Usnea: The Herbal Antibiotic

AND OTHER MEDICINAL LICHENS

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Usnea longissima on Madrone
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Usnea
Antibiotic and Antifungal Herb
and other Medicinal Lichens

INTRODUCTION

They are bright red and yellow, and grow on rocks. They are long wispy strands of gray-green hair, hanging like beards from hardwood trees in rainy forests. Or they are floppy and leaf-like. Some have raised vein-like structures, and look like something out of a grade B science-fiction movie that might fall on your neck and take over your mind.

No, these are not plants from Mars or figments of a Star Trek set designer’s imagination. They are lichens — highly specialized plants with a long history of use. Dye for Scottish tweeds, a medieval hair wash, fodder for caribou, an ingredient in an Icelandic bread recipe, the color for the chemist’s litmus paper, and modern European antibiotic ointments and treatments for athlete’s foot all come from lichens

A science fiction writer would have trouble conceiving of an organism as strange as a lichen. Not really a “plant”, a lichen is two organisms living together as one in a symbiotic relationship. A fungus base provides a rigid structure on which chlorophyll-bearing algae spread out and provide food sugars for both. It is nature’s version of a solar collector. The two become so interwoven that they act like a single new living entity. Their reproductive structures are different from either the algae or the fungus. They also produce different chemicals than either of the original organisms — chemicals with unique medicinal properties.
Information about the medicinal uses — both traditional and modern — of these strange and useful plant forms is not solely the interest of the esoteric “Lichenologist”. The following facts can be of practical value to you in your daily life:

- Extracts from some species are common ingredients of high-quality herbal products throughout Europe.
- They contain powerful antibiotic compounds useful for urinary and respiratory tract infections, athlete’s foot and other fungal infections.
- Researchers have isolated immune-strengthening compounds from some lichen species.
- The medicinal species are easy to identify, and there are few, if any, harmful look-alikes.
- They are very abundant and can be gathered throughout the world.

**HISTORY AND TRADITIONAL USES**

A distinguished traveler making his way through the valley of the Nile in 1864 discovered a vase from the 18th dynasty (1700-1600 B.C.), with contents undisturbed for 3000 years. In the vase were Juniper berries and a lichen, *Evernia furfuracea*. *Evernia* does not grow in Egypt, but was imported for its food value and curative properties. Egyptians still imported this medicinal lichen from Europe until this century. This story, from a published note by Muller-Argau (1881), shows how people have appreciated the medicinal properties of lichens throughout our recorded history.

The Chinese also used species of lichens, probably thousands of years ago. Early Chinese herbalists recommended *Usnea longissima* (Sun Lo in Chinese) as an expectorant and as a powder
application to heal external ulcers. *U. longissima* is still used today—as a tincture to treat tuberculosis lymphadenitis.

Likewise the ancient Greeks used lichens as medicines. Hippocrates recommended a lichen, perhaps *Usnea barbata*, for uterine complaints. Although these ancients knew of lichens, it is difficult to determine which genera or species they were writing about. Before the 1700's most lichens, mosses and liverworts were lumped together under “lichen”, “moss”, or “musci”.

### Some Lichens and their Uses

<table>
<thead>
<tr>
<th>Lichen Name</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Alectoria jubata</em></td>
<td>Amerindian wild food plant.</td>
</tr>
<tr>
<td><em>Borrera flavicans</em></td>
<td>To poison wolves</td>
</tr>
<tr>
<td><em>Cladonia pyxidata</em></td>
<td>Whooping cough; dose—1 teacup</td>
</tr>
<tr>
<td><em>Evernia prunastri</em></td>
<td>Astringent; lung complaints</td>
</tr>
<tr>
<td><em>Gyrophora cylindrica</em></td>
<td>“Tripe de roche”—emergency food</td>
</tr>
<tr>
<td><em>Lecanora parella</em></td>
<td>A dye plant, litmus paper</td>
</tr>
<tr>
<td><em>Parmelia aquila</em></td>
<td>Astringent, for asthma and old coughs</td>
</tr>
<tr>
<td><em>Parmelia abessinica</em></td>
<td>Ingredient in a curry powder</td>
</tr>
<tr>
<td><em>Ramilina farinacea</em></td>
<td>Yields a mucilage similar to gum arabic</td>
</tr>
<tr>
<td><em>Rocella tinctoria</em></td>
<td>Source of the famous orchil dye; also a cough remedy</td>
</tr>
<tr>
<td><em>Umbilicaria esculenta</em></td>
<td>Sold in Japan as “iwa-take”, or “rock mushroom”—a delicacy</td>
</tr>
<tr>
<td><em>Umbilicaria spp.</em></td>
<td>“Rock tripe” used by Franklin and his crew as a survival food.</td>
</tr>
<tr>
<td><em>Unsea plicata</em></td>
<td>Astringent; whooping cough</td>
</tr>
</tbody>
</table>
Today’s three most commonly used medicinal lichens, *Usnea* (“Old Man’s Beard”), *Cetraria* (Iceland Moss), and *Lobaria pulmonaria* (Lungwort) probably originated in Scandinavia. Pereira states that the Danish apothecaries used Iceland Moss in the late 1600's.

British Herbalist John Gerard illustrates *Usnea florida* in his *Herbal*, but doesn’t give any uses for it. He recommends another lichen, which he calls *Muscus guernus*, for strengthening the stomach and staying nausea. Gerard and other writers detail additional lichens in use in England. The accompanying chart (on page 3) summarizes these and other uses.

**Lichen dyes**

Lichen dyes provided the distinctive coloring of the original Harris Tweeds, still made in Scotland. The famous purple dye, orchil, known to the ancient Egyptians, Phoenicians, and Greeks, is made from the lichen *Rocella tinctoria*, and other species. This purple dye was highly esteemed in both the ancient and medieval worlds, and a cloth dyed with it was even more beautiful than the famous Tyrian purple made from a species of mollusk. In the Middle Ages it fell out of favor, as blue and green colors became more popular. This recipe for the dye comes from about 1540:

**Recipe for a natural dye**

Take 1 lb of *Rocella tinctoria*, very clean, and moisten it with a little stale urine; add to this 2 oz. each of ammonium chloride, potassium chloride, potassium nitrate and calcium carbonate. Pound them well and mix together. Let them remain so during 12 days, stirring them twice a day; and then to keep the herb continuously moist, add a little urine and in this situation let it remain 8 days longer, continuing to stir it. Afterwards add 1 1/2 lb of potassium carbonate, well pounded, and 1 1/2 pt stale urine. Let it remain 8 days longer, stirring as usual after which you add the same quantity of urine. At the expiration of 5 or 6 days, it then be fit for use.
Spread out the dye and allow the excess moisture to evaporate and it will take on the odor of violets. The resulting paste can be stored for future use.

An alternative method that proves more effective, is simpler, and certainly more hygienic — albeit less authentic— uses only ammonia, omitting the urine and other salts.

One Rocella species, *Rocella babingtonii*, is common on trees in California from San Francisco Bay south into Baja. It is flat, branched, white to light gray, and 4-8 cm long. This species can be used as a source for the purple dye.

**Signatures, Skulls, and Astrological Signs**

In the 15th century A.D. the belief was popular that God marked certain plants in a way so people could recognize their medicinal uses. Applying this “Doctrine of Signatures”, people took the appearance of some lichens to indicate what part of the body they would affect. Thus a leafy lichen with raised vein-like markings resembling lung tissue was a lung remedy. The long gray-green strands of “Old Man’s Beard” was a specific for the hair and scalp. Modern science has now verified some of these traditional uses, and the lichens are still used in these ways in some cultures.

Lichens that grew on the bare skulls of corpses were treatments for epilepsy and other ailments of the head. In the mid-eighteenth century, many practitioners subscribed to this “heady” medicine and paid a handsome price for it. Collectors even devised a method for cultivating the lichen by making a paste of it and spreading it on a likely skull to grow, esteeming the cultivated variety as highly as the wild kind. Some even held that the bearer of this lichen would be “impenetrable as not to be pierced with a musket bullet.”
Astrological conditions also supposedly influenced healing with lichens. Their virtues were thus greater when “the moon is in the increase in the house of venus.”

CHEMISTRY

The mystery in the chemistry of lichens concerns their “secondary compounds”, which are not by-products of normal plant metabolism. Because it takes extra energy to produce them, scientists speculate that they must have an important value to lichens, such as protecting them from attack by bacteria, fungus and other microorganisms, and from browsing by deer and other animals. Scientists have been most interested in the antibiotic properties.

Lichen chemistry is complex and varied — more than 200 compounds have been identified, and much remains to be discovered. These compounds are usually species-specific, and are used to identify particular lichens. The compounds of most interest are as follows:

✔ Lichen acids (antibiotic; precursors to dyes)
✔ Polysaccharides (immune stimulating)
✔ Mucilage (soothing to mucous membranes)
✔ Anthraquinones, including endocrocin (laxative)
✔ Fatty acids
✔ All essential amino acids.
✔ Vitamins (a small quantity)
✔ Carotene
Pollution and Heavy Metals

Because lichens grow slowly and are long-lived, they sometimes accumulate potentially toxic heavy metals, although levels should pose no problem for people using lichens medicinally — the amount consumed is too small. The lead and selenium content of Finnish Icelandic Cetraria was relatively low—only twice that of wheat. The iron content is exceedingly high (530 mg/kg of dry weight)\textsuperscript{8}. As a safety measure, it is wise to pick lichens at least 200 feet from well-traveled roads, factories, or other sources of pollution.

MODERN VERIFICATIONS OF TRADITIONAL USES

Iceland Moss

The most widely used of the lichens throughout the ages in Western medicine is Cetraria islandica, the Iceland Moss. The famous botanist Linnaeus was influential in establishing its long-standing importance in medicine. Iceland Moss has been used since the 1700’s for chronic ailments of the respiratory, urinary and digestive systems.

Scandinavians and Icelanders harvest Iceland Moss commercially and consume it widely. People in these countries have long mixed this lichen with cereal grains or mashed potatoes to make “an uncommonly healthful bread\textsuperscript{9}.” It is thus sometimes called brödmose (bread-moss). Other traditional uses include porridges, gruels and decoctions. See the accompanying recipes.

The consistency of a decoction is almost like jello. This is traditionally flavored with sugar, lemon peel, white wine, or aromatic spices like ginger and cinnamon, to make a “very agreeable kind of diet\textsuperscript{9}, nutritive for those recuperating from illness\textsuperscript{10}.

Those using Cetraria for building up the weak and the sick did not know about the water-soluble immune-stimulating

\textit{Usnea}
polysaccharides in lichens which may explain, in part, their effectiveness in recuperation. Polysaccharides are giant sugar molecules which occur widely in lichens, some fungi, and higher plants such as Echinacea spp. and Astragalus membranaceus. They are immune stimulating, increasing the phagocytic potential of the reticuloendothelial system (RES). Thus the immune system may be better prepared to clear the body of cancer cells, bacteria, toxic wastes and virus-infected cells.

Scientists now know that the water extract (the polysaccharides) of Cetraria will inhibit plant viruses (on the tobacco plant.) These extracts also caused a 89% inhibition of cancer in infected mice. One researcher found that 46-49% of the carbohydrates of an Iceland Moss bread were digested. Wallerstein found that 53-64% of lichenin, a main polysaccharide in Iceland Moss, was assimilated.

**Lungwort**

Another well-known medicinal lichen is Lobaria pulmonaria, the Lungwort. Because of its resemblance to lung tissue, it was thought to be a gift to mankind as a lung remedy. It was boiled in milk to make a "cough tea", or "lichen chocolate", and proved to be quite beneficial.

During W.W. II both the Germans and the Americans investigated many lichen species for their antibiotic properties. They found more than 50% of the species tested active—mostly against gram positive bacteria such as Streptococcus, Staphylococcus and Pneumococcus.

**Usnea**

Usnea, or Old Man’s Beard, hangs in gray-green strands from pines, oaks, Douglas fir, apple trees and other fruit trees in orchards and forests throughout the northern hemisphere. The
Usnea species are the most common source of antibiotic and antifungal lichen acids, particularly usnic acid. They have widespread potential for medicinal applications.

I have collected one species (*U. longissima* — see cover) in California for more than 5 years, and have manufactured a liquid extract that has proven effective for urinary tract infections and upper respiratory infections. Chinese herbalists have used this same species for thousands of years, calling it "Sun-Lo". The Malayans still use some *Usnea* species as a general tonic and a tea for colds.

The name "Usnea" may have originated at the time of the Arabian school of medicine and pharmacy — the name is not in the literature of the ancient Greeks or Romans. The Formulary of Al-Kindi (ca. 850) calls *Alectoria usneoides* "ushna," and recommends it for a swollen spleen.

Modern Germans also recognize the medicinal value of *Usnea*. "Hagers Handbook", an authoritative German reference on medicinal plants, says of Usnea:

Generally, Usnea in the earlier therapeutics beside other lichens found wide application against mucous membrane conditions, hemorrhage, diarrhea, and dysentery as well as stomach weakness.

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**Usnea Species Used in Medicine**

*U. hirta* (L.)
*U. barbata* (l.)
*U. florida* (L.) Wigg.
*U. longissima* (Ach.)
*U. bayle*
*U. lobata* Hoffm. and *U. diffracta*

Source: Hagers Handbuch der Pharmazeutischen Praxis (14)
The accompanying charts and drawings show the major medicinal species of *Usnea*, including those found abundantly in the Western U.S., and some of their medicinal uses.

### Usnea Species

**Abundant in the Western U.S.**

**U. Californica** — a long pendulous species attached to branches of trees and large shrubs, especially Oaks, Manzanitas, and Pines, that may be a variation of *U. ceratina*. (figure 1)

**U. ceratina** — common tufted or pendulous *Usnea* growing on trees. The main branches are very papillate (beset with stubby projections). (figure 2)

**U. dasypoga** — This species has branches that are more slender than the others, and the papillae are smaller.

**U. longissima** — very long main stalk - short, regular branches (see cover). (figure 3)
Clinical and Laboratory Research

The discovery of penicillin during World War II stimulated the search for other antibiotic substances from plants. Lichens attracted interest as early as 1944 because of their traditional uses. More than 50% of the species tested contained antibiotic lichen acids. Many of these acids are active, the most common being usnic acid of *Usnea* and other genera.

These lichen acids are effective against gram positive bacteria, such as *Streptococcus* (strep throat etc.) *Staphylococcus* (impetigo, etc.), *Mycobacterium tuberculosis*, and other fast-growing species. The acids have little effect on gram negative bacteria such as *Salmonella* and *E. coli* that inhabit the digestive tract. This may be a mixed blessing. It would be nice if *Usnea* extract inhibited *Salmonella* and other pathogenic bacteria of the gram-negative type. On the other hand it is good that *E. coli* is not much affected. *E. coli* can be beneficial, and is particularly disturbed by broad-spectrum antibiotics such as penicillin.

Other gram-negative bacteria in the human intestine may also be beneficial, part of our “body ecology”, so it is noteworthy that *Usnea* may not adversely affect them.

### Medicinal Uses of Some Usnea Species

<table>
<thead>
<tr>
<th>Usnea spp.</th>
<th>Constituents</th>
<th>Activity</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>U. birta</em></td>
<td>usnic, thamnolic, usnaric acids, etc.</td>
<td>antibiotic, esp. sodium salts</td>
<td>(1)</td>
</tr>
<tr>
<td><em>U. barbata</em></td>
<td>barbatolic, usnic, lobaric, tartaric acids, vit. C</td>
<td>in homeopathy; HPUS 8, headache, sunstroke</td>
<td>(2)</td>
</tr>
<tr>
<td><em>U. florida</em></td>
<td>usnic, stictinic, lobaric acids</td>
<td>tuberculosis antibiotic</td>
<td>(3)</td>
</tr>
<tr>
<td><em>U. longissima</em></td>
<td>usnic, evernic</td>
<td>expectorant</td>
<td>(3)</td>
</tr>
</tbody>
</table>
Identifying Usnea Species

- The outer portion (the cortex) of the usnea should be gray-green.
- It should be round rather than flat.
- Pull apart a main stem (thallus) (see figure 4). It should have a slender white cord inside. This cord will be quite elastic when the lichen is moist (in wet weather), but stiff when it is dry.

More Effective than Penicillin

Usnic acid is more effective against some bacterial strains than penicillin. For instance, usnic acid completely inhibited the growth of different strains of human tuberculosis in dilutions of 1:20,000-1:50,000, and weakened their growth at 1:200,000-1:2,000,000. It inhibited the growth of *Staphylococcus*, *Streptococcus* and *Pneumococcus* at 1:20,000.
Penicillin and usnic acid have different modes of action. The penicillin molecule very closely resembles a structural component in the cell walls of gram positive bacteria. The bacteria incorporate this penicillin molecule into their cell walls and the resulting structure is not sound. The bacteria swell up and burst. The penicillin does not harm human cells because their cell walls are very different.

Scientists think that usnic acid works by disrupting cellular metabolism, either by preventing the formation of ATP (the cells’ energy source) from ADP, or by uncoupling of oxidative phosphorylization. Human cells are far less permeable to usnic acid and are not affected.

Usnea may also be superior to the drug Flagyl (metronidazole). Usnea is effective against Trichomonas, a parasite which can cause, among other things, a serious infection of the uterine cervix. Flagyl is widely prescribed for Trichomonas infection, but it can also cause cancer. After oral administration it can be found in the bloodstream, cerebrospinal fluid and breast milk. Nursing mothers should strictly avoid this drug. (Physician’s Desk Reference, 1983, p. 1874)
Usnic acid is poorly water soluble. This may make it at times unavailable to the site of an infection, but offers the advantages of slow absorption or slow, steady and longer lasting release into a site of infection. This is one reason why so many European antibacterial and anti-fungal creams and balms are made from *Usnea* species.

Besides its strong selective anti-bacterial activity, *Usnea* has the great advantage in offering support to the natural defenses of the body. Polysaccharides from several *Usnea* spp. have shown anti-tumor activity in various animal species\(^1\).

**TOXICOLOGY**

Usnic acid has the potential to be toxic, but because it is poorly and slowly absorbed when in either a tea or alcoholic solution, there is little cause for concern. The LD\(_{50}\) (i.v.) is 25 mg/kg in mice\(^2\). It is best not to swallow the alcoholic tincture without diluting it, as it can be irritating. Large quantities of a strong tea of some lichens could cause gastro-intestinal upset, because of the irritating nature of the lichen compounds. As with all herbal medicines, it is best to start with a low dose and slowly work up to a full therapeutic or nutritional dose. This allows the body to adjust to the energy of the particular herb or combination, and if one pays attention, is a way to determine whether it is the right remedy, or one that might prove to irritate or in some way be unsuitable.

It is noteworthy that very few lichens are poisonous. Exceptions are two bright yellow or orange alpine species, *Letharia vulpina* and *Cetraria penastri* (Ahmadjian & Hale). The former was used by northern people to poison wolves. As a general rule, it is best to avoid the use of any bright-colored lichens growing in the high mountains.
**Chinese Medicine**

*U. longissima*, a West Coast species is called "Sun Lo."

**Traditional Uses:** expectorant, surface treatment of ulcers

**Energy:** cooling

**Taste:** slightly bitter

**Direction:** alcohol preparation — surface acting water extract, decoction — internal acting

**Meridians:** lung, spleen, kidney

**Form:** Whole lichen thallus is collected from trees, powdered and tinctured, or the whole herb is decocted for tea, up to 10 grams/day.

**Use:** Usnea tincture is the strongest form for antibiotic use — the usnic acid is poorly water soluble.

Dilute the tincture before using — it can be irritating.

**Other forms:** decoction, tea, oil, commercial creams and salves
General Indications

Infection, inside or outside the body, by gram positive bacteria, fungus, protozoa (Trichomonas), or yeast.

Systems affected:

- Urinary tract
- Respiratory Tract
- Gastrointestinal tract

Actions:

- Antibiotic
- Immune strengthening
- Papaverine-like activity (relaxing to smooth muscle, especially the colon or bronchi.)

Iceland Moss Bread

For adventurous souls. This bread is common in Iceland and Scandinavia.

The bread may be immune-stimulating because of its high polysaccharide content. One researcher found that about half the carbohydrates in Iceland Moss bread were digested. Lichenin, a main polysaccharide in Iceland Moss, is 53-64% assimilated.

1. Oven-dry the Iceland Moss, and grind it to a fine powder.
2. Mix one part grain flour with 3 parts Iceland Moss.
3. Bake as usual with yeast.

Iceland Moss Gruel

Cook one pound of Iceland Moss in 2 quarts of water.

Strain and add raisins and cinnamon.
Specific Treatments

✓ Use a dropperful 2-3x/day for acute bacterial infection.

✓ Apply full-strength or diluted 50-50 with water (check for individual sensitivity first!) with a cotton swab externally for any cuts, especially if infected. Apply full strength several times a day for impetigo.

✓ Put a dropperful in water and gargle several times a day for sore throat or strep throat.

✓ Put drops of tincture in water, and fill a plastic spray bottle (old antihistamine sprayer, etc.) and squirt a small quantity up the nasal passages several times daily for sinus infection. To this mixture it is good to also add a few drops of sage oil or of golden seal tincture.

✓ Add to formulas for colitis, any urinary tract infection (such as urethritis or cystitis), or lung and bronchial tract conditions (such as bronchitis, pleurisy, pneumonia or tuberculosis).

✓ Put a dropperful in water and use as a douche, taking it internally as well, for Trichomonas.

✓ The tea from the whole lichen can be combined with 3 grams (a few slices) of licorice, and a few slices of ginger root for colds and flu. Drink 1 cup of the decoction up to 3 times a day for up to 10 days, if needed.

Iceland Moss Porridge

Kids will neglect their corn-flakes after they get a taste of these!

Boil the lichen in 3 or 4 waters, discarding each time. (To get rid of bitter taste.)

Simmer and stir until thick.

Skim off the scum.

Salt to taste and serve.


NUMBERED REFERENCES

18. Lawrey, *op cit.*