OMPHALINA

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Newsletter of FORAY NEWFOUNDLAND AND LABRADOR

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July 14, 2016

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, *newsletter of Foray Newfoundland & Labrador, has no fixed schedule of publication, and 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.*

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COVER

Undescribed species of *Hebeloma*, Pasadena Ski and Nature Park, Oct 9, 2007. Why put an unknown species on the cover? Well, apart from the fact that this is the *Hebeloma* issue, a mere month ago they were all unknown to me. And you, I bet. See inside to learn how unknown, and see if you have the courage to pick up the *Hebeloma* Challenge (p. 6).

I dare you!

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CONTENT

Message from the Editor

For Bastille Day we bring you a *Hebeloma* issue, the biggest regular issue we have ever published.

Hebeloma, you say, puzzled. Yes, indeed, this verecund genus contains about 200 species world-wide, and we have just learned that about 10% of them grow in our province. Read inside to learn how they have snuck below our radar.

We are lucky to have had the help of Henry Beker, one of the world's foremost experts on genus *Hebeloma*, and his team*. With their help, this issue is possible, baring for you all that we know (or do not know) about this diffident group of mushrooms.

The purpose of this issue is not to make every reader a *Hebeloma* expert—nobody can remember so much only on one reading. The purpose is to have the descriptions of these species in one place, as a resource for you to turn to, when next you come to identify a *Hebeloma* species. Such descriptions on these pages will be the closest you can come to a book of our mycota. At one time I had hoped to put one together, but it is unlikely that I shall have the time. The next person to try it should find these overviews helpful.

And when can you expect to see your next *Hebeloma*, you ask? Well, why not try to find some at the beginning of the season, and practice identifying them with the help of these keys and descriptions? Very likely this year's foray will bring in a bumper crop of *Hebeloma* species, so hone up your skills first!

Goose Bay has sufficient urbanized grassland to find most of our grassland *Hebeloma* species. There certainly is sufficient sand to satisfy all sand loving species. There are both coniferous woods and regions of deciduous trees for most of our woodland species. And if we get out to any nearby tundra habitat, even those species could be found. This is a foray with the potential of finding all our species of *Hebeloma*, including the undescribed new species.

Let us see, if anybody dares to take up the *Hebeloma* challenge (see p. 6).

As always, Foray matters first, including a great description by John Maunder of why the Goose Bay area is a host to many "southern" species.

See you in Goose!

andrus

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FORAY MATTERS…

Foray 2016 at Happy Valley-Goose Bay!

We still have places available on our registration list for the upcoming foray, please register as soon as possible!

Cheap flights are currently available to Goose Bay! As this issue goes to press, Air Labrador offers a flight at about $150 (including taxes) one-way from St. John's, Provincial Airlines (PAL) has a flight under $200 one-way from Deer Lake, and Air Canada just announced a seat sale. If you don't want to drive, but do want to attend this foray, please check flights on-line and book soon to lock in the fares! Please remember to bring warm clothing, insect spray, sun screen, and your foray hat and whistle.

Lichenologist Troy McMullin will have copies of his new Lichen Field Guide (reviewed in Omphalina 7(1): 16-17, Jan, 2016) for sale at the foray. This will be a great opportunity to purchase a valuable book.

Andrus Voitk, our editor, will have prints of some of his favourite photographs of new species and other contributions to science that have been based on fungi collected at our forays. Many of these photos have (or will) appeared in Omphalina, and now custom prints are available matted and framed with UV glass. The price per print is $150, of which all profits go to Foray Newfoundland and Labrador.

Please bring any mushroom or lichen art and craft items that you would like to display during the foray.

The Goose Bay area of Labrador operates on Atlantic Time (Atlantic Daylight Savings Time during the foray). This means that the time there is ½ hour less than the time on the Island of Newfoundland, the same as the time in Halifax and Moncton.

See you on Friday, September 9th, for the reception at the Birch Brook Nordic Ski Lodge!

Michael Burzynski

Labrador's "warm oasis": who knows what mushrooms lurk there?

John E. Maunder

The land God gave Cain
Jacques Cartier, 1534, on seeing the southern Labrador coast

God made Labrador in six days, and on the seventh he threw rocks at it
Old Newfoundland saying

While these decidedly uncomplimentary assessments may describe some aspects of its outer coast and northern regions, Labrador is a land of many surprises. One of these is a significant "warm oasis" in the Lake Melville region. The most noticeable result of this localized thermal anomaly is an isolated pocket of boreal forest nested firmly within a broad, east-west expanse of low subarctic woodland that stretches all the way west to Hudson's Bay.[1]

The Lake Melville region has the most favourable climate in all of Labrador. Indeed, it has warmer summers and shorter winters than its surrounding areas, and a respectable growing season of 120-140 days. Harbouring a portion of the **High Boreal Forest ecoregion**, its dominant vegetation is a closed-crown forest of balsam fir (*Abies balsamea*), black spruce (*Picea mariana*), birch (*Betula* spp.) and aspen (*Populus tremuloides*). Spruce/feathermoss forest occurs on higher ground and lichen woodland prevails on the lower river terraces.[2]

A favourable place, to be sure, but also an interesting one, biologically. Many species in the region have disjunct (occur in two or more regions that are separated) occurrences;[3] including, among others, green addersmouth orchid (*Malaxis unifolia*), shaved sedge (*Carex tonsa*), hiddenfruit bladderwort (*Utricularia geminiscapa*), sand heather (*Hudsonia tomentosa*), common woodsorrel (*Oxalis montana*), Newfoundland floater clam (*Pyganodon fragilis*), blue-spotted salamander (*Ambystoma laterale*), wood frog (*Lithobates sylvaticus*), and spring peeper (*Pseudacris crucifer*).

How did these, and other, disjunct species get there, and why do they remain? A debate on these subjects is rarely conclusive. Nonetheless, a brief examination of long-term climate change in southern Labrador should prove instructive.

In order to set up the argument, we should first look at a similarly striking marine example of a "warm oasis", featuring the shallow water invertebrates of the greater Northumberland Strait–Prince Edward Island region, north of Nova Scotia. Populations of many of these marine species are, today, dramatically disjunct from populations of the same species found, otherwise, only to the south of Cape Cod. For shell collectors, Caribou Island, near Pictou, N.S., offers a particularly rich selection of typically "southern" malacological treasures.

Early in the hypsithermal warm period (ca 8500–3500 yrs BP = before present), many southern species followed warming ocean temperatures northward, populating regions as far north as the southern Gulf of St. Lawrence, and even a few of the warmer bays of southwestern Newfoundland. Later, as climate began to cool again, these originally-more-southerly species began to withdraw, back towards the south.[4] Nonetheless, members of some of the more hardy species were able to hang on in the still relatively warm Northumberland Strait region, to become the disjunct northern populations we see today.

In Labrador's Lake Melville region, it is evident that a terrestrial/freshwater version of the very same thing took place during the same general time period, as climate first warmed up and later cooled—although events there were complicated a little by the relatively tardy melting of the great Laurentide Ice Sheet centred upon the Quebec-Labrador Peninsula. The Goose Bay area, at the west end of Lake Melville, did not shake off the mantle of ice until finally about 7.5 thousand yrs BP.[5]

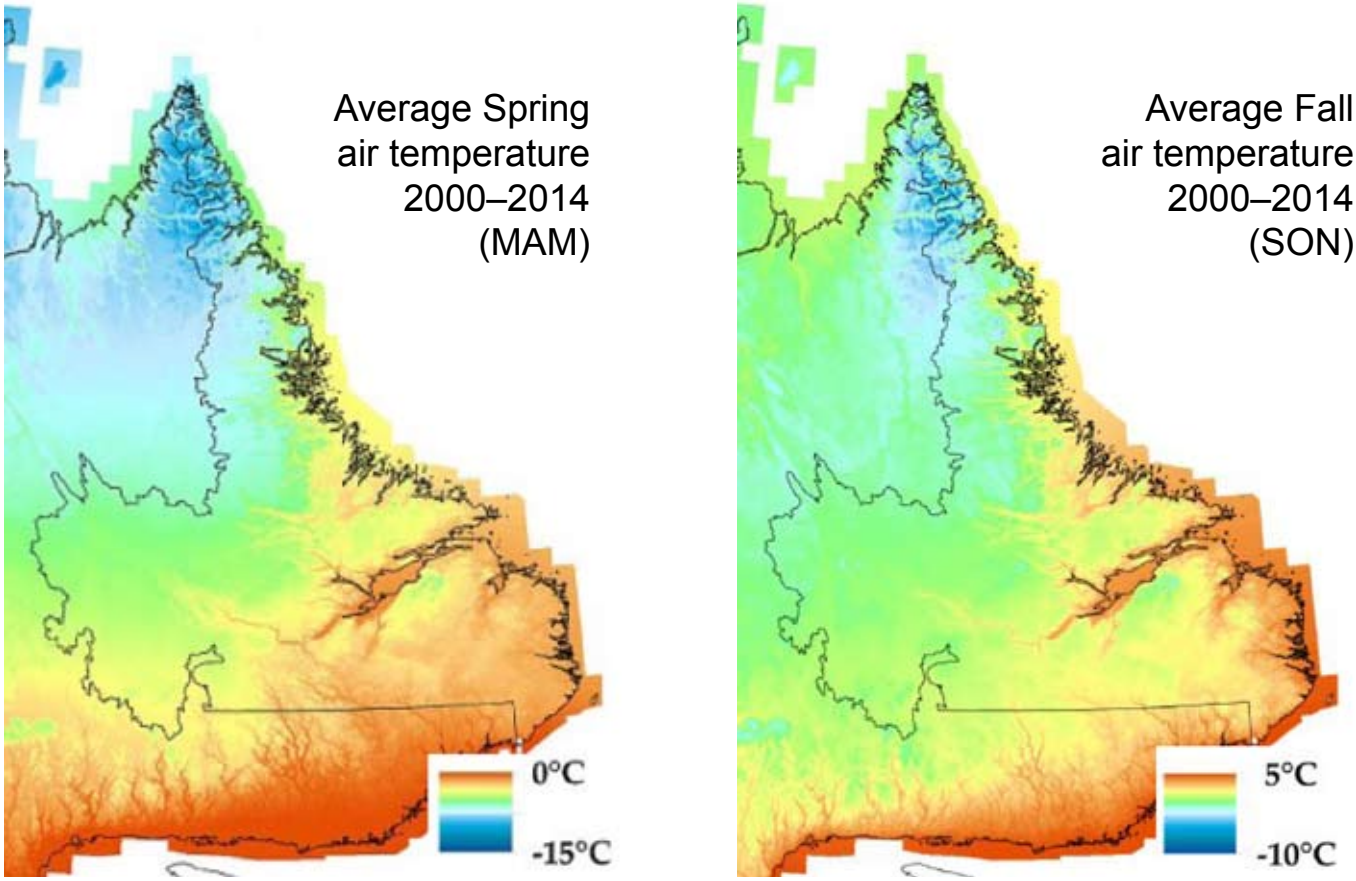

Figure 1: An illustration of the "warm oasis" in the Lake Melville area (i.e. the long arm of the sea at the lower right of each map) in the spring and fall (adaption of Fig. 8 from Way et al., with permission).[6] The warm area closely matches the boundaries of the "High Boreal Forest" ecoregion, illustrated in the title banner.

Periglacial low arctic tundra was replaced by shrub tundra between ca. 8000—7500 yrs BP; the shrub tundra was replaced by spruce woodland, during the "hypsithermal warm period", by around 6000 yrs BP, and the spruce woodland was replaced by boreal forest by about 5000 yrs BP. By about 4000 yrs BP, as regional climatic cooling began.[5]

As in the Northumberland Strait, the climate of the Lake Melville region is still relatively benign; likely, at least partly, owing to the ameliorating effect of the "lake" itself, to the relatively low altitude of the land, and to the sheltered nature of the area's river valleys. A recent study makes this dramatically clear;[6] see the red-orange isopleth for the Lake Melville area, illustrated in Figure 1.

Is there a similar disjunct fungal element, with more southern affinities, species lurking in the Lake Melville area? Do mushrooms actually care about any of the things discussed above? Who knows? The beginnings of an answer may well emerge from the results of the upcoming Foray of 2016. We shall see!

Acknowledgments:

I thank Robert Way & collaborators for the use of the isopleth illustrations in Fig. 1; title banner adapted with permission from map of NL ecoregions published by Parks & Natural Areas Division, Department of Environment & Conservation, NL, 2007.

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HEBELOMA

Almost 20 years ago I took a mushroom identification course, which introduced me to *Hebeloma*, a genus containing two common, brown-spored, toxic lawn species: *H. crustuliniforme*, a pale mushroom of medium size, known by the red droplets on its gills, and the smaller *H. mesophaeum* with a darker centre on the cap. This knowledge was and still is confirmed by field guides, which list the first or both species, but seldom more. To my great delight I immediately identified the same two species on my lawn—shown in the banner photo—a paler one with red droplets on the gills, and a smaller one with a darker central cap. These I promptly introduced as *H. crustuliniforme* and *H. mesophaeum* in my book.[1] In this issue you will learn that almost all hebelomas have dark discs and/or red droplets on their gills.

Over the years identifiers at our forays began to introduce additional species. Spurred by them, I also became more adventurous, bought more books, including one devoted strictly to genus *Hebeloma*,[2] and also strayed into the land of additional mysterious names. To be honest, I never felt very satisfied: either none of the descriptions fit with my mushroom, or several did equally well. So I did what any reasonable person would: I gave up collecting them, thus sparing me the unsatisfying effort to identify them. Any unease such action might have given my conscience was quickly assuaged by noting that most of the identifiers at our forays took the same approach: when there was a choice on the table—and there always was—most identifiers invariably chose a species other than *Hebeloma*. Those often ended up in the trash bin. Human nature.

Then along came Henry Beker, a student of *Hebeloma*, with a request for specimens for a review of the genus using modern technology. We sent him 52 specimens, both from my personal collection and the Foray herbarium. Now Beker and his colleague Ursula Eberhardt have confirmed what you may already suspect: we do not know this genus.

At all.

For starters, 10% of our *Hebeloma* collections were not from genus *Hebeloma*. We identified 14 species morphologically; the results from our experts, using phylogeny and morphology, indicate 19 different taxa. Out of the 52 collections we only got two names right! But in fairness, some of these species have only recently been named, and some taxa like *H. crustuliniforme* have now been split into several different species.

Why so difficult? Well, *Hebeloma* is a nondescript genus, not colourful, dramatic or cute; to our knowledge, it is not an edible, neither prevents nor cures cancer, and has no other redeeming features to make someone take notice, let alone a special interest in it. At the same time, it probably has some 200 species, most of which resemble each other. All of this conspires to make it overlooked, uncollected, unidentified, unfamiliar. Other genera command the attention of both collector and identifier.

Is there hope? Fortunately, yes. Although our ability to identify *Hebeloma* was not altogether stellar, most of the time we were close: 69% of our identifications were in the correct section and subsection. Henry tells me that to key out species is difficult, but the key for sections and subsections is relatively easy, once you get the hang of it. Thus, the secret to identifying these is to take small bites. First, decide which section or subsection your find belongs to. So far, we have at most five species in any (sub)section, so now you have reduced your work to figuring out which of five or less, not which of 19. This might be doable.

This review also showed some distinct regional and habitat preferences. Thus, the numbers under consideration can be reduced by knowing what is likely to be found where you are collecting (and what is not). With a little effort and practice the accuracy of our identification should improve markedly.

A story like this may occasionally have another effect. Somebody reading this may actually get curious, or even angry, and take up the challenge. Thinking that identifying hebelomas cannot be beyond human ability, such a stubborn soul may become determined to become proficient at identifying ours. Because there are so few people in this arena, that person would immediately become one of the world's few *Hebeloma* experts.

I dare you!

Andrus Voitk

HEBELOMA: key to sections and sect. *Denudata* subsections

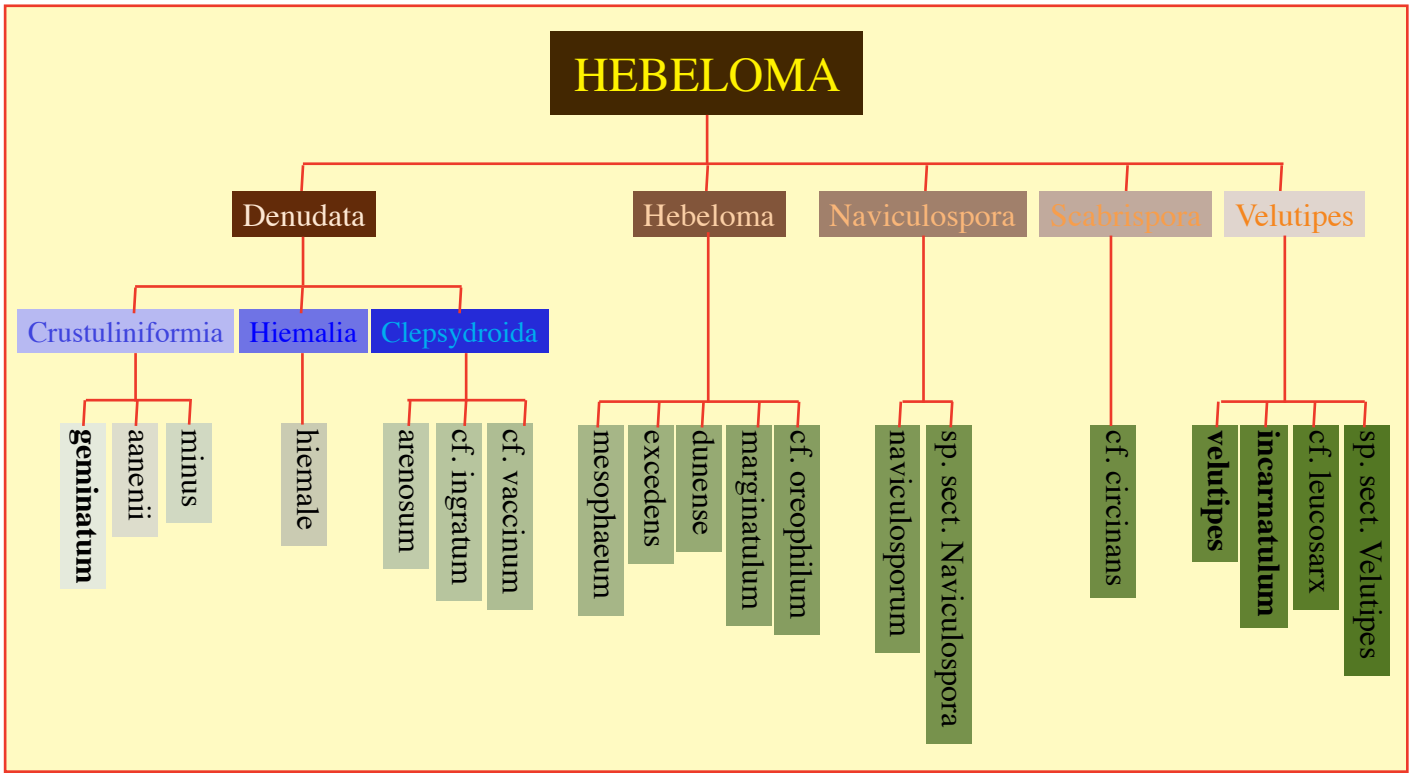
Henry Beker, Ursula Eberhardt

So far we only know of 19 species from NL. Given we have now examined collections from a number of years collecting, there may not be too many more species in the region ... but who knows! It is easier to fit your find to one of about 20 than one of 200! But selecting one from 20 very similar species is still challenging. The more you can narrow it down to manageable units, the easier to match your specimen. One way to do this is to identify the section to which your species belongs. Sections are divisions below genus level. Some sections with many species are further subdivided into subsections.

Now, don't get concerned that you have to learn another layer or two of scientific names before you can identify your find! First, there is no need to learn these names. We use them because they are there, but we might as easily call the groupings A, B, C, etc. And you need not even learn the letters. Just know they are there, use them to key out your find, and forget about them. They are written down here for your use and reference, so that you need not remember them. Think of this as a tool to help you with identification, not a pain.

Look at the diagram below. At the bottom are our 19 (so far) species. To identify your find by comparing to these 19 would be a difficult chore. But split them into sections (and subsections in one case)—with a good key to get you there—makes your life much easier. This way you never have to worry about more than five choices to fit your find. Warning: the key places a lot of stress on microscopic findings. If you do not do microscopy, the macroscopic description, added to knowledge of the distribution and habitat may break this down enough to come close, as explained in the next section.

The diagram on this page lists only the species we have identified in NL to date, arranged within their subgroups in order of abundance, the three commonest species shown in **bold**. We shall follow the same order in the species descriptions. However, as you will learn in subsequent sections, there is good reason to believe that we have not collected all the species of Hebeloma in the province yet. Therefore, on the next page **all** the *Hebeloma* sections are keyed out, in case you should find additional species, which may belong to other sections. Should your find not fit comfortably with any description, do not become alarmed or dismayed. Because the likelihood is high that there are additional species in the province, you may have an unrecorded or even undescribed one—even a new species, unknown to science. If you suspect this, please let the editor know.



KEY TO *HEBELOMA* SECTIONS

1a Lamellae with a distinct pinkish tinge, spore deposit with distinct reddish hues ..... sect. ***Porphyrospora***

1b Lamellae without a pinkish tinge, spore deposit Isabella, brownish olive, umber to sepia, or whitish ⟶ **2**

2a Basidiomes with very sweet smell (the "*Hebeloma sacchariolens* smell") ..... sect. ***Sacchariolentia***

2b Basidiomes without strong distinctive sweet smell ⟶ **3**

3a Growing on burnt ground, spores strongly dextrinoid, on ave. ≤ 10.0 × 6.0 and ave. cheilocystidium significantly swollen near the base by comparison with the median part ..... sect. ***Pseudoamarescens***

3b Not growing on burnt ground, or if on burnt ground, not satisfying other conditions ⟶ **4**

4a Basidiomes with cortina (may be fugacious), most cheilocystidia distinctly ventricose ... sect. ***Hebeloma***

4b Basidomes without cortina, or if cortina present then most cheilocystidia not ventricose ⟶ **5**

5a Basidiomes not rooting; without membranous annulus; not pruinose; ave. cheilocystidium length ≥ 40 µm; cheilocystidia consistently gently clavate, clavate-stipitate, clavate-ventricose, ventricose or a mixture of these shapes ⟶ **6**

5b Basidiomes rooting or with membranous annulus or with cylindrically shaped spores or with pruinose pileus or with cheilocystidia more or less cylindrical or with very irregular cheilocystidia or with cheilocystidia of ave. length < 40 µm ⟶ **7**

6a Most cheilocystidia gently clavate or ventricose or number of full length lamellae (L) at least 80 and spores strongly dextrinoid ..... sects. ***Sinapizantia*** & ***Velutipes***

6b Most cheilocystidia clavate-stipitate or clavate-ventricose, if number of full length lamellae (L) at least 80, then spores at most weakly dextrinoid ..... sect. ***Denudata***

7a Basidiomes with membranous annulus or distinctly rooting or with cylindrically shaped spores or with cheilocystidia more or less cylindrically shaped or cheilocystidia extremely irregular (not associated with Cistaceae) ..... sects. ***Duracinus, Myxocybe, Naviculospora, Scabrispora*** & ***Syrjense***

7b Basidiomes not rooting; without membranous annulus; spores not cylindrical; most cheilocystidia distinctly clavate-ventricose and either ≤ 40 µm long or associated with Cistaceae ..... sect. ***Theobromina***

KEY TO *HEBELOMA* SECTION *DENUDATA* SUBSECTIONS

1a Spores strongly ornamented, strongly dextrinoid, perispore loosening on most spores ... subsect. ***Echinospora***

1b Spores otherwise ⟶ **2**

2a Most cheilocystidia clavate-stipitate (strongly swollen at the apex, constricted in the median part and cylindrical or only slightly swollen in the lower half) ..... subsect. ***Crustuliniformia***

2b Many cheilocystidia with significant swelling in the lower half ⟶ **3**

3a Many spores weakly ornamented and weakly dextrinoid and perispore not loosening other than very occasionally, or if perispore of many spores loosening, then pileus is not yellow or cream in the centre, but with brown or buff tones ..... subsect. ***Hiemalia***

3b The above conditions not satisfied ..... subsect. ***Clepsydroida***

HEBELOMA: micromorphology

Henry Beker, Ursula Eberhardt

Given the importance of the spores and cheilocystidia (cystidia on the edge of the lamella), before we begin with the identification, I shall describe briefly the main shapes and spore properties. Some of these figures are reproduced from our recent book.[3]

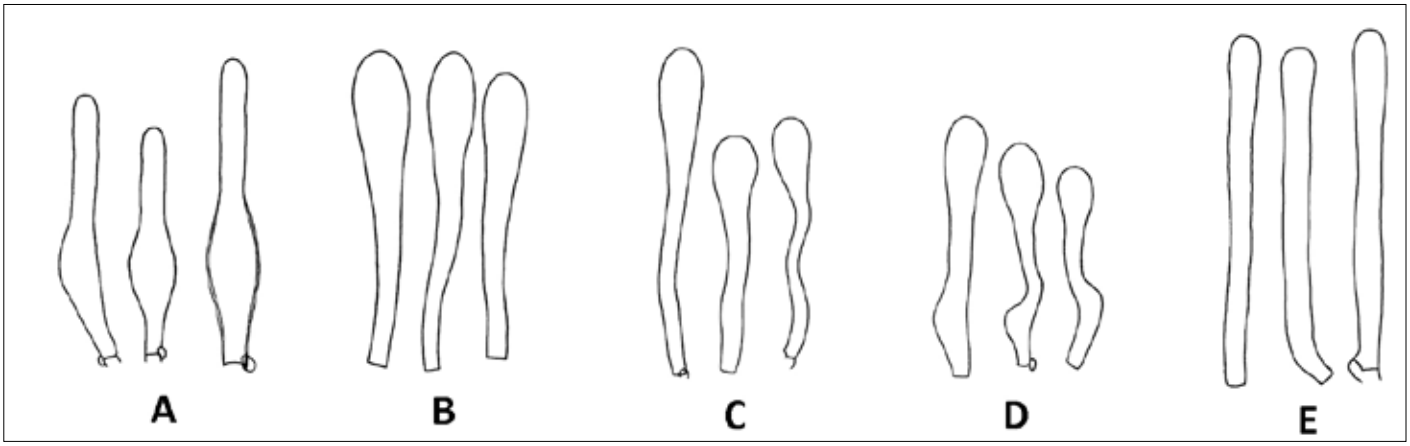


Figure 1. Main cystidial shapes. These are the shapes we need to recognize in order to use the key.

A: Ventricose (ventrum = belly) or lageniform (lagena = large flask). Swollen lower part with a narrow, more or less cylindrical upper part.

B: Gently clavate to clavate, i.e. club-like (clavum = club) swollen at the apex, tapering more or less gently toward the base.

C: Clavate-stiptate, i.e. club-like with a stem (stipes = trunk) clavate at the apex and then more or less constricted in the middle to form a more or less cylindrical (or very slightly swollen) lower part. If the apex is more round or swollen, the shape is capitate or capitate-stipitate (capitum = head).

D: Clavate-ventricose, i.e. swollen apex and lower half, and a more or less constricted middle; somewhat hourglass shaped. Again, capitate-ventricose can also occur.

E: Cylindrical.

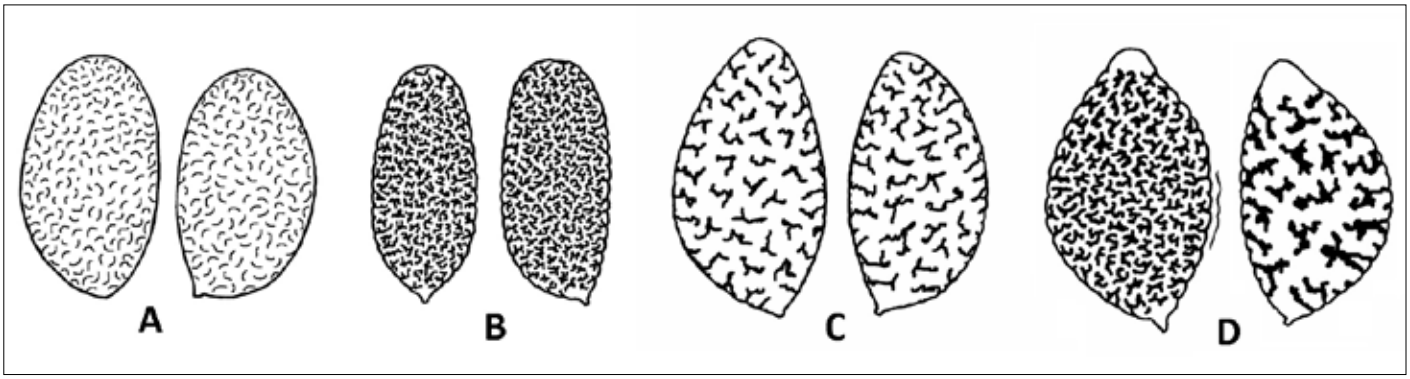


Figure 2. Main *Hebeloma* spore shapes. Dorsal view, L, lateral view, R.

A: Ellipsoid: reasonably symmetrical.

B: Cylindrical: again reasonably symmetrical.

C: amygdaloid or almond-shaped: asymmetrical in profile.

D: limoniform: asymmetric, with a pronounced papilla giving the lemon shape.

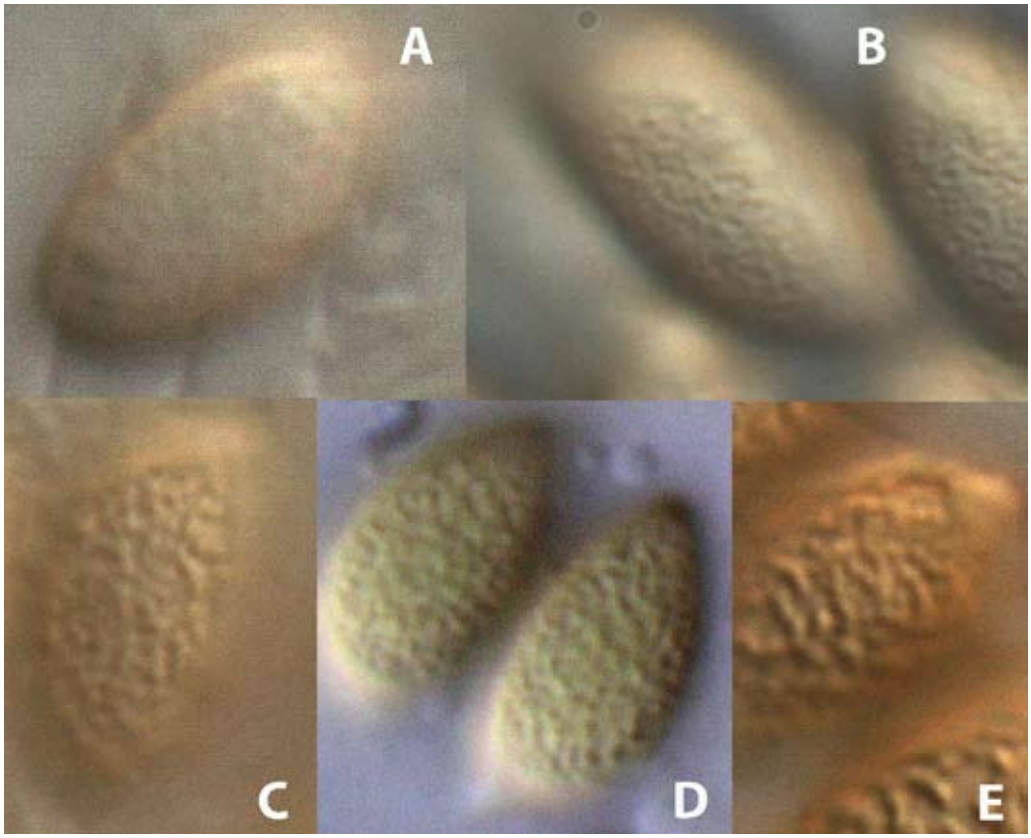


Figure 3. Spore ornamentation at high magnification (x1600). **A:** almost no visible ornamentation, even at high magnification (*H. mesophaeum*). **B:** clear ornamentation but only visible at high magnification (*H. dunense*). **C:** distinct ornamentation, reasonably visible at x1000 (*H. velutipes*). **D:** pronounced ornamentation, readily visible at x1000 (*H. geminatum*). **E:** very strong ornamentation, easily visible at low magnification (*H. anthracophilum*, not ((yet)) recorded in NL).

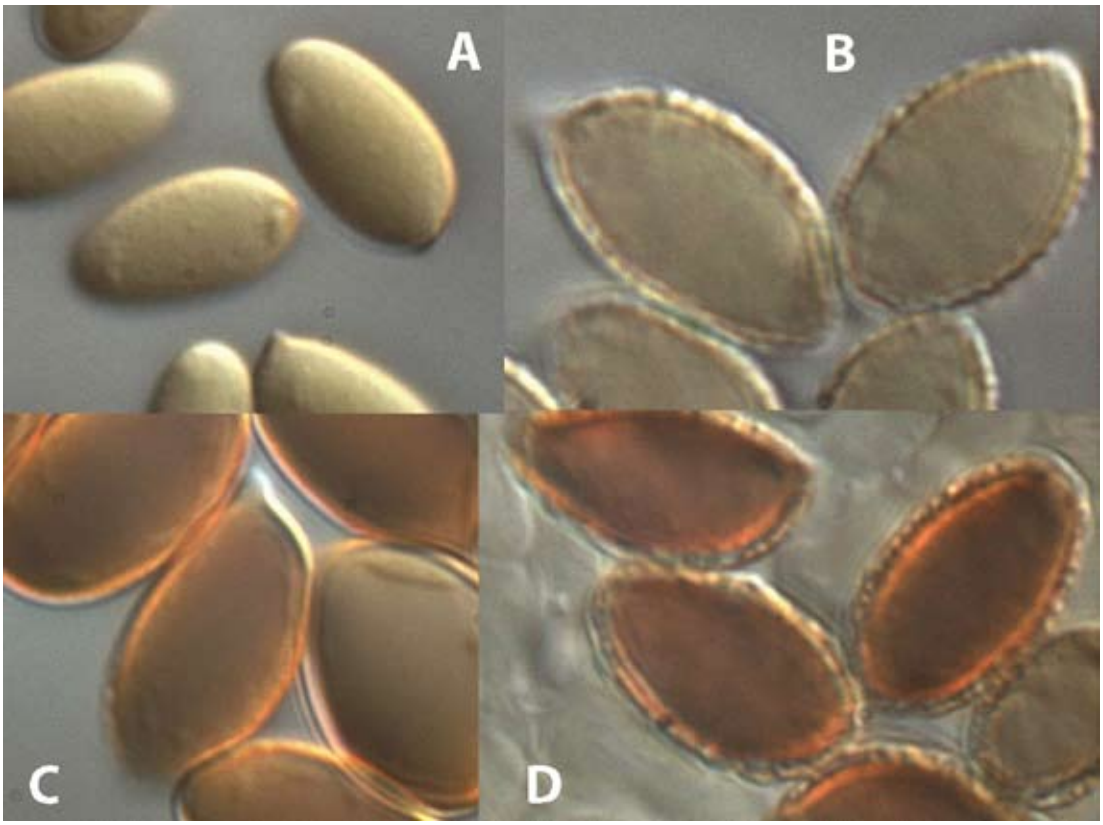


Figure 4 Dextrinoid reaction (the colour change of spores in Melzer's reagent or Iodine). **A, B:** almost no colour change (*H. mesophaeum* & *H. geminatum*, resp.) **C:** strong dextrinoid reaction (*H. velutipes*). **D:** immediate and very strong dextrinoid reaction; and also a good example of a loose perispore—layer around the spore (*H. birrus*, not ((yet)) recorded in NL).

If this is your first introduction to micromorphology, you may think some of the differences are rather subtle. They are. Recognizing these characters gets better with practice, but sometimes doubt still remains. However, if you add cystidial shape, spore size and shape, ornamentation, dextrinoid reaction and perispore attachment to macroscopic findings, tree partners, ecology and distribution, you should be able to narrow down your identification; the microscope gives the identifier much additional ammunition.

NL *Hebeloma*: species distribution

Andrus Voitk, Henry Beker, Ursula Eberhardt

Preliminary comments

- *Our data are far from complete; much more collecting is needed to confirm these impressions. These observations should be viewed as preliminary data only.*
- *Most of our province has not been surveyed.*

Knowing the distribution and habitat of a species can be a great boon to identification: you can narrow down the choices significantly by knowing what species grow where you collect.

Discussion

The map on the opposite page shows the sites of all the 47 confirmed *Hebeloma* collections. The first thing you notice is that most of the province remains unsampled. As with most distribution maps, this one follows the Trans Canada Highway, at least from the Avalon Peninsula to Corner Brook, and then two ends of Hwy. 430: around Gros Morne National Park (GM) and L'Anse aux Meadows. Not surprisingly, most of the survey of Labrador has been done along the coastal highway of the Labrador Straits.

The next obvious observation is the presence of two colourful clumps on the west coast, showing marked species diversity. The upper one is around GM, where we have had five forays, more than anywhere else. The second is around the home of one of the authors (AV), where he has collected for 14 years. The intense collection in these two areas explains why the west coast seems to be disproportionately species rich. After so much collecting, it is reasonable to assume that new species in this region will be relatively uncommon. The corollary is that if exposed to similar collecting intensity, other regions will likely also turn up more species. In other words, probably all the species of *Hebeloma* in the province have not been recorded yet.

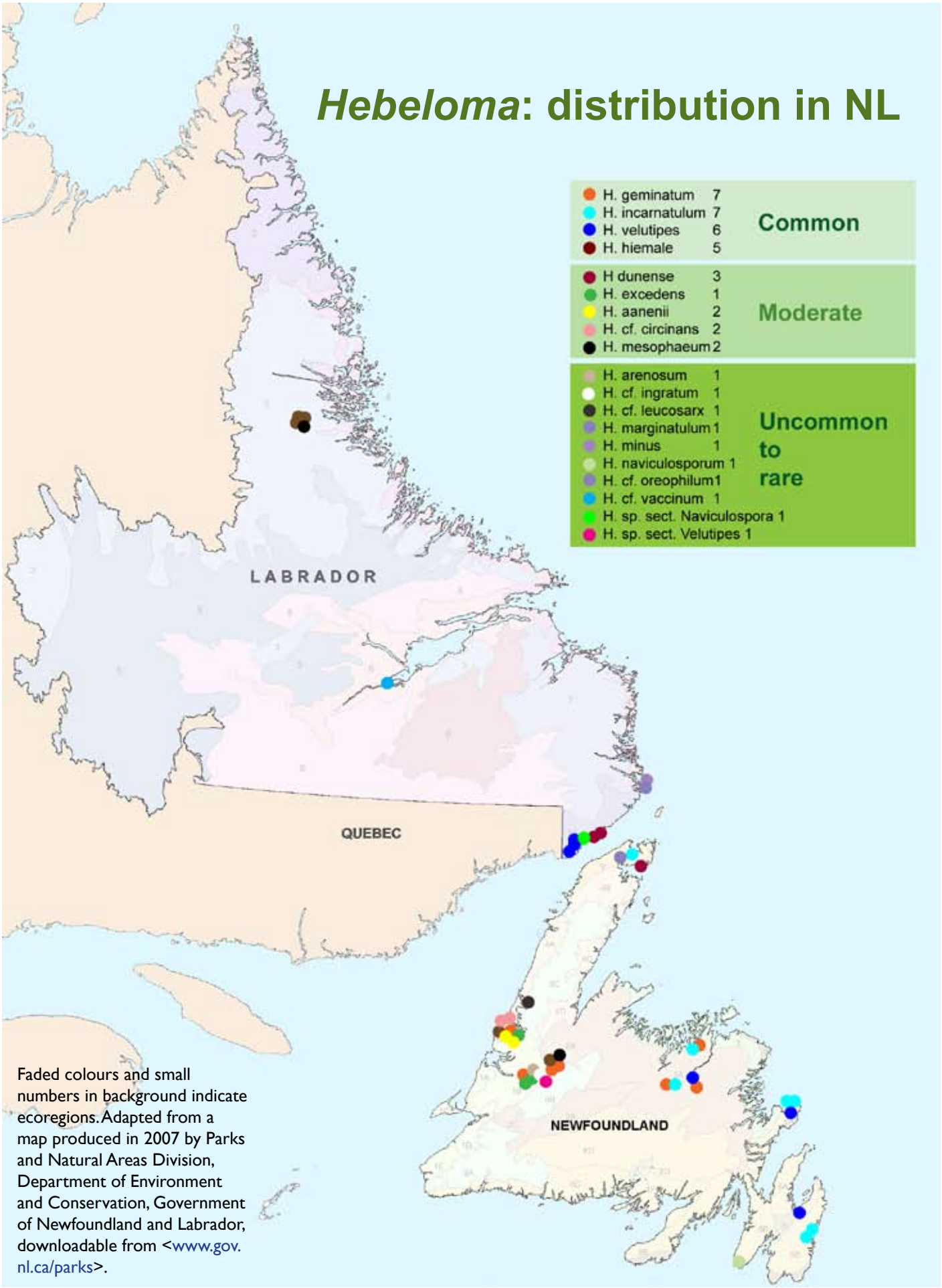
Another thing you will see on the map is that not all species are found all over; some seem to limit themselves to certain regions and do not seem to be found elsewhere. This is most obvious with the most abundant species: *Hebeloma geminatum, incarnatulum and velutipes*. Both *H. incarnatulum* and *H. velutipes* are found along a diagonal band across the northeast coast of the Island, from the Avalon all the way to the Labrador Straits. Because these are among the most abundant species, the likelihood is high that they do not grow on the west coast, because the high intensity of collecting there should have turned up such common species. On the other hand, the equally common *H. geminatum* occupies a horizontal band from the west coast through to central Newfoundland. Because it is a common species, one might have expected it elsewhere, were it not selective about its habitat.

When it comes to less abundant species, whether their distribution is due to collector variables or species preference is less certain. Still, it is noteworthy that the three collections each of both *H. aanenii* and *H. excedens* come from the west coast. It is possible that the calcareous bedrock of the west coast is an attractant to some species and repellent to others. *Hebeloma dunense* has been collected from the Great Northern Peninsula (GNP) and Labrador Straits; as its name suggests, it is a species of northern sand dunes, and also arctic habitats. Known heath dwellers like *H. marginatulum*, *H. minus* and *H.* cf. *oreophilum* have been recorded from the heaths of the Labrador Straits, fitting well with their known habitat preferences. Without more collections, no conclusions about the remaining singletons seem warranted.

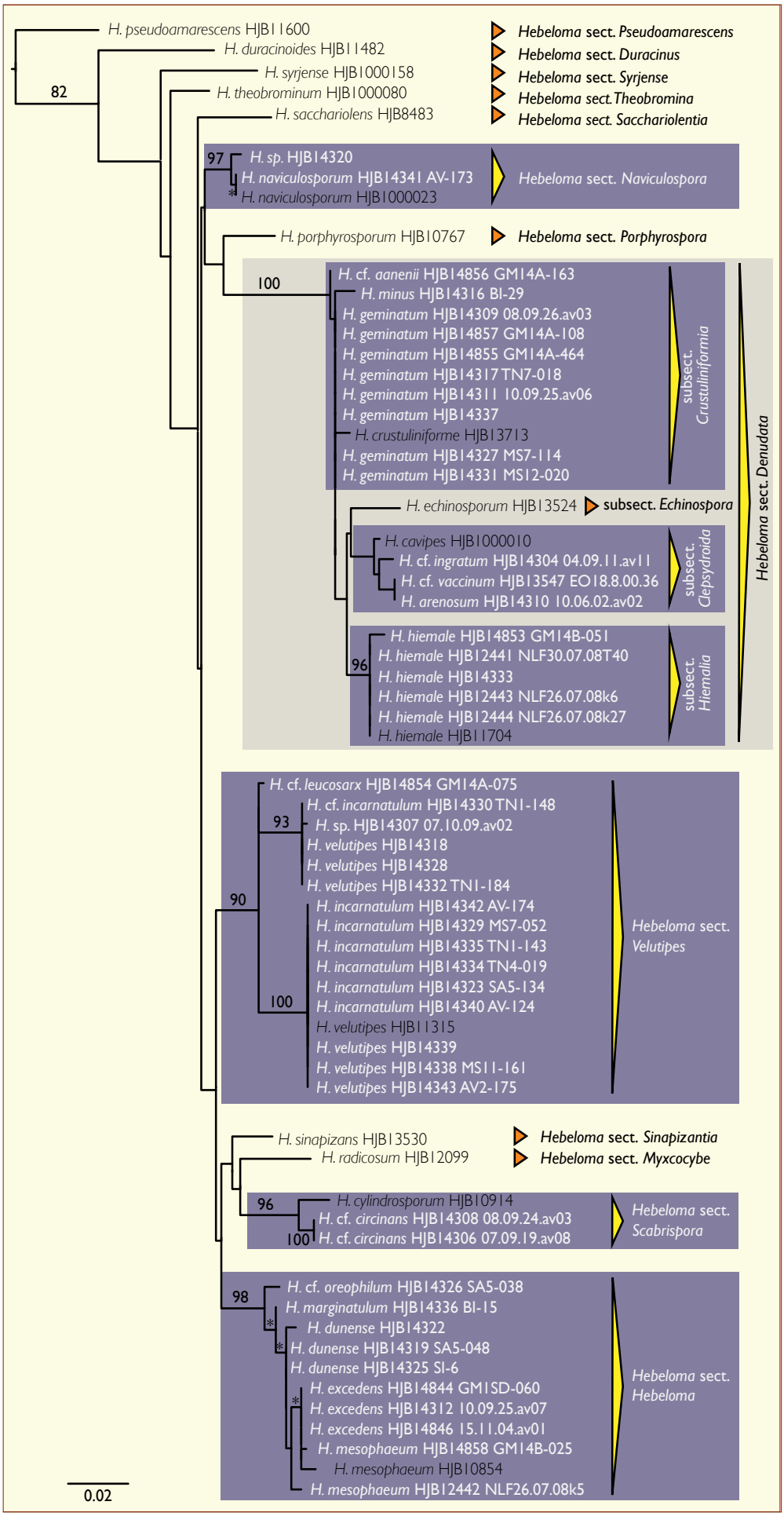
To sum up: if you believe that common things are common (distressingly often this is the case), then, should you find a *Hebeloma:*

- on the **west coast**, think of *H. geminatum, H. aanenii* or *H. excedens*;
- on the **Avalon**, think of *H. velutipes* or *H. incarnatulum*;
  - on **Cape St Mary's** think of *H. naviculosporum* (which may be unique to this exposed hyperoceanic sheep meadow)
- in **central NL**, think of *H. velutipes, H. incarnatulum* or *H. geminatum*;
- on the **GNP** or **Labrador Straits**,
  - on grassland think of *H. velutipes, H. incarnatulum*;
  - on sandy soil think of *H. dunense;*
  - on barren heathland think of *H. marginatulum, H. minus,* or *H.* cf. *oreophilum.*

If these do not fit, key your find out for the less common species.



Faded colours and small numbers in background indicate ecoregions. Adapted from a map produced in 2007 by Parks and Natural Areas Division, Department of Environment and Conservation, Government of Newfoundland and Labrador, downloadable from <www.gov.nl.ca/parks>.



NL *Hebeloma* phylogeny

Ursula Eberhardt, Nicole Schütz, Henry Beker

Maximum Likelihood phylogeny based on ITS sequences of representatives of all sections and subsections recognized in *Hebeloma* in Europe;[3] NL collections printed on darker panels in white. The classification, on the right, uses orange triangles for sections or subsections not (yet) found in NL, and yellow triangles for infrageneric taxa present in NL. We did not include sequences not belonging to *Hebeloma* (outgroup), but the tree was rooted in *Hymenogaster* and *Naucoria* spp. sequences. The calculation comprised a bootstrap analysis (1000 replicates), a semi-statistical procedure that gives an idea of the data support for each branch representing at least two sequences. Only bootstrap values ≥ 80% are given. Some of these values are represented by * in the figure, wherever writing space is scarce.

Trees are generally read from the root (left) to the tips (right). Every branch represents an evolutionary lineage. The left-most node (junction of a horizontal and a vertical line) of each (sub) branch represents

the ancestor of all nodes and tips connected to this node. In phylogeny, branches of trees originating from a single node are termed monophyla (singular monophylum, Greek mono – one, phylos – clan). All members of a monophylum are descendants from the same ancestor and all descendants from a single ancestor are part of the monophylum. Only taxa that are represented by a monophylum are phylogenetically supported and only branches supported by bootstrap ≥ 75-80%, within the data set used to run the analysis, are reasonably well supported by data. Where bootstrap support is lower, slight differences in the calculation are prone to suggest a different branching pattern. The length of the horizontal lines in the tree is scaled according to evolutionary distance; to determine the distance between any two sequences or internal nodes, the length of all horizontal lines between the two sequences/nodes is added.

Most infrageneric taxa we recognize in *Hebeloma* are supported by bootstrap (not shown in the current figure, because many sections are only represented by a single sequence). The relationship between different sections (or subsections) is normally not supported. Thus, although we get phylogenetic support for infrageneric taxa, we cannot—certainly not with only ITS—reconstruct the evolutionary history of the genus. Many species do form monophyletic branches even in ITS trees. However, this is not the case for many species in *Hebeloma* subsections *Crustuliniformia* (in what has been referred to as the "crustuliniforme complex") and *Clepsydroida* and in the sections *Velutipes* and *Hebeloma*. Also, it has long been known that members of *H. velutipes* can have one or both of two quite different variants of the ITS.[4] Accordingly, many of the morpho-species described in this article do not form their own branches, or monophyla, in this ITS-based tree. Within the context of *Hebeloma* in Europe, for many of these species we have identified other genetic loci that helped us delimit species where ITS failed. It remains to be seen whether our results for Europe will hold for American *Hebeloma*.

References

1. Voitk A: A little illustrated book of common mushroom of Newfoundland and Labrador. Gros Morne Co-Operating Association, Rocky Harbour, NL. 2007.
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3. Beker HJ, Eberhardt U, Vesterholt J: *Hebeloma*. Fungi Europaei 14. Edizioni Tecnografica, Lomazzo. 2016.
4. Aanen DK, Kuyper TW, Hoekstra RF: A widely distributed ITS polymorphism within a biological species of the ectomycorrhizal fungus *Hebeloma velutipes*. Mycol. Res. 105: 284–290. 2001.

NL *Hebeloma*: species descriptions

Henry Beker, Ursula Eberhardt

The next 19 pages describe each of the species found in NL to date. This is very much a work in progress. We have not yet examined all North American types and hence the application of names is based on the best information we have so far. Some of these names may change after more type studies. In some cases, particularly where we use "cf.", the species is close to the European species with this name but there are some differences, which require further study. Consequently, although some names may be uncertain, all the species that we have identified are good genetic species. Thus, if you have mastered the species, applying a different name to it, if need be, should be a small matter.

The designation, "*Hebeloma* sp. sect. *Xxxx*", indicates that we are reasonably certain that the collection does not correspond to a known European species, and as yet we have not discovered a matching previous North American description, but have keyed it to its appropriate section; it may or may not be an undescribed species.

Observations reported in the descriptions are taken from NL material, usually the specimens illustrated. Thus, they may differ elsewhere, and the full range of the species is not covered. Microscopic measurements exclude both extreme five percentiles. Because the shape of the cystidia is very important, a simple measurement of length and apical width is inadequate. To describe cystidial shape in a more precise way, the following parameters are usually measured: Length (l), Maximum width near apex (A), Minimum width in median part (M), Maximum width in lower third (B) and written as l x A x M x B. See our detailed account of preferred measurement technique, as well as more complete descriptions.[3]

All photos were taken in NL, except three (noted). Microscopic photos—taken from the illustrated NL collection (except the three mentioned)—show, in order: a) spores focused on their perimeter to show size and shape, and the perispore (ornamentation only seen along periphery), b) spores focused on upper surface to show ornamentation, c) basidia, and d) cheilocystidia. All microphotography by the author.

Photo: Andrus Voitk

Hebeloma geminatum

Cap 30-100 mm diameter; opaque; viscid to glutinous when young or moist; margin slightly incurved in youth, domed, becoming plane, often with broad umbo; beige to caramel, lighter toward margin, aging to golden tan. Gills close, over 80 full length (margin to stem); notched, edge finely serrate; conspicuous droplets on edges when young or moist; very light pinkish-gray, becoming tannish. Stem 7–12 x 30-70 mm; even or slightly swollen toward base; no cortina, ring, or ring zone; apex prominently flocculose, decreasing toward base; white with no or minimal staining. Flesh white to creamy; cucumber to radish smell, taste of radish, bitter. Sporeprint brownish olive. Ecology ubiquitous in parks and woodlands on a variety of soils, with both broadleaf and coniferous trees. Mid September to end October. Distribution WORLD: widespread throughout Europe; distribution in North America not yet known. NL: band across the middle of Newfoundland from the Bay of Islands to Bonavista Bay.

Microscopic SPORES: amygdaloid, 10.1–11.6 × 5.6–6.4 µm; ave. 10.9 × 6.0; Q_a=1.82; perispore rarely loosening; ornamentation distinct, even at low magnification; dextrinoidity weak. BASIDIA: 30.9 × 7.7 µm (ave.), 4-spored. CHEILOCYSTIDIA: clavate-stipitate, occasionally capitate-stipitate 54–72 × 7.2–11.4 × 4–5.6 × 3.3–4.6 µm; ave. 60 × 9.1 × 5 × 4.

Comment A newly described species within the *Hebeloma crustuliniforme* complex. This species is very similar to *H. aanenii* but can usually be distinguished by the average wider cheilocystidial apices, usually greater than 8.5 µm. The only other species recorded in NL with clavate-stipitate cheilocystidia is *H. minus* which is much smaller and has less than 40 full length gills. Based on our collections so far, *H. geminatum* is the commonest species in the Bay of Islands region, "replacing" *H. crustuliniforme* in NL.

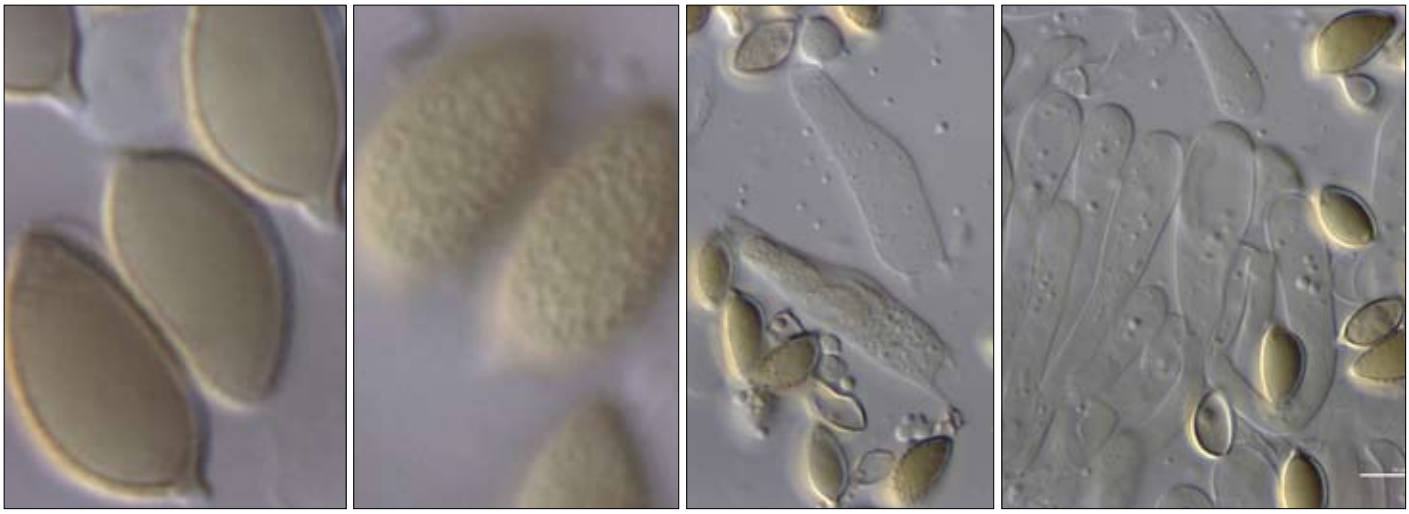


Photo: Roger Smith

Hebeloma aanenii

Cap 20-65 mm diameter; opaque; viscid to glutinous when young or moist; edge slightly incurved in youth; hemispherical, becoming convex to near-plane, sometimes becoming umbonate with age; beige, lighter toward margin. Gills close, usually over 80 full length (from margin to stem); notched, edge finely serrate; droplets; very light cream-buff, becoming tannish. Stem 4–9 × 30-95 mm; even or slightly swollen toward base; no cortina, ring, or ring zone; apex flocculose, decreasing slightly toward base; white; some discoloration with age. Flesh white to creamy; smell, and taste of radish. Sporeprint brownish olive. Ecology in parkland and woodland with a variety of trees both broadleaf and conifer. Mid September to end October. Distribution WORLD: common throughout Northern Europe; no other records yet from the North America. NL: two collections from the Killdevil Campgrounds, in Gros Morne National Park.

Microscopic SPORES: amygdaloid, 9.4–12.4 × 5.4–6.4 µm; ave. 10.6 × 5.9; Q_a=1.79; perispore rarely loosening; ornamentation distinct, even at low magnification; dextrinoidity weak. BASIDIA: 26.2 × 7.8 µm (ave.), 4-spored. CHEILOCYSTIDIA: clavate-stipitate, occasionally capitate-stipitate 62–84 × 5.9–9.6 × 3–5.4 ×1.9–4.6 µm; ave. 72 × 7.7 × 4.1 × 3.4.

Comment Another newly described species within the *Hebeloma crustuliniforme* complex. Differs from the very similar *H. geminatum*, by its average narrower cheilocystial width at the apex; usually less than 8.5 µm. The only other species recorded in NL with clavate-stipitate cheilocystidia is *H. minus* which is much smaller and has less than 40 full length gills. Named in honour of Duur Aanen, a Dutch student of *Hebeloma*, known for his mating studies within the genus.

Hebeloma minus

Cap 9-16 mm diameter; opaque, slightly hygrophanous; viscid to glutinous when young or moist; convex to umbonate; clay-buff, often slightly lighter toward margin. Gills medium to distant, less than 40 full length (from margin to stem); notched, edge finely serrate; droplets often on edges when young or moist; very light cream, becoming tannish. Stem 2–4 × 15-24 mm; even; no cortina, ring, or ring zone; apex flocculose, decreasing toward base; white, no staining. Flesh white; radish smell and taste. Sporeprint brownish olive. Ecology in tundra with dwarf willow. End July to September. Distribution WORLD: rare but widespread In the alps and the European arctic, likely circumpolar. NL: single find from Battle Harbour, but probably in most suitable tundra habitat with dwarf willow.

Microscopic SPORES: amygdaloid, limoniform, 9.9–13.4 × 6.1–7.5 µm; ave. 11.9 × 6.8; Q_a=1.76; perispore rarely loosening; ornamentation distinct, even at low magnification; dextrinoidity weak. BASIDIA: 35.6 × 9.3 µm (ave.), 4-spored. CHEILOCYSTIDIA: mostly clavate-stipitate or capitate-stipitate 44–66 × 7.3–12.1 × 3–5.1 × 3.3–6.4 µm; ave. 54 × 9.8 × 4.1 × 4.6.

Comment Of our tundra species, this is easily distinguished by the small size, small number of full length gills and lack of cortina. Photo from Svalbard.

Photos: Roger Smith

Hebeloma hiemale

Cap 12-50 mm diameter; opaque, not hygrophanous; viscid to glutinous when young or moist; convex, becoming plane, often with broad umbo; cinnamon, sometimes lighter toward margin but often evenly coloured. Gills medium spacing, 35–70 full length (from margin to stem); notched, edge finely serrate; droplets on edges when young or moist; very light gray-white, becoming tannish. Stem 4–7 × 20-60 mm; even or widening toward base; no cortina, ring, or ring zone; apex pruinose, decreasing toward base; white, staining gray-brown. Flesh white to creamy; smell and taste mildly cucumber to radish. Spore-print dull brown. Ecology widespread in forested areas, with both deciduous and coniferous trees. August to end November. Distribution WORLD: widespread in Northern Europe and apparently also in North America; occurs also in arctic and alpine areas. NL: collected from Konrad Brook, Labrador, and Stanleyville trail in Gros Morne National Park.

Microscopic SPORES: amygdaloid, 11.5–13.8 × 6.6–7.6 µm; ave. 12.5 × 7; Q_a=1.79; perispore rarely loosening; ornamentation distinct but weak; dextrinoidity weak. BASIDIA: 32.4 × 9.8 µm (ave.), 4-spored. CHEILOCYSTIDIA: mostly clavate-ventricose, occl. capitate-ventricose 47–67 × 5.2–9 × 3.2–5.1 × 4.7–8.3 µm; ave. 55 ×7.1 × 4.4 × 6.7.

Comment Distribution may well prove more widespread. Smaller fruitbodies and less full length lamellae should separate this from members of subsect. *Crustuliniformia*. More likely to be confused with species from subsect. *Clepsydroida*, but these all exhibit more ornamented and/or more dextrinoid spores. All the species of sect. *Velutipes* also have more dextrinoid spores, while the species of sects. *Hebeloma*, *Naviculospora* and *Scabrispora* have very differently shaped cheilocystidia.

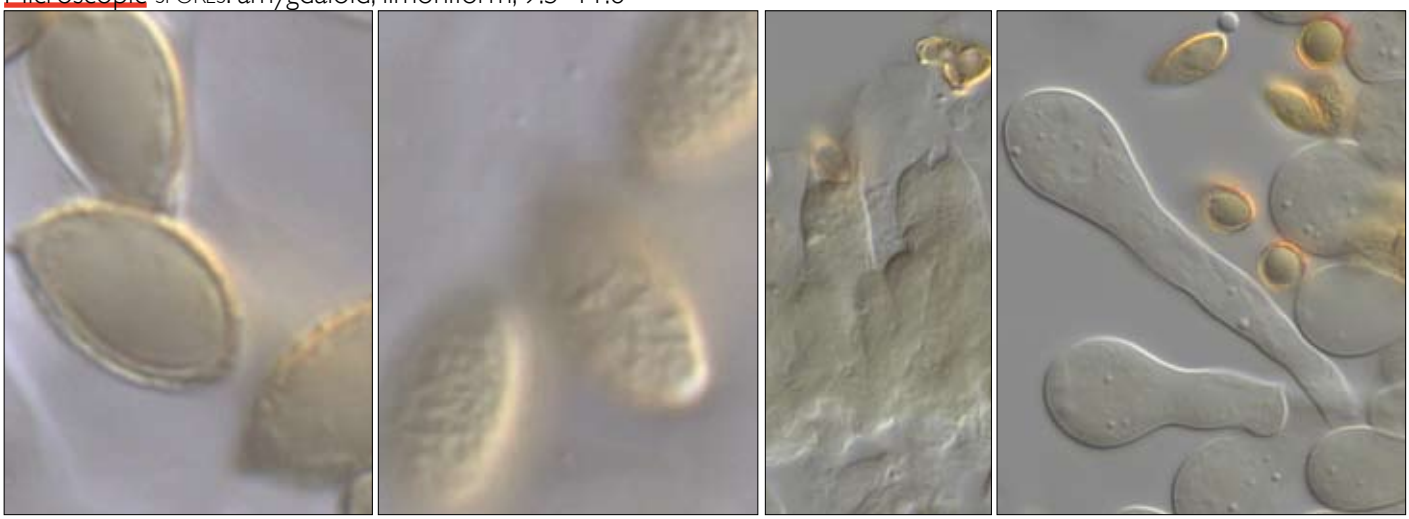
Photo: Andrus Voitk

Hebeloma arenosum

Cap 30-90 mm diameter; opaque; viscid to glutinous when young or moist; domed, becoming plane, often with broad umbo; finely fibrillar; brown, aging lighter, particularly at margin. Gills moderately spaced, approx. 60 full length (from margin to stem); notched, edge finely serrate, becoming marginate; buff, becoming darker. Stem 4–9 × 20-50 mm; even; some veil remnants visible in youth, no ring; pruinose above, becoming finely fibrillose below; hollows quickly; white, becoming orange tan; no staining. Flesh white to creamy; smell and taste of radish. Spore-print dull brown. Ecology not yet understood but NL collections were from lawns under birch in built-up areas. Early June to end July. Distribution WORLD: not known from Europe but appears quite widespread In North America. NL: so far only collected once from Humber Village.

Microscopic SPORES: amygdaloid, limoniform, 9.5–11.8 × 5.5–6.6 µm; ave. 10.7 × 6.1; Q_a=1.77; perispore not loosening; ornamentation distinct, even at low magnification; dextrinoidity reasonably strong, clearly visible. BASIDIA: 27.1 × 8.8 µm (ave.), 4-spored. CHEILOCYSTIDIA: mostly clavate-stipitate to clavate-ventricose (more clavate-stipitate than usual in subsect. *Clepsydroida*), 35–65 × 6.6–13.4 × 3.6–6.8 × 4.8–9.2 µm; ave. 50 × 9.6 × 5.2 × 7.1.

Comment Very closely related to the European *H. cavipes*. The cheilocystidia place it firmly within sect, *Denudata*. The dextrinoid spores make it easy to distinguish, microscopically, from the species of subsects. *Crustuliniformia* & *Hiemalia*. Spore dextrinoidity also separates this species from *H. ingratum*. *H. vaccinum* has significantly larger spores with length always greater than 12 µm. The strongly brown coloured cap is also distinctive but we need to study further collections of this species before we can say how consistent this character is.

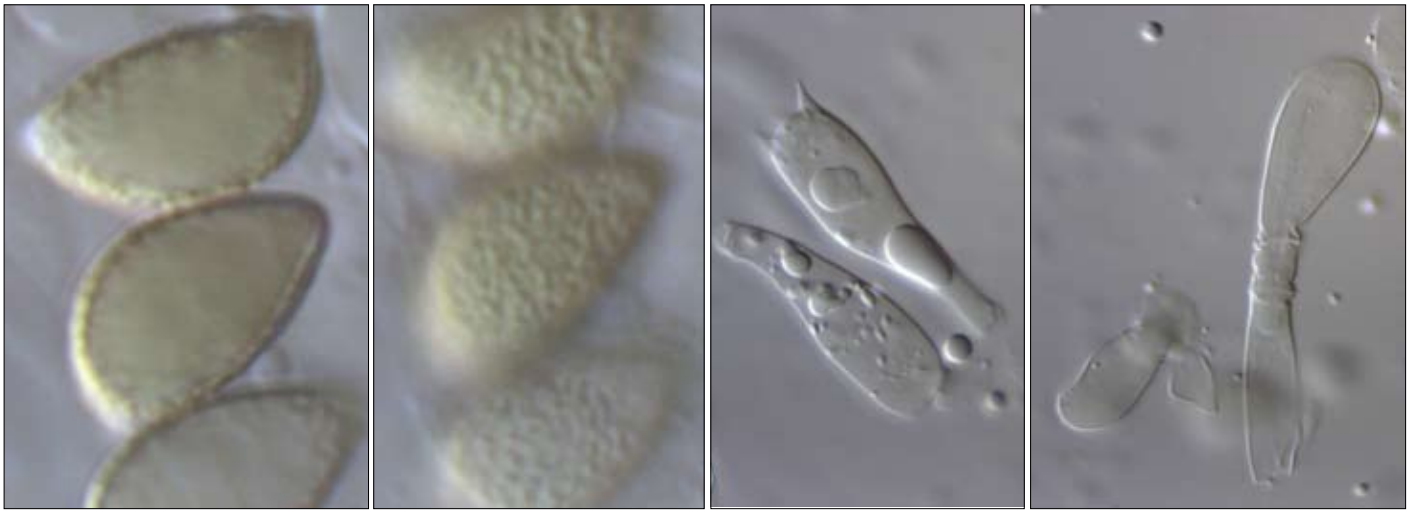


Hebeloma cf. *ingratum*

Cap 25-75 mm diameter; opaque, slightly hygrophanous; viscid to glutinous when young or moist; margin slightly incurved in youth, crenulate-striate at very edge, domed, becoming plane, often with broad umbo; pinkish-buff, lighter toward margin. Gills moderately to closely spaced, approx. 70 full length (from margin to stem); notched, edge finely serrate; conspicuous droplets on edges when young or moist; white, becoming beige. Stem 5–8 × 30-60 mm; even; no cortina, ring, or ring zone; apex prominently flocculose, decreasing toward base; white with no or minimal staining. Flesh white to creamy; cucumber to radish smell and taste, bitter. Sporeprint dull brown. Ecology with deciduous trees in woodlands or parklands, in NL on lawns under birch in built-up areas. Mid September to end October. Distribution WORLD: widespread throughout Northern Europe and also known from arctic areas of North America. NL: so far a single collection from Humber Village.

Microscopic SPORES: amygdaloid, limoniform, 9.8–11.8 × 5.6–6.8 µm; ave. 10.9 × 6.5; Q_a=1.7; perispore rarely loosening; ornamentation distinct, even at low magnification; dextrinoidity weak. BASIDIA: 32.4 × 9.2 µm (ave.), 4-spored. CHEILOCYSTIDIA: mostly clavate-ventricose, 56–74 × 7–12.4 × 3.9–6 × 4.9–6.8 µm; ave. 62 × 9.5 × 4.7 × 5.8.

Comment The cheilocystidia clearly place this species in sect. *Denudata*. Their hourglass shape and the strongly ornamented spores rule out sects. *Crustuliniformia* and *Hiemalia*. Spore non-dextrinoidity rules out other species of sect. *Clepsydroida*, recorded in NL. While phylogenetically (at least based on ITS) the NL collection conforms well with *H. ingratum*, macroscopically it is unusual for this species. European collections tend to have a pruinose rather than floccose stem and the cap colour tends to be more clearly brownish. Microscopically, on the average, both spores and cheilocystidial apices are a little wider than found in Europe. Further collections needed!



Hebeloma cf. *vaccinum*

Cap 15-36 mm diameter; opaque, not hygrophanous; viscid to glutinous when young or moist; evenly convex, often becoming umbonate with age; clay buff to dark brick, lighter toward margin. Gills moderately spaced, 35-60 full length (margin to stem); notched, edge finely serrate, white; droplets; cream becoming tannish. Stem 4–8 × 18-38 mm; even or slightly swollen base, may have gently constricted middle; no cortina, ring, or ring zone; pruinose to flocculose, decreasing from apex to base; whitish to dirty yellow, turning brownish, not staining. Flesh white to creamy; smell and taste of radish or chocolate. Sporeprint brownish olive. Ecology small troops on poor soil, always with willow, common in dunes but also found in woodlands and arctic areas, September. Distribution WORLD: widespread throughout Northern Europe, probably circumpolar in arctic areas. NL: single collection from Goose Bay, Labrador.

Microscopic SPORES: amygdaloid, limoniform, 11.6–13.7 × 6.1–7.5 µm; ave. 12.7 × 6.9; Q_a=1.84; perispore loosening in many spores; ornamentation distinct, even at low magnification; dextrinoidity reasonably strong, clearly visible. BASIDIA: 28.3 × 8 µm (ave.), 4-spored. CHEILOCYSTIDIA: mostly clavate-ventricose, 42–54 × 4.7–8.1 × 2.6– 4.3 × 4.6–6.8 µm; ave. 47 × 6.5 × 3.4 × 5.6.

Comment The shape of the cheilocystidia and the strongly dextrinoid spores rule out all members of sect. *Denudata* recorded in NL except *H. arenosum*, which has significantly smaller spores. This specimen was collected in 2000 by P. Kallio in Goose Bay, identified by Esteri Ohenoja. Look for it in the Goose Bay foray. Photo from dunes in Wales.

Photo: Roger Smith

Hebeloma mesophaeum

Cap 13-45 mm diameter; opaque, not hygrophanous; viscid to glutinous when young or moist; campanulate, often with broad umbo; fibrillar veil remnants suspended from margin; light beige, with darker brown disc. Gills moderately spaced, approx. 40 full length (margin to stem); notched, edge finely serrate, whitish; droplets rare; very light buff, becoming tannish. Stem 3–6 × 20-60 mm; even; usually obvious cortina, pruinose to floccu-lose above, fibrillose below; hollows with maturity; white, staining light or rusty brown. Flesh white to creamy and darkening; cucumber to radish smell, taste mildly radish-like. Sporeprint brownish olive. Ecology ubiquitous, probably the most common *Hebeloma* species, recorded on all soil types with broadleaf and coniferous trees. NL collections in lawns under birch in built-up areas. Mid September to end October. Distribution WORLD: Common and widespread throughout Northern Europe, including arctic and alpine areas. NL: two collections, one from Sir Richard Squires Memorial Provincial Park and the other from form Konrad Pond, Labrador.

Microscopic SPORES: ellipsoid, 8.3–9.8 × 5–5.9 µm; ave. 9 × 5.5; Q_a=1.64; perispore not loosening; ornamentation very weak; dextrinoidity non-dextrinoid. BASIDIA: 29.8 × 8.1 µm (ave.), 4-spored. CHEILOCYSTIDIA: ventricose, 34–48 × 3.6–5.2 × 3.2–4.5 × 6.1–8.8 µm; ave. 43 × 4.3 × 3.9 × 7.3.

Comment *H. mesophaeum* is the type of the genus. It has the typical ventricose cheilocystidia common to all members of sect. *Hebeloma.* Distinguishable from *H. excedens* only by molecular studies. Differs from *H. oreophilum* by its ellipsoid spores; differs from *H. dunense* and *H. marginatulum* buy its smaller, on average, spores, rarely longer than 10 µm.

Photo: Andrus Voitk

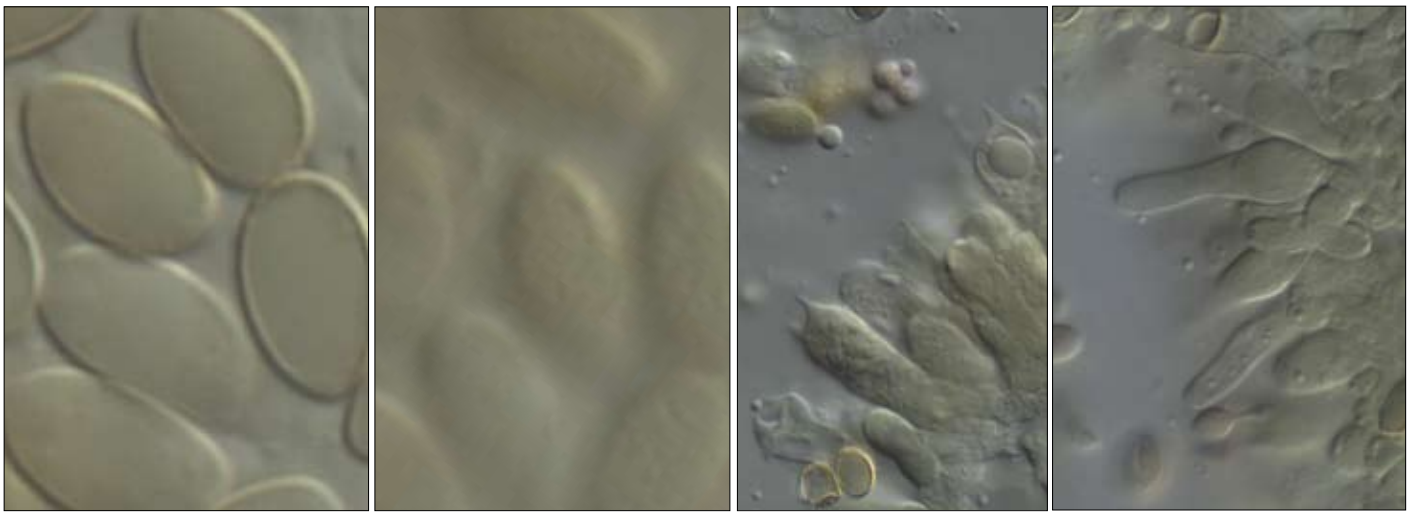
Hebeloma excedens

Cap 15-50 mm diameter; opaque, not hygrophanous; viscid to glutinous when young or moist; campanulate, becoming plane, often with broad umbo; fibrillar veil remnants suspended from margin; light beige, with darker brown disc. Gills moderately spaced, approx. 50 full length (margin to stem); notched, edges finely serrate, whitish; droplets rare; very light pinkish-gray, becoming tannish. Stem 3–6 x 20-60 mm; even or slightly enlarged toward base; usually obvious cortina, pruinose to flocculose above fibrillose below; hollows with maturity; white, staining light or rusty brown. Flesh white to creamy and darkening; cucumber to radish smell, taste mildly radish-like. Sporeprint dull brown. Ecology not fully understood, NL collections in lawns under birch in built-up areas. Mid September to end October.

Distribution WORLD: not yet recorded from Europe, widespread In North America. NL: two collections, one from Humber Village and one from Sir Richard Squires Memorial Provincial Park.

Microscopic SPORES: ellipsoid, 7.4–9.7 × 5–6.1 µm; ave. 8.8 × 5.6; Q_a=1.58; perispore not loosening; ornamentation very weak; dextrinoidity non-dextrinoid. BASIDIA: 27.4 × 7.1 µm (ave.), 4-spored. CHEILOCYSTIDIA: ventricose, 25–36 × 4–5.1 × 3.7–5.6 × 5.7–8.2 µm; ave. 30 × 4.5 × 4.5 × 7.

Comment It has the typical ventricose cheilocystidia common to all members of sect. *Hebeloma.* Currently distinguishable from *H. mesophaeum* only by molecular studies. Differs from *H. oreophilum* by its ellipsoid spores and from *H. dunense* and H. *marginatulum* buy its smaller, on average, spores, rarely longer than 10 µm.



Hebeloma dunense

Cap 16-40 mm diameter; opaque, not hygrophanous; viscid to glutinous when young or moist, fibrillar when dry; pink-beige velar fibres remain on cap margin; convex with blunt umbo, becoming plane, often with blunt nipple to broad umbo; beige, lighter toward margin. Gills moderately spaced, approx. 40-44 full length (margin to stem); notched, edge smooth or very finely serrate; droplets rare; cream, becoming uniformly cinnamon. Stem 4–8 × 40-80 mm; even; evanescent cortina; pruinose to flocculose above and fibrillose below; narrowing slightly toward base; creamy with brown staining, aging to rust brown. Flesh white to creamy; cucumber to radish smell and taste. Sporeprint brownish olive. Ecology in sandy soil, always with willow, common in dunes and arctic areas, but also found in parkland and woodland. August to early October. Distribution WORLD: widespread. NL: so far collected from the Great Northern Peninsula and the Labrador Straits.

Microscopic SPORES: ellipsoid, 9.2–11.7 × 5.7–6.9 µm; ave. 10.3 × 6.3; Q_a=1.64; perispore not loosening; ornamentation weak but distinct; dextrinoidity weak but distinct. BASIDIA: 25.6 × 6.5 µm (ave.), 4-spored. CHEILOCYSTIDIA: ventricose, 38–52 × 5.1–6.3 × 4.5–5.5 × 8.1–10.7 µm; ave. 45 × 5.8 × 5.1 × 9.4.

Comment Distinguished by the evanescent cortina, the presence of willow and poor sandy soil. It has the typical ventricose cheilocystidia common to all members of sect. *Hebeloma.* Differs from *H. oreophilum* by its ellipsoid spores; differs from *H. excedens* and *H. mesophaeum* by its larger spores, always on average longer than 10 µm. In arctic areas it can be difficult to separate from H. marginatulum but has slightly rougher and slightly more dextrinoid spores.

Hebeloma marginatulum

Cap 14-36 mm diameter; opaque, rarely hygrophanous; viscid to glutinous when young or moist; domed, becoming more plane, may have broad umbo; fibrillose whitish velar elements around cap and at edge; beige, slightly lighter toward margin. Gills moderately spaced, approx. 40 full length (margin to stem); notched, edge finely serrate; no droplets; cream, becoming tannish. Stem 3–5 × 15-30 mm; even; fugacious ring zone; pruinose or flocculose above; whitish tan, usually staining brownish with age. Flesh white; radish smell and taste. Sporeprint dull brown. Ecology exposed arctic or alpine sites, with willow on poor soil. End July to September. Distribution WORLD: widespread In alpine and arctic habitats, probably circumpolar. NL: single find from Battle Harbour.

Microscopic SPORES: ellipsoid, 9.1–10.6 × 5.6–6.2 µm; ave. 10.1 × 5.9; Q_a=1.71; perispore not loosening; ornamentation weak; dextrinoidity non-dextrinoid. BASIDIA: 31.3 × 8.6 µm (ave.), 4-spored. CHEILOCYSTIDIA: ventricose, 43–75 × 3.7–5.5 × 3.8–5.8 × 6.1–12.2 µm; ave. 52 × 4.5 × 4.8 × 9.

Comment Distinguished by the cortina, the arctic ecology and the presence of willow. It has the typical ventricose cheilocystidia common to all members of sect. *Hebeloma*. Differs from *H. oreophilum* by its ellipsoid spores; differs from *H. excedens* and *H. mesophaeum* by its larger spores, always on average longer than 10 µm. It can be difficult to separate from *H. dunense* but has less rough and less dextrinoid spores. Photo of alpine collection from Italy.

Hebeloma* cf. *oreophilum

Cap 15-25 mm diameter; opaque, slightly hygrophanous; viscid to glutinous when young or moist; margin slightly incurved in youth, convex, becoming plane, often with broad umbo; reddish mid-brown, lighter toward margin. Gills moderately spaced, approx. 40 full length (margin to stem); notched, edge finely serrate; no droplets; very light pinkish-gray, becoming beige-tan. Stem 3–5 x 25-45 mm; even; cortina present; loosely fibrillose for full length; fibrils stain brown. Flesh white to creamy; cucumber to radish smell, and taste. Sporeprint brownish olive. Ecology in tundra heath with willow. August to end September. Distribution WORLD: appears to be circumpolar. NL: single find from the Great Northern Peninsula.

Microscopic SPORES: amygdaloid, sometimes limoniform, 9.8–13.3 × 5.8–7.7 µm; ave. 12 × 7; Q_a=1.71; perispore not loosening; ornamentation weak, but distinct; dextrinoidity strong. BASIDIA: 26.2 × 7.7 µm (ave.), 4-spored. CHEILOCYSTIDIA: ventricose, 35–49 × 4–5.8 × 4.1–5.4 × 6.6–11 µm; ave. 41 × 4.8 × 4.5 × 8.8.

Comment Recently described, small tundra species. Small size, cortina, and fibrillar stem should help distinguish it from the others. It is the only species so far recorded from NL with amygdaloid, dextrinoid spores and ventricose cheilocystidia. Our specimen requires a little more analysis to confirm the identity with certainty.

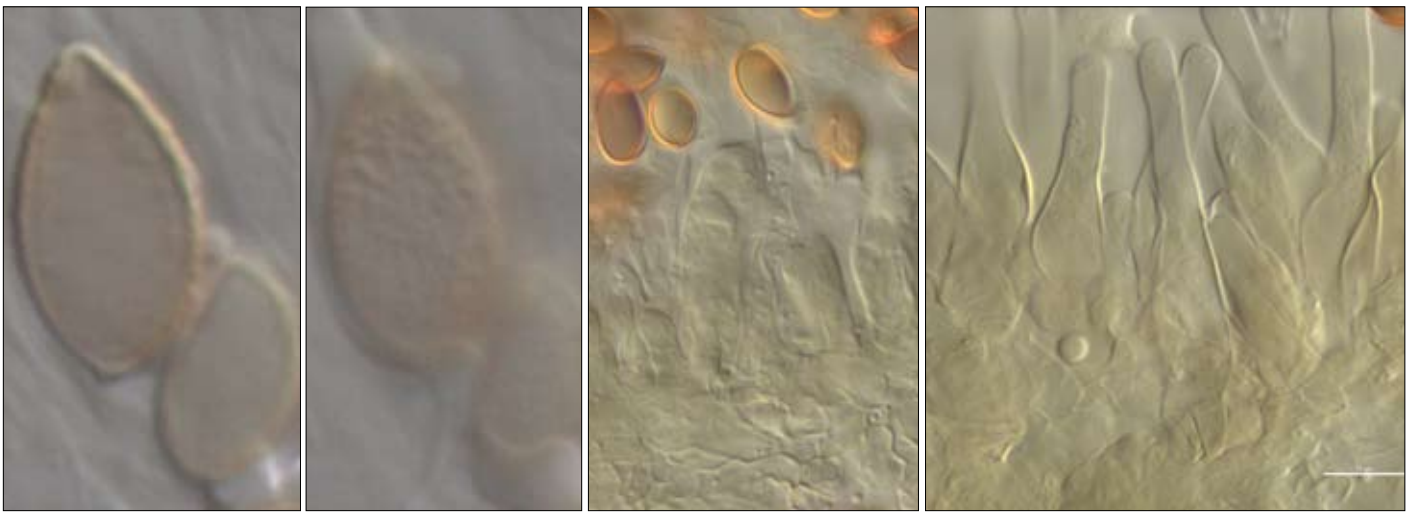


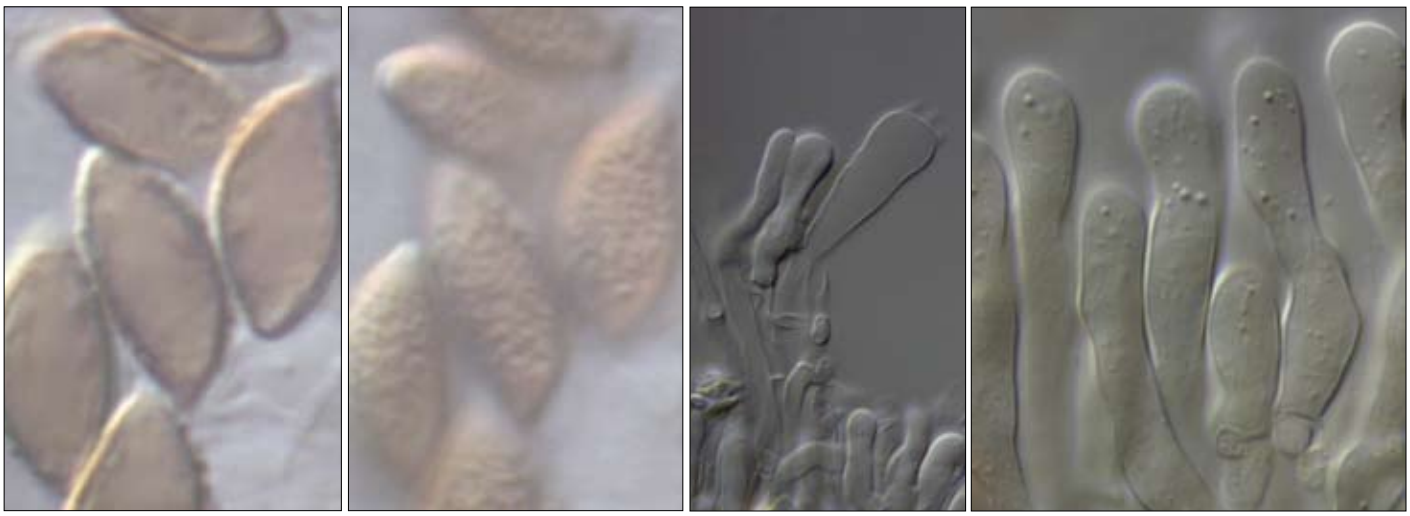
Photo: Roger Smith

Hebeloma naviculosporum

Cap 30-50 mm diameter; opaque, not hygrophanous; viscid to glutinous when young or moist; margin sometimes crenulate, domed, becoming plane, often with broad umbo; orange-brown, sometimes lighter toward margin. Gills moderately close, 60-80 full length (margin to stem); notched, edge finely serrate, whitish; no droplets; light pinkish-beige, becoming tannish. Stem 6–10 × 35-60 mm; even; no cortina, ring, or ring zone; apex pruinose or flocculose, decreasing toward base; white staining brownish. Flesh white to creamy; smell and taste earthy. Sporeprint ochraceous brown. Ecology in "wild" grasslands, base-poor soil with conifers. Mid September to end October. Distribution WORLD: quite widespread in subalpine or subarctic places. NL: single collection from Cape St Mary's.

Microscopic SPORES: amygdaloid, navicular, 9.6–11.3 × 4.7–5.6 µm; ave. 10.3 ×5.1; Q_a=2.01; perispore rarely loosening; ornamentation weak, but distinct; dextrinoidity strong. BASIDIA: 27.6 × 7.4 µm (ave.), 4-spored. CHEILOCYSTIDIA: cylindrical (or slightly clavate), irregular, 27–40 × 4.5–7.3 × 3.7–5.1 × 3.5–5.6 µm; ave. 34 × 5.6 × 4.4 × 4.6.

Comment The orange-brown cap, the habitat in grassy places with conifers and the cylindrical to slightly clavate cheilocystidia distinguish this species from others recorded in NL. The spores with an average Q value of over 2 also distinguish this species.

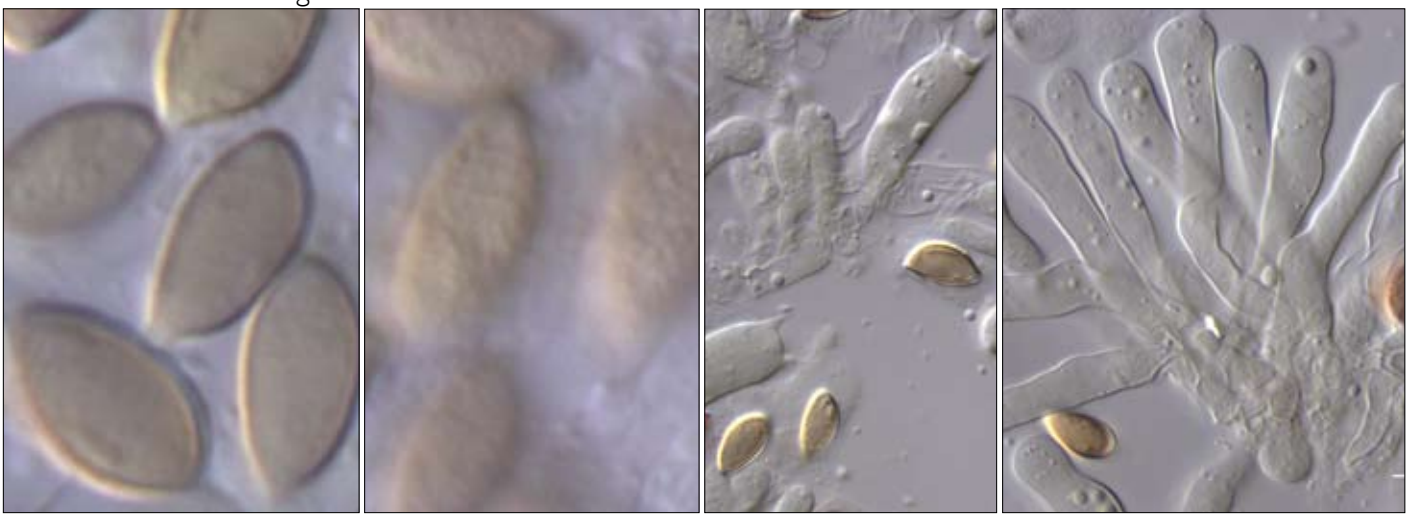


Hebeloma* sp. sect. *Naviculospora

Cap 45-120 mm diameter; opaque, not hygrophanous; viscid to glutinous when young or moist; convex, becoming plane with slightly incurved margin edge, often with broad umbo; orange-brown, lighter toward margin. Gills close, with over 80 full length (margin to stem); notched, edge finely serrate, white; no droplets; very light beige, becoming tannish. Stem 6–14 × 25-60 mm; even or slightly swollen base, may have gently constricted middle; no cortina, ring, or ring zone; pruinose to flocculose, decreasing somewhat from apex to base; light beige, turning brownish, stains brown. Flesh white to creamy; smell and taste earthy. Spore-print dull brown. Ecology found in cespitose clusters on coniferous duff in early September. Distribution WORLD: unknown. NL: single collection from Pinware River, Labrador.

Microscopic SPORES: amygdaloid, 8.9–10.8 × 5.1–5.7 µm; ave. 9.8 × 5.3; Q_a=1.84; perispore rarely loosening; ornamentation weak, but distinct; dextrinoidity strong. BASIDIA: 25.2 × 6.4 µm (ave.), 4-spored. CHEILOCYSTIDIA: cylindrical (or slightly clavate), irregular, 29–44 × 5.2–8 × 4–6.3 × 3.8–6.2 µm; ave. 37 × 6.6 × 5.1 × 5.1.

Comment Probably an undescribed (new to science) species. Need more collections and further study before formal description. If you are driving to Goose Bay this year, stop at the Pinware River and look for it along the footpath used by salmon fishers at the mouth of the river. Resemble *H. naviculosporum*, from which it differs by its clustered growth and spores with a lower Q value.



Photos: Andrus Voitk

Hebeloma cf. *circinans*

Cap 20-40 mm diameter; opaque, not hygrophanous; viscid to glutinous when young or moist; edge slightly incurved in youth; hemispherical, becoming convex to near-plane, often with broad umbo; marbled and finely pruinose, becoming glabrous; clay-buff, lighter toward margin. Gills close, moderately spaced, approx. 60 full length (margin to stem); notched, edge finely serrate; no droplets; very light pinkish-buff, becoming tannish. Stem 4–7 × 30-60 mm; even or tapering toward base; no cortina, ring, or ring zone; apex pruinose to floccolose, decreasing toward base; white; staining dark brown Flesh white to creamy; smell, and taste mild, like bitter tea. Sporeprint dull brown. Ecology in boreal habitats with conifer trees. Mid September to end October. Distribution WORLD: uncommon but widespread In Northern Europe. These are the first collections from North America. NL: collected in two separate years from Gros Morne National Park, the trail to Stanleyville.

Microscopic SPORES: amygdaloid, 8.2–9.9 × 4.6–5.5 µm; ave. 9 × 5.1; Q_a=1.77; perispore sometimes loosening; ornamentation moderately strong; dextrinoidity weak but distinct. BASIDIA: 26.9 × 6.8 µm (ave.), 4-spored. CHEILOCYSTIDIA: cylindrical, short, 24–38 × 4.1–6.5 × 4.3–5.6 × 4.1–6.1 µm; ave. 29 × 5.4 × 5.1 × 5.

Comment Woodland setting, no cortina, tapering stem, and brown staining should help distinguish this species. The short cylindrical cheilocystidia plus the short narrow spores also separate this from other species so far recorded in NL.

Photo: Roger Smith

Hebeloma velutipes

Cap 20-80 mm diameter; opaque, not hygrophanous; viscid to glutinous when young or moist; convex, becoming plane, often with broad umbo; almost evenly cream-buff, a little more caramel coloured over disc. Gills close to moderately spaced, 50-75 full length (margin to stem); notched, edge finely serrate; droplets when young or moist; very light pinkish-cream, becoming tannish. Stem 4–9 × 25-95 mm; even with basal bulb with white rhizomes; no cortina, ring, or ring zone; apex velutinous, becoming pruinose below; hollows with maturity; stem and pruina white, both sometimes stain brown with age or handling. Flesh white to creamy; smell radish, taste bitter, radish-like. Sporeprint dull brown. Ecology One of the most common and widespread *Hebeloma* species. Mid September to end October. Distribution WORLD: Apparently throughout the world but needs further research. NL: band parallel to the NE coast of the Island, extending to Labrador.

Microscopic SPORES: amygdaloid, occasionally limoniform, 9.6–11.8 × 5.8–6.8 µm; ave. 10.7 × 6.4; Q_a=1.66; perispore sometimes loosening; ornamentation weak but distinct to moderately strong; dextrinoidity strong. BASIDIA: 27.6 × 7.7 µm (ave.), 4-spored. CHEILOCYSTIDIA: gently clavate, some ventricose, 56–81 × 6–9.3 × 4.1–6.2 × 3.4–4.5 µm; ave. 69 × 7.8 × 5.3 × 3.8.

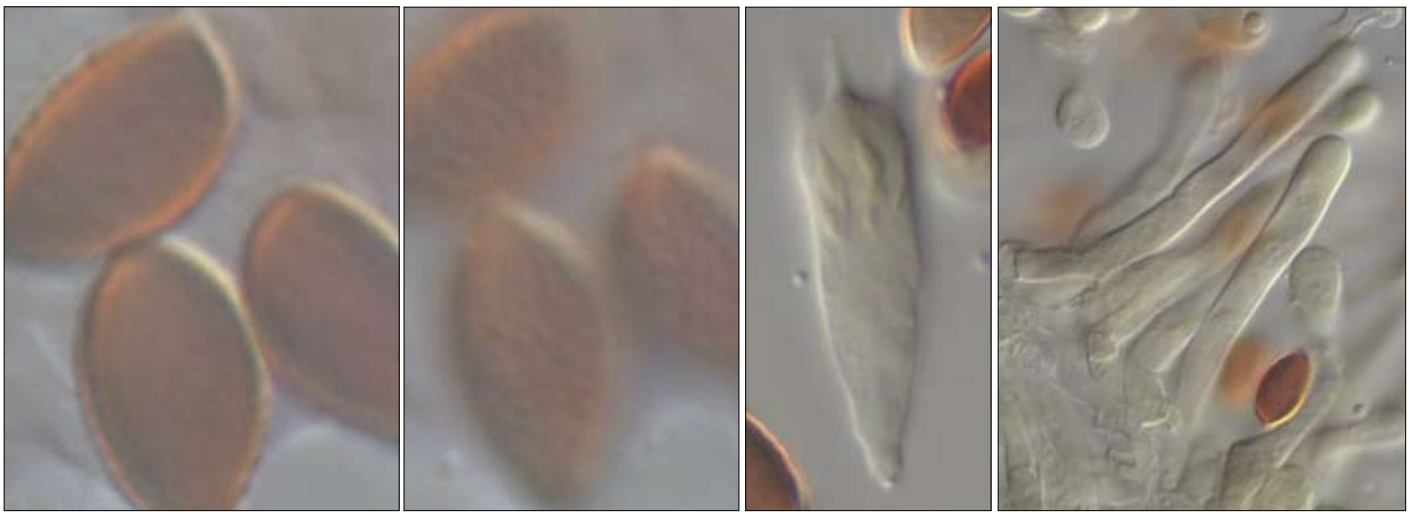
Comment Like all species of sect. *Velutipes*, this species has a mixture of gently clavate (the majority) and ventricose cheilocystidia. Very variable. Very similar to *H. leucosarx*, which generally has a darker cap colour and a more slender appearance, and to *H. incarnatulum*, which also has a more slender appearance, is very much a boreal species, and also has cheilocystidia with a narrower average apex width.

Hebeloma incarnatulum

Cap 20-55 mm diameter; opaque, not hygrophanous; viscid to glutinous when young or moist; convex, becoming plane, often with broad umbo; ochraceous to cream-buff, more coloured over disc. Gills close, moderately spaced, 50-65 full length (margin to stem); notched, edge finely serrate; droplets when young or moist; very light pinkish-cream, becoming tannish. Stem 6–9 × 60-120 mm; even with basal bulb with white rhizomes; no cortina, ring, or ring zone; apex velutinous, becoming pruinose below; hollows with maturity; white, not staining. Flesh white to creamy; smell radish, taste mildly bitter, radish-like. Sporeprint dull brown. Ecology in moss near conifer and in built-up areas within forested regions. Very much a boreal species. Mid September to end October. Distribution WORLD: Common and widespread in boreal habitats. NL: band parallel to the NE coast of the Island, extending to Labrador.

Microscopic SPORES: amygdaloid, 9.2–11.0 × 5.8–6.5 µm; ave. 10.1 × 6.1; Q_a=1.65; perispore rarely loosening; ornamentation weak but distinct; dextrinoidity strong. BASIDIA: 26.0 × 7.5 µm (ave.), 4-spored. CHEILOCYSTIDIA: gently clavate, some ventricose, 39–56 × 4.4–6.5 × 3.5–4.9 × 3.7–5 µm; ave. 47 × 5.5 × 4.0 × 4.2.

Comment Fruits in moss with conifers, has a pronounced umbo, bulbous stem, and quite a slender appearance. Microscopically distinguished by the gently clavate cheilocystidia with narrow apex.



Hebeloma* cf. *leucosarx

Cap 20-40 mm diameter; opaque, minimally hygrophanous; slightly viscid when young or moist; occasionally covered by light fibrils with velar fibrils at margin; hemispherical, becoming convex, often with broad umbo; uniformly buff tan to brown. Gills close; moderately spaced, 50-70 full length (margin to stem); notched, edge finely serrate, whitish; droplets when moist; cream to light tan. Stem 3–5 × 35-70 mm; with basal bulb; no ring, ring zone or cortina; apex velute; whitish, staining brown. Flesh whitish; smell and taste mild to radish-like. Sporeprint dull brown. Ecology in coniferous woods, often in moss. August to end September. Distribution WORLD: widespread In Northern Europe. NL: so far only collected from the Western Brook Pond trail in GM.

Microscopic SPORES: amygdaloid, occasionally limoniform, 9.6–10.8 × 5.8–6.6 µm; ave. 10.3 × 6.2; Q_a=1.65; perispore not loosening; ornamentation weak but distinct; dextrinoidity strong to very strong. BASIDIA: 28.4 × 7.8 µm (ave.), 4-spored. CHEILOCYSTIDIA: gently clavate, some ventricose, 55–70 × 5.4–9 × 4.2–4.8 × 3.3–8.2 µm; ave. 62 × 7.3 × 4.5 × 5.

Comment: Fruits with conifers, often in moss, has a pronounced umbo and bulbous stem with quite a slender appearance. Microscopically it can be distinguished from *H. incarnatulum* by the broader apex of the gently clavate cheilocystidia and from *H. velutipes* by the darker colored cap and the more slender appearance. This is the first record we have been able to confirm from North America. We referred this collection to *H.* cf. *leucosarx*, but need more collections and more study for clarification.

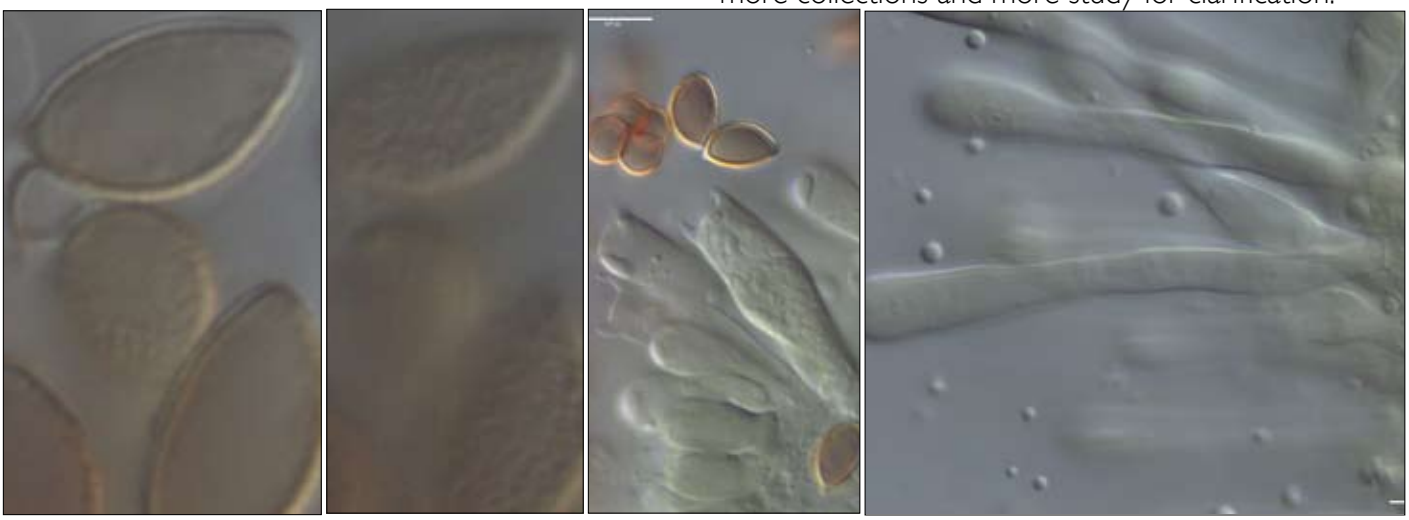


Photo: Andrus Voitk

Hebeloma sp. sect. *Velutipes*

Cap 35-80 mm diameter; opaque, not hygrophanous; viscid to glutinous when young or moist; domed, becoming plane, often with broad umbo; evenly coloured cinnamon; margin covered with whitish fibrils. Gills moderately close; notched, edge finely serrate; droplets when young or moist; very light pinkish-gray, becoming tannish. Stem 4–12 × 30-60 mm; even or slightly swollen base; no cortina, ring, or ring zone; flocculose for its full length; white; no staining. Flesh white to creamy; cucumber to radish smell, and taste. Sporeprint dull brown. Ecology found in conifer duff in mixed coniferous forest in September. Distribution WORLD: unknown NL: only known collection from Pasadena Ski and Nature Park.

Microscopic SPORES: amygdaloid, 10.9–12.7 × 6.7–7.9 µm; ave. 11.8 × 7.3; Q_a=1.62; perispore rarely loosening; ornamentation weak but distinct; dextrinoidity strong. BASIDIA: 30.9 × 8.5 µm (ave.), 4-spored. CHEILOCYSTIDIA: gently clavate, some ventricose, som clavate-stipitate, 38–63 × 5.5–9.3 ×3.6–6.4 × 3.1–7.5 µm; ave. 52 × 7.3 × 5 × 5.1.

Comment Possibly a new species. Certainly in sect. *Velutipes*. It appears close to *H. leucosarx* but phylogenetic analysis (based on ITS) puts it close to *H. velutipes*, for which the cap would be very dark. Need to confirm with additional collections and studies. Search in Pasadena Ski and Nature Park warranted!

THE MAIL BAG

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

Just in at press time: OMPHALINA is always so original. Other newsletters introduce mycologists coming to their foray—your last issue featured one, because she is not coming. Gotta love it! Wayne.

Dear Andrus and you all!

Thank you again for the OMPHALINAS which contains so many new and interesting things. I have eaten *Lyophyllum fumosum* and *decastes* and liked them, but whether some were *L. shimeji*, I cannot say. So I have eaten unknown mushrooms, which is against the rules! *Lactarius alpinus* I have seen maybe twice in my life, in the Alps and in Yamalo-Nenetsia on Polar Urals. It is beautiful!

I wish you very nice and successful days at Goose Bay!

Greetings to all my friends and acquaintances in NL!

Esteri

PS I don't send photos of myself often, but here are two remarkable reasons: the FNL hat and T-shirt, used in special situations, like this foray of the MYCOLOGICAL SOCIETY OF OULU.

OULUN SIENISEURA (OSS) was founded in 1972, and has around 200 members (1 per 1,000 population). Interest in the fungal world has increased during the whole time, although the years with good mushroom seasons have been always better than the others. The program has not basically changed much during these years: lectures, exhibitions, spring and autumn excursions, courses, mushroom food cooking and savoring evenings, dying events, editing of small publications, visits to mushroom growers and to other mycological societies, and naturally also participating in different national and international forays and conferences. The budget has mainly been based on members' annual payments, but the town has often offered to it busses for transportation to forests and given free premises for exhibitions and lectures. Today the town is saving money in all actions and has reduced support, but the Society has got a good meeting place in nice public rooms.

The Society has a home page <http://sites.google.com/site/oulunsieniseura1/> and is also on Facebook.

Ed comment: Thank you, Esteri! Nice T-shirt and nice cap. Your fans here will be very happy to see both.

Hello, Andrus!

How refreshing to find the two articles about *Lyophyllum* and *Hypsizygus*. As you know, I am very interested in these genera and have even written a book about them. We have *H. marmoreus*, and no doubt *L. shimeji* also grows here, since it is found in Sweden.

All the best to you all on your exciting foray in Goose Bay. I very much regret that I no longer travel well enough to join you there—a good place to find *L. shimeji*.

With best wishes for a good summer and excellent foray,

Kuulo Kalamees

Ed comment: Thank you Kuulo. Yes, I do have your book and consulted it often during preparation of these two articles. We still remember you fondly from our first foray in 2003, where you and your team made up our inaugural faculty.

Back in 2013 we discovered quite extensive fruiting of *Lyophyllum shimeji* in the southern Alberta range of the Rockies. Many were growing singly confounding the typical growth pattern, so we did not even get the genus right. Most were id'd as *Clitocybe* sp. All the cespitose specimens were labeled *L. decastes*. Did not even know *L. shimeji* was an option, but found out later, after sequencing them.

Martin Osis

Ed comment: I didn't know the shimeji *option, either. Ellen Larsson thought the species likely has a circumpolar distribution and should be found in poor soil across North America. A true gentleman, Martin, you have made her look good!*

I do not want to let slip the dogs of primacy war betwixt AB & NL. Our article claimed to be the first report of the species from North America, not the first collection.

SMALL PRINT: *For the record, our first collections of* L. shimeji *in this review date from 2007.*

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  - Wildlife Division
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