetorus*, a pinkish lichen with disc-shaped apothecia typically found on decayed softwood stumps, is also commonly called fairy puke. In our older forests, *Alectoria sarmentosa* or witches hair drapes the branches of softwoods trees in long stringy mats resembling hair, creating a eerie scene worthy of Halloween.

As previously mentioned, the original Halloween was largely about the dead. Since some mushrooms resemble parts of the human body, they undoubtedly received great notoriety among the ancient pagans who may have seen the uncanny appearance of fingers, phalli and ear-shaped mushrooms as a sign the dead were entering the world of the living, especially when the appearance coincided with Samhain. Even today, one cannot mistake the macabre *Xylaria polymorpha* for its finger-like looks, hence it common name dead man's fingers, or the ear-shaped *Auricularia americana* (auris meaning ear) sprouting from tree trunks in cemeteries, or members of the Phallaceae family (stinkhorns) for their resemblance to a phallus protruding from the ground. Add the flies attracted by their rotting meat smell and stinkhorns are an easy fit for Halloween. *Xylaria polymorpha* has yet to be recorded in this province, but the genera *Geoglossum* and *Elaphocordyceps* have a few worthy substitutes even if we commonly know them as earth tongues.

Another recognizable character of Halloween is the Jack-o'-lantern, an obsolete name for a night watchman, jack-with-the-lantern. The name dates back to medieval Ireland as an explanation for the flickering lights that often appeared over the Irish countryside. Legend has it that after outwitting the devil several times, a wily character named Stingy Jack was barred from both Hell and Heaven, leaving him to wander in the darkness between the two with only a lit lump of coal in a carved turnip lantern to find his way. The Irish placed ghoulishly carved Jack-o'-lanterns in a window to ward off the roaming trickster and other evil spirits, especially around All Hallow's Eve. Irish children carried Jack-o'-lanterns door-to-door to represent the souls of the dead while begging for soul cakes on All Saints Day. When the Irish immigrated to America, the pumpkin, native to North America and associated with harvest time, replaced the turnip and a ubiquitous modern Halloween symbol was born.

The mushroom known as *Omphalotus olearius* on this side of the Atlantic (absent in Newfoundland) bears the common name "Jack-o'-lantern". The gills of a fresh *O. olearius* are bioluminescent, glowing eerily greenish when placed in the dark. This


Photo: Andrus Voitk


Photo: Andrus Voitk


Photo: Andrus Voitk

Photo: Andrus Voitk

Photo: Andrus Voitk

glow is a biochemical reaction due to an enzyme called luciferase acting upon a compound called luciferin, a reference to another Halloween favourite, Lucifer, which oddly enough means "giver of light". Often confused with the delicious chanterelle, the Jack-o'-lantern mushroom is poisonous and according to Tom Volk will make you so sick you wish you were dead.

The official colours of Halloween are orange and black. Orange has long been associated with harvest time, especially with the pumpkin. Black, representing death, has an equally long association with Halloween and is amply represented in fungal common names, mainly as a warning against eating specific mushrooms, e.g. Death Angel or Destroying Angel (*Amanita bisporigera*), Death Cap (*Amanita phalloides*). The Black Trumpet (French, Trompette des morts) for *Craterellus cornucopioides* suggests a similar warning, but surprisingly, it is a choice edible. Not found in Newfoundland and Labrador. Pity.

Orange, red and the ghoulish, bloody side of a modern Halloween are found in two mushrooms that exhibit some very spooky behaviour: they bleed when cut. The "blood" of *Lactarius thyinos* is not the whitish liquid common in most *Lactarii*, but reddish-orange. If you could collect enough *L. thyinos*, it would make a sweet Halloween treat. Their fruity smell and taste would be welcomed by any myco-savvy trick-or-treater. On second thought, you might want to keep them for yourself, otherwise the cops might show up on your doorstep and accuse you of giving kids hallucinogenic mushrooms, even though this *Lactarius* has no toxins or hallucinogens. *Mycena haematopus*, as its specific epithet suggests, bleeds a red blood-like liquid when its stalk is crushed. Euw, as my former fifth graders would say!

Since the Irish brought Halloween to America over a century ago, Hollywood movies and fantasy literature have turned many ordinary things into innocuous thrills and titillations that characterize the modern version of this ancient celebration. Black cats, bats, owls, spiders, cobwebs, ghosts, skeletons, skulls, bones, ghoulish anatomy, witches, wizards, pumpkins, graveyards, headstones, and haunted houses are now popular Halloween decorations. Despite their long association with all things Halloween, mushrooms are missing from the list. Maybe those of us interested in mycology should start adding mushrooms cutouts to our Halloween lawn and home decorations and dress in myco-costumes when greeting trick-or-treaters or partying. After all, anyone dressed as a mushroom at Halloween must really be a fun guy.

The Bishop's Sketchbook

The Newfoundland chanterelle and its tricksters: Glynn's photo and painting of *Hygrophoropsis aurantiaca* (grows on wood, hollow stem), and painting of *Amanita flavoconia*, a frequent denizen of the chanterelle's environs.

Part of the plant galls of Newfoundland and Labrador series:

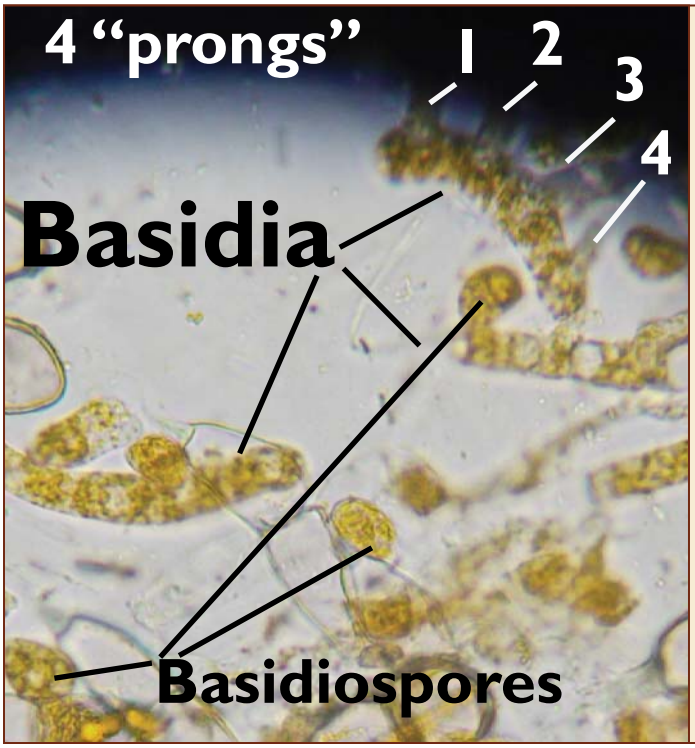
Gymnosporangium: Life cycle

Andrus Voitk, Henry Mann

Photo: Claudia Hanel

We have three native species of "juniper" in the province. The first is not a juniper at all: in Newfoundland and Labrador all species of the genus *Larix*, known elsewhere as larch, are called juniper. The other two are "true" junipers: *Juniperus communis* and *J. horizontalis*. In addition, we have several introduced ornamental species. All of these may be infected with a rust fungus form the genus *Gymnosporangium*, the cedar (or juniper) rust. As the reader of Omphalina knows from previous articles, the life cycles of rust fungi are quite complicated. This is the first of three articles related to the species of *Gymnosporangium* found in our province. This article attempts to discuss the most confusing aspect of all, their sex life. The subject is very involved and has its own terms, but stay with it!

Sexual reproduction produces individuals of unique genetic make-up, differing from that of their fellows and their progenitors. Unique individuals come about from mixing their genetic make-up from two different individuals, the parents. The world is always changing, with significant differences in factors such as climate, important to the welfare of organisms in its triosphere. If they all stayed the same, they would wither and die out, when changes become inimical to their welfare. Constant small genetic change produces some individuals that thrive better in changed conditions, thus allowing evolution to favour those fit to continue propagating the species in altered conditions.



Basidiospores 1

Gymnosporangia are basidiomycetes, producing unique basidiospores from structures called basidia. A basidium is a specialized four-pronged club-like cell, visible with a microscope, whose only function is to produce spores. Each basidiospore carries within it one-half of all the genetic material required for a sexually reproductive fungus. Once released, spores are borne everywhere by wind and other vectors, but not far, limiting the opportunity to infect. Only those that land on a suitable substrate will germinate, and require water to do so. Suitable substrate for basidiospores of *Gymnosporangium* is a member of the Rosaceae family. In Newfoundland and Labrador this is most often either chuckley pear (*Amelanchier*) or mountain ash (*Sorbus*) [apple (*Malus*) for *G. juniperi-virginianae*, which we have not encountered yet].

Spermatia

When basidiospores land on a suitable rose family host, they begin to germinate, producing long threads, mycelia, whose cells contain a nucleus with only one-half of the genetic information required by a reproductive fungus. These mycelia form small lesions on the host, called spermagonia, flask-like structures that open up with time like craters. The illustrations show early (above) and late (right) spermagonia. Specialized mycelia release spores into the flask or hollow. Other mycelia form a hairy tuft around the crater. Each hair is a specialized receptive mycelium, ready to fuse with a spermatium of the other "sex" from a suitable parent type. The crater contains nectar to attract insect "pollinators". As they sup, some spermatia adhere to them, which are then released onto hovering and sticky receptive mycelia. Once these enter the mycelium, it contains a full complement of chromosomes, one from each parent in a separate nucleus: the genetic material from the "father" in the spermatium, and from the "mother" in the suitably paired receptive mycelium.

Aeciospores

The mycelial cells with two nuclei, one from each parent, now grow through the host and when they reach the surface again, they produce the next sporulating unit, the tube-like aecium. Aecia produce aeciospores, each of which contain nuclei from both mother and father. These do not infect or germinate on the host where they were produced. Instead, they are borne all over by wind, rain or other vectors. Only those that land on a suitable substrate will germinate. In the case of *Gymnosporangium*, this substrate is one or both of our juniper species.

Teliospores

Gymnosporangium aeciospores that land on juniper under the right conditions, germinate and produce mycelia, again with two nuclei, one from each parent. The host plant responds to the invading mycelium with various forms of abnormal plant tissue growth (gall formation). The organism overwinters, and in the spring it forms gelatinous horn-like sporulating structures called telia (see title banner). These produce two-celled teliospores, each cell containing one nucleus from the mother and one from the father. These fuse into one large (diploid) nucleus (the light area in the cells). The teliospore germinates in the telial horn, producing rod-like basidia. The site and number differ for the species; the micrographs illustrated in this article are of *G. clavariiforme*.

Basidiospores 2 (meiosis)

A diploid (with full complement of genetic material) nucleus is extruded into the basidium. Inside each diploid nucleus the chromosomes from each parent duplicate. Each pair from the mother joins a similar pair from the father. During this junction members of the pairs cross over and exchange parts of the chromosomes. Thus, the newly formed chromosome is made up of variable proportions of its mother's and father's genetic information. Although they are the "same" chromosomes and of the same number, the genetic information they contain is a different mix than it was in the original genes. The pairs now pull apart and a new nucleus forms around each set. The cell splits with one new diploid nucleus in each daughter cell. The genetic information in the daughter cells is different in each, and differs from that of the mother and father. Each member of each pair also differs from the other and from members of the other pair. Next, the chromosome pairs split apart and form separate nuclei with one strand of chromosomes to each nucleus. A new cell is formed around each nucleus. The final result is four new cells, each containing one-half of the full genetic information (haploid). Two are of one "sex" type and two of the other. Each differs from its parents and siblings in genetic content. The basidium forms four prongs and the new small cells are extruded into the prongs, and thence into the world as new basidiospores.

These are unable to grow on juniper, but are carried all over by wind or other vectors. Some that land on suitable substrate (*Amelanchier* or *Sorbus)* germinate. Go back to Basidiospores 1 to go round again.

Constant genetic shuffling produces different individuals, much as our children are different from us and from each other, yet alike. Some of these changes may enable the individual to withstand more heat or cold, for example. Should temperatures change, such individuals will have a better opportunity to continue the species into the future. They will be favoured, while those with a different genetic heat tolerance will tend to die off. And so it goes.

To complete it cycles, *Gymnosporangium* requires two hosts. Instead of infecting wild chuckley pear, some species of the genus infect commercial fruit (apples, pears, quince, etc). As the photo of aecia on fruit suggests, on fruit they can do significant damage to growers' incomes. However, because two hosts are required to complete the cycle, the effect can be minimized by eliminating the other host from the vicinity of the commercial orchard. Some rusts are much more difficult to control, because they have a fifth stage that allows them to perpetuate the species in one host. *Gymnosporangium* does not have that safety valve.

The next article describes the five cedar rusts in our province, a much easier chore than trying to explain sex at our age.

The plant galls of Newfoundland and Labrador series:

Gymnosporangium: Species in Newfoundland and Labrador

Andrus Voitk, Henry Mann

Photo: Claudia Hanel

What a pleasant surprise, to find, in the spring of the year, a bright splash of orange on a juniper bush! Closer inspection reveals needle-like projections of what must surely be some kind of fungus. The infectious agent is a rust, a species of *Gymnosporangium* (gymno = naked, sporangium = fruit body). The rusts have earned their appellation because of the rusty orange colour of their spores and fruit bodies. There are over 50 species of *Gymnosporangium* in the world.[1] Over 15 infect juniper. This article attempts to describe the five species on juniper that we have found in Newfoundland and Labrador to date, relying heavily on the 1965 paper by Parmalee and the 1973 monograph by Kern.[2] While the references are a bit old, the mushrooms have not changed appearance significantly in the interim.

Our observations are incomplete. There may be more species that we have not found yet. We have not seen all stages of all species. The keys are a trial identification aid, put together from our observations, information from the references, and other sources. The Editor would be very pleased to hear of inaccuracies or possible improvements to them. The aim is to enable you to differentiate between the species macroscopically. This is not always possible, and often microscopic examination is required for accurate identification. In some cases frustration with the keys may serve to convince you of that.

References

1. Parmalee JA: The genus *Gymnosporangium* in Eastern Canada. Canadian Journal of Botany, 43:239-267. 1965.
2. Kern FD: A revised taxonomic account of *Gymnosporangium*. Pennsylvania State University Press, University Park, Pa. 1973.

DICHOTOMOUS (nearly) KEY

AECIA

On *Amelanchier*

Jul-Aug

Spore colour bright orange ..... *G. clavipes*

Spore colour yellow-brown ..... *G. clavariiforme*

Spore colour cinnamon brown ..... *G. nidus-avis*

Comment: Differentiating between the lighter yellow-brown and darker cinnamon brown is easy, if they are side by side. It is not nearly as easy with a single collection. Microscopy!

Aug-Sep ..... *Gymnosporangium corniculans*

On *Sorbus* (Aug-Sep) ..... *G. cornutum*

TELIA

On *Juniperus communis*

Colour dark orange, flat cushion... *G. cornutum*

Colour bright orange

telia like a horn or tube ..... *G. clavariiforme*

telia like a cushion ..... *G. clavipes*

On *Juniperus horizontalis*

From fusiform swelling on stems ..... *G. clavipes*

From round galls on twigs ..... *G. corniculans*

From base of needles, witch's broom . *G. nidus-avis*

KEY TO *GYMNOSPORANGIUM* SPECIES IN NEWFOUNDLAND AND LABRADOR	AECIA	TELIA
G. clavariiforme (clavariiforme = clublike)		
Host	*Amelanchier*	*J. communis*
Time	Jun-Jul	Apr-May
gall	fusiform swelling stems	fusiform swelling twigs & needles
site	leaf +++ small groups on blades & large groups on vascular tissue, fruit +++, stem	branches
shape early	tubular	cylindrical
shape later	finely lacerate to base	gelatinized horn
size	0.7-1.5mm	2-5mm
colour	fawn, tan	orange
spore colour	yellow-brown	yellow-brown
G. clavipes (clavipes = clubfoot)		
Host	*Amelanchier*	*J. communis, J horizontalis*
Time	Jun-Jul	Apr-May
gall	fusiform swelling stems, if there	fusiform swelling twigs & needles
site	fruit only, rare on stems	twigs, needles
shape early	tubular	cushion shaped
shape later	coarsely lacerate to base	gelatinized fused cushion
size	1.5-3mm	
colour	whitish	orange
spore colour	bright orange	orange
G. corniculans (corniculans = horn-forming)		
Host	*Amelanchier*	*J. horizontalis*
Time	Sep	Apr-May
gall	markedly thick gall on leaf	galls on twigs
site	leaf ++++	twig, branch
shape early	horn-shaped, somewhat recurved	cylindrical tapered centripetal spikes on gall
shape later	retain horn shape, lacerate along sides	
size		
colour	dark brown	red-brown
spore colour	dark brown	brown
G. cornutum (cornutum = horned)		
Host	*Sorbus*	*J. communis*
Time	Aug-Sep	Apr-May
gall	thick gall on leaf	fusiform swelling twigs & needles
site	leaf +++, vascular tissue, fruit ±	needles (below), twigs
shape early	tubular	flat to cushion shaped
shape later	lacerate at apex	
size	3-5mm	
colour	fawn	dark brown
spore colour	brown	
G. nidus-avis (nidus-avis = bird's nest)		
Host	*Amelanchier*	*J horizontalis*
Time	Jun-Jul	Apr-May
gall		witch's broom
site	leaf +++ (rarely both sides, prefers vascular tissue, necrosis if on leaf), fruit +++, stem ±	abaxial base of needles
shape early	tubular	cushion shaped
shape later	coarsely lacerate to base	Apr-May
size	2-4mm	2-9mm
clour	fawn	orange-brown
spore colour	cinnamon brown	light brown

Gymnosporangium clavariiforme

Photo: Vello Liiv

AECIA on *Amelanchier* fruit. Yellow-brown spores.

Photo: Claudia Hanel

TELIA, orange, hornlike on *Juniperus communis* twigs. Wide distribution: top photo from Estonia.

Gymnosporangium clavipes

Photo: Maria Voitk

AECIA on *Amelanchier* fruit. Bright orange spores make for easy identification.

Reader-Participation Project

Directions:

Print out this page.
Go in woods this spring, take your own picture. Paste in brown frame to cover this text. Fill in caption below. Scratch out "Reader", add your name to photo credit. Call your mother and tell her you are a published author. Send bottle champagne (expensive) to Editor in gratitude.

Photo: Reader

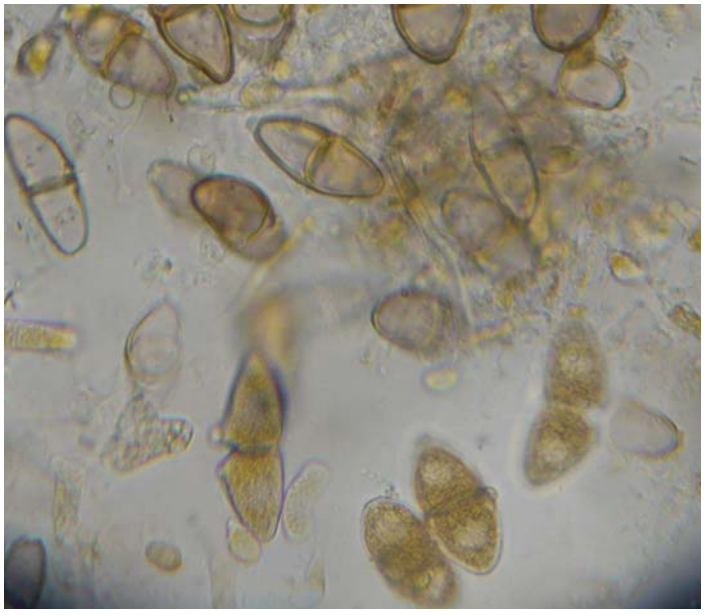
TELIA (lower right). Not yet seen by us—add your own caption!

Gymnosporangium corniculans

SPERMAGONIA on *Amelanchier* leaf.

TELIA & GALL on *Juniperus virginiana*.

AECIA (middle: early, bottom: mature) on *Amelanchier* leaf. Note how the horns retain their horn shape and split along the sides to release dark brown spores. Some authorities synonymize this taxon with *G. nelsonii*, whose horns burst at the top to sporulate, like all the others illustrated here.

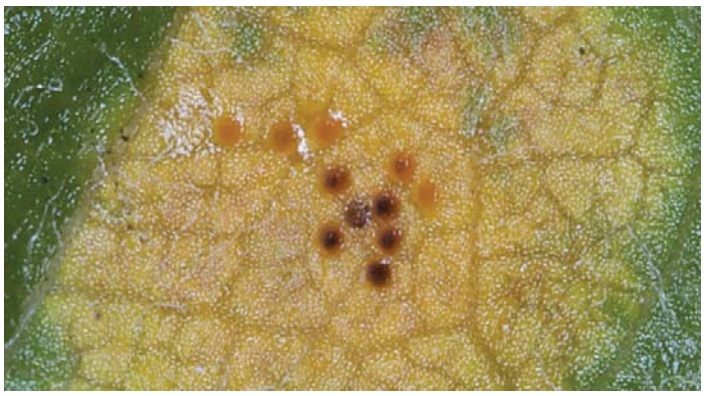


TELIOSPORES. Two-celled, as for all in the genus. Granular ones in bottom with large pale nuclei are beginning to form basidia on one side. Empty ones on top have finished and extruded nuclei into the basidia.

Gymnosporangium cornutum

Photo: Maria Voitk

AECIA on underside of *Sorbus* leaf, unopened above and sporulating below. Found on both *S. americana* and *S. decora*, but not on *S. aucuparia*, even in the same vicinity between infected native trees.



SPERMAGONIA on upper side of *Sorbus* leaf (progressive age downwards).

Reader-Participation Project

Directions:

Print out this page.
Go in woods this spring, take your own picture.
Paste in brown frame to cover this text. Fill in caption below. Scratch out "Reader", add your name to photo credit.
Call your mother and tell her you are a published author.
Send bottle champagne (expensive) to Editor in gratitude.

Photo: Reader

TELIA (lower right). Not yet seen by us—add your own caption!

Gymnosporangium nidus-avis

Photo: Maria Voitk

Witch's brooms, the galls of *G. nidus-avis*. Normal *J. horizontalis* branches creep flat to the ground. The abnormal growth is a proliferation of branches, pointing toward the sky (middle of the bush). The leaves (needles) soon die, leaving several upright bushy dead sections, a sure sign of ongoing *G. nidus-avis* infection.

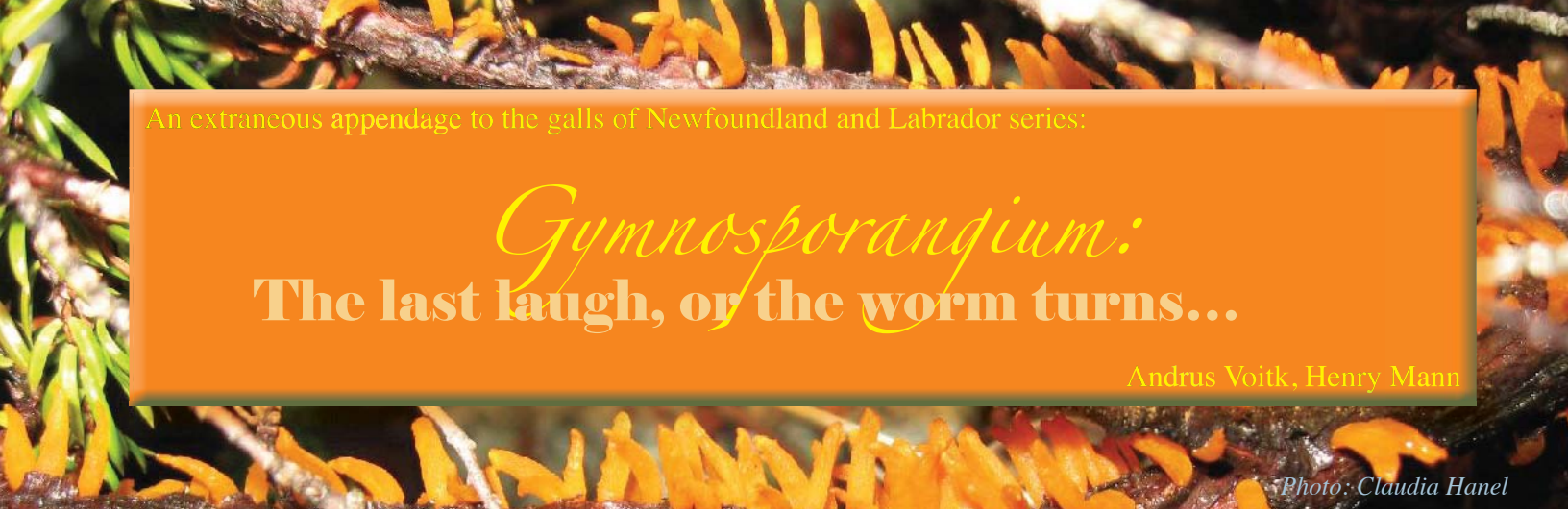
Photo: Maria Voitk

SPERMAGONIA on *Amelanchier* leaf. Note colourful lesion on leaf (chlorotic spot—see next article in series).

AECIA on *Amelanchier* fruit, petiole and leaf. Cinnamon-brown spores.

TELIA on *Juniperus horizontalis*. Above down: young telia forming at the base of the needles, gelatinous telial horns at full maturity, old telia at the end of the season.

TELIOSPORES. They hang from the telial inner wall by long tails. The spores are two-celled. Each cell has a full complement of genetic material (diploid), initially in two nuclei, that quickly fuse. Spore in upper right corner shows such nuclei (light areas in middle of each cell). Germination is about to begin. Initially the tip becomes a bit longer and lighter in colour. Then a small rod begins to project, which eventually develops into the basidium. Three cells toward the right lower corner show such lightening and small projectile formation. For the low-down on sex in the telial horn, read the previous article in the series.



An extraneous appendage to the galls of Newfoundland and Labrador series:

Gymnosporangium: The last laugh, or the worm turns…

Andrus Voitk, Henry Mann

Photo: Claudia Hanel

In the previous two articles, we saw how the rust used the plant to fool insects to do its bidding. When *Gymnosporangium* basidiospores land on a suitable host (e.g. a chuckley pear), they germinate to produce mycelia. These, in turn, produce flask-shaped structures called spermagonia, opening to the outside. Inside, they manufacture their spermatia, and on the rim, specialized receptive mycelia extend like fronds. Each spermatium and each receptive mycelium contains a nucleus with one-half of the genetic material required by a reproductive fungus. Somehow the spermatium needs to be brought in contact with a receptive mycelium from a suitable mate.

Because this process resembles pollination, the rust decides to create a flower. But not with its own materials, as real flowers do. No, it bends the host chuckley pear to its ends. Not only does it eat part of the chuckley pear, it also causes a response that changes host colour. The even green around the spermagonium becomes bright yellow, then spreads with orange and red parts. A foolish insect, used to finding nectar in bright flowers, will be lured. Very cleverly, the rust also causes some nectar to be secreted into the spermagonial flask, likely using the plant's own sugars for this purpose.

In the course of picking up its sweet reward, the foolish insect comes in contact with the spermatia in the nectar, and on exiting the spermagonia, it brings adherent spermatia in contact with waiting receptive mycelia. These eagerly accept the genetic material of the spermatium as a second nucleus. Thus fulfilled, the hyphae grow to seek a place to form aecia, keeping the cycle going.

The clever rust laughs at the silly plant and foolish fly that it has duped into serving its own ends—to go forth and multiply.

But, laughs best who laughs last. Even flies need to reproduce. Like the mushroom, they also do it in several stages (egg, larva, pupa, adult). They do not have nearly the same amount of eggs as mushrooms have spores, so eggs cannot be randomly deposited on the wind. They must be left in a place carefully calculated to provide each hatched larva succor for its development into eventual adulthood. What better food for this than gene-packed spores in spore-packed aecia?

While the mushroom evolves with its hosts, unnoticed by all, the fly quietly evolves along, learning to use the mushroom in a most nefarious way for its own ends. Attracted to a spermagonial "flower", it deposits its eggs there to hatch. By the time they hatch, the silly rust has produced aecia, full of gobsmackingly yummy spores. The larvae gorge themselves on these spores, taking the energy for their own propagation from the spores that were meant for the mushroom's propagation! More of the unbroken chain here.

At least, that is the theory. Or one theory. The presence of spore-gobbling worms could be explained other ways and the exact mechanism may differ in some details. We do not really know how things happen. We do not even know the insect species. Our queries to date have suggested that neither does anybody else.

Why write about things you do not know? Well, perhaps there is somebody out there who knows. She may become so incensed at the nonsense we write that in a huff she may write us a terse note with the real story. Alternately, perhaps nobody knows, but somebody may be piqued to investigate and find out. Meanwhile, Henry will try to hatch some flies next season. Hang in there: more may come in future issues.

Larvae on **aecia**, eating, counterclockwise from top right, cinnamon-brown spores of *Gymnosporangium nidus-avis*, yellow-brown spores of *G. clavariiforme*, and orange spores of *G. clavipes*. Do we know that they eat spores? No, but why else are they there and why do the sated worms glow with the colour of each respective spore? Somehow we do not favour different fly species with different coloured larvae, or larvae that eat something else, but find protection in the spores because of a chamelion-like ability.

Bottom is a picture from Germany of similar larvae on the **telia** of *Gymnosporangium fuscum* on a *Juniperus* sp., reproduced with the kind permission Claudia Brückner. She has narrowed them down to a species of the gall midge family Cecidomyiidae; ours may belong to the same fungivorous family.

Photo: Claudia Brückner

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THE MAIL BAG

OR WHY THE PASSENGER PIGEONS ASSIGNED TO SERVE THE LAVISH CORPORATE AND EDITORIAL OFFICES OF OMPHALINA GET HERNIAS

Obviously, our rot issue set off sympathetic vibrations in many minds, because it generated much more mail than usual. A couple excerpts from art critics:

> Another beautiful edition, love Maria's fibre art…
>
> Pauline Payne

> As usual, it's informative and interesting. I like Maria's fibre artwork a lot.
>
> Dave Malloch

And one from a food critic, with a threat:

> I eagerly await each issue like a child in a candy shop. I should mention that there's a toothy species—*Mucronella bresadolae*—that often grows on and presumably digests Gloeophyllum sepiarium. Maybe it likes the creosote aftertaste. One of these days I'm going to write something for your august publication...
>
> Larry Millman

OMPHALINA in the Press

Our secret agents assigned the clandestine task of following the insidious but relentless spread of OMPHALINA through the very warp and woof (a term you learn if you associate with fiber arts practitioners) of the world, reports that within the last month

1. OMPHALINA was mentioned in a chapter on amateur mycology by Raymond McNeil in the newly published "L'Univers des Champignons, sous la direction de Jean Després".
2. The Boston Mycological Club distributed an issue of OMPHALINA to all its members, mentioning in its Bulletin that this is a leading mycological internet publication, albeit quirky (the latter apparently a plus).
3. And, what should grace the very top of the home page of the North American Mycological Association, <http://www.namyco.org/>, but our rot issue?

And youse gets it for free...

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    - Wildlife Division
  - Department of Natural Resources
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