

Usnea in the Pacific Northwest

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The species concepts in the key below were revised based primarily on Halonen et al. (1998), Halonen (2000), and Tavares (1997); also see other references.

Thallus fruticose, tufted to ca. 10 cm diam or pendulous to 1 m long (or longer), pale greenish or yellowish green, occasionally reddish brown or blackening; branching various but often with numerous perpendicular short (2-20 mm), lateral branches (fibrils); main branches often papillate, roundish to weakly angular in cross section, with a dense central cord (axis) surrounded by a cottony medulla and a dense cortex; isidia ("isidiomorphs" according to Clerc) or soredia usually present; apothecia rare; lateral or terminal, with a thalloid, fibrillose margin and pale disk; spores hyaline, nonseptate; thallus always with usnic acid in the cortex and a wide variety of other lichen substances, most commonly salacinic, norstictic, stictic, psoromic, squamatic, protocetraric, and fatty (e. g. murolic) acids; photobiont *Trebouxia*; in our area usually on bark or wood, rarely on rock.

Spot tests can be quite unreliable in *Usnea*. For example, many specimens with norstictic acid or salacinic acid will yield a K- and P- reaction or slow, weak positive reactions. UV fluorescence is also sometimes challenging, because in most species the medulla and axis are pale in UV light while the usnic acid in the cortex absorbs UV, and is therefore dark. This contrast suggests a UV+ reaction, but it is not the strong fluorescence seen with specimens containing squamatic acid.

Introductory Key

- 1a Cortex or central cord distinctly reddish, brown, yellow, or blackening **Group 1, Lead 7**
- 1b Cortex yellow green to green and central cord white
 - 2a Thallus pendulous, often long, typically > 12 cm **Group 2, Lead 12**
 - 2b Thallus tufted, ± erect or drooping, typically < 12 cm
 - 3a Thallus with sparse to abundant apothecia; soredia and isidia lacking **Group 3, Lead 24**
 - 3b Thallus with few or no apothecia; soredia and/or isidia usually present
 - 4a Branches pinched at the nodes and slightly to distinctly expanded in the internodes, so that individual branch segments are cigar shaped **Group 4, Lead 30**
 - 4b Branches cylindrical **Group 5, Lead 40**

Group 1

Colored Axis or Cortex (red, yellow, brown, or black)

7a Central cord pale reddish, yellow, or brown

8a Central axis yellow; cortex often with red spots. Thallus small to medium, to 5(6) cm long; branching anisotomic dichotomous; branches with swollen, cigar-shaped segments, pinched at the nodes; branches usually with annular cracks; soralia often bearing isidia; main branches papillose central axis thin; medulla thick and lax; fibrils absent to sparse; soralia P+Y-R, or K+Y or K+Y-R (norstictic acid and/or other stictic acid group compounds) or rarely psoromic acid (K-, P+Y); on both hardwoods and conifers; mediterranean, oceanic; very common w Cas, esp at low elevations in the Coast Ranges; also in the Willamette-Puget trough and the Cascades

U. flavocardia Räsänen

U. wirthii Clerc

[*U. cornuta* s. lat. and *U. fragilescens* var. *mollis* rarely have red spots in the cortex and the central axis is occasionally yellowish to orangish when breakdown products of salacinic acid are present; the axis of these species is typically white in healthy thalli; see Key 4 below]

8b Central axis reddish, rose, or brown; cortex yellowish green to green

9a Central axis brown; medulla usually K+O, P+O (constictic, salazinic (trace), and diffractaic (trace) acids); cortex not tuberculate and lacking isidia and soredia. Thallus pendulous, with cylindrical slender branches; medulla compact; cortex matte; annular cracks conspicuous, often abundant; papillae absent; fibrils sparse; eastern North America, known in the PNW from a specimen in sub-boreal BC and a specimen from near the coast in Curry Co., Oregon

U. trichodea Ach.

9b Central axis reddish, pinkish brown, or rose; medulla and axis often C+Y or pale Y, CK+ deep yellow orange (diffractaic and barbatic acids and accessory substances); cortex with raised tubercles which commonly bear isidia and coarse soredia. Thallus pendulous, to 30 cm; base pale to rarely blackened; medulla compact; cortex thick and glossy; annular cracks often abundant and conspicuous; tubercles sometimes coalescing into ridges; fibrils and papillae sparse to abundant; this widely distributed oceanic species is rare in the PNW, occurring from BC to California

U. ceratina Ach. and *U. californica* Herre

[*U. californica* is sometimes separated as having cortical cell lumina less than 1 µm in width, smaller than those of *U. ceratina* in Europe (Tavares 1997). Halonen et al. apparently did not mention *U. californica*. The distinction needs more study. Sometimes the rose pigment in the axis is faint. Diffractaic acid is also found in *U. longissima*, *U. trichodea*, and rarely in *U. hirta*]

7b Central cord white

10a Cortex with a diffuse red pigment or red spots; on bark or wood near the coast. Thallus reddish brown on at least the lower 2/3 of the thallus when fresh, the reddish hue produced by coalescing reddish spots in the cortex; thallus containing salacinic, norstictic, and miscellaneous other compounds in the stictic acid group; widespread in tropics and subtropics n on the coast to n Ore

U. rubicunda Stirton

[Tavares (pers. comm.) writes: “some lichenologists have mistaken the orangish pruina that forms on the surface of some specimens of the *U. subgracilis* group for the red of *U. rubicunda* and consequently misidentified them, thinking that they were a protocetraric acid strain of *U. rubicunda*.”]

10b Cortex blackening toward the branch tips; on rock in subalpine to alpine. Thallus tufts to 2 cm diam; branches often black spotted or banded; medulla P-, K- (usnic acid only). Arctic-alpine with disjuncts in Washington and Oregon Cascades

U. sphacelata R. Br.

Neuropogon lambii Imshaug

Group 2 Pendulous

12a Base blackened; cortex with abundant annular cracks, especially at the base; cortex thick (10-20% of radius); medulla compact, thin (7-15% of radius); soralia typically larger than ½ of the branch diameter, isidiate at least when young. Thallus pendent to subpendent, rarely shrubby, to 25 cm long; fibrils and papillae variable, but papillae usually indistinct; branching mainly isotomic dichotomous but becoming anisotomic near the tips; soralia often numerous, distinctly raised, closely spaced to confluent, occasionally absent or sparse; medulla K+Y or R, P+Y or O, with salacinic acid and accessory protocetraric and constictic acids, rarely with accessory barbatic acid; on conifers, hardwoods, and shrubs; common in oceanic areas from Calif to BC, usually found near the coast, sometimes in the Coast Ranges, sporadic in the Willamette-Puget trough

U. silesiaca Motyka

U. madeirensis Motyka

[Halonen et al. (1997) and Halonen (2000) use the name *U. madeirensis*. Tavares (1997) asserted that *U. silesiaca* is the correct name; an attempt to conserve *U. madeirensis* against *U. silesiaca* failed (Clerc 2004).]

12b Base blackened or not, but if blackened, then with fewer annular cracks; cross section and propagules various

13a Papillae lacking

14a Main branches very long, rarely dividing, with dense short perpendicular fibrils; central strand of main branches > 0.5X thickness of branches; central axis I+B. Thallus commonly very long (to >> 1 m), cortex eroded on the main branches; soredia occasionally present; central axis white but occasionally turning pinkish or reddish brown in decorticate branches; apothecia rare; cortex and medulla K-, C-, P- (with various combinations of evernic, diffractaic, barbatic, and 4-O-demethylbarbatic acids; sometimes with usnic acid only), rarely K+Y-O, P+O (salacinic acid); on both conifers and hardwoods, frequently in riparian areas but also on fog-swept ridges; locally common in moist low-elevation coastal forests; Alaska to Calif in the coastal states and provinces

U. longissima Ach.

[This species shows rich chemical variation in the Pacific Northwest. In BC (Halonen et al. 1998) evernic acid was most frequent, followed by barbatic acid); the various chemotypes were recognized as species by Asahina, but these have largely been ignored because the specimens are otherwise indistinguishable morphologically)

14b Main branches often rebranching, fibrils absent to moderate; central strand of main branches < 0.5X thickness of the branch; central axis I-

15a Main branches becoming strongly pitted (foveolate) and ridged, bluntly angular in cross-section. Thallus sometimes long (to 30 cm), soft, sparsely branched; soredia and isidia lacking; central strand and terminal branches ± sinuous; fibrils lacking or very sparse; apothecia rare; medulla I-, usually K+Y to O and P+O (with salazinic acid), rarely with only usnic acid (K-, P-); usually on conifers; widespread, boreal south in mountains to Ariz, Calif, and Mex; uncommon and scattered in PNW

U. cavernosa Tuck.

15b Main branches not or only weakly pitted

16a Main branches ridged or wrinkled; isidia usually abundant; papillae often present but weakly developed; annular cracks few

U. scabrata (see below)

16b Main branches smooth, cylindrical; isidia and soralia sparse to almost lacking; annular cracks common.

17a Base slightly to distinctly blackened; papillae usually present, though often sparse and low; medulla usually containing salacinic acid (K+Y to R, P+O), rarely

with usnic acid only (K-, P-); cortex moderately thick (___% of radius); medulla ___?___ and compact (___% of radius); axis ___ (___% of diameter). Thallus often 30 cm or more long; sometimes resembling *Alectoria*; usually with abundant slender branches but never with abundant fibrils; soralia absent to scattered, usually minute, borne on small tubercles; isidia usually absent but occasionally present. Usually on conifers; uncommon to locally common in the Coast Ranges and Cascades at low to middle elevations; BC (and probably Alaska) to Oregon

U. chaetophora Stirton

17b Base not blackened; papillae absent; cortex relatively thick (8-14% of radius); medulla thin and compact (6-16% of radius); axis thick (43-64% of diameter); medulla K+Y or K-, P+R (protocetraric acid with accessory compounds in the stictic acid group). Thallus to 50 cm long or more, sometimes resembling *Alectoria*; fibrils absent to abundant; cortex matte; soralia absent to abundant, minute; isidia absent to sparse, soon abraded; usually on conifers near the coast

U. schadenbergiana Göpp. & Stein

U. hesperina Motyka

U. subgracilis Vainio

[See Clerc's (2004) nomenclatural conclusion regarding loss of the familiar name *U. hesperina*.]

13b Papillae present

18a Branches with abundant annular cracks (typically 6-15 cracks per cm) that sometimes expose the medulla; papillae usually sparse and low, mainly on the thickest branches; soralia absent to scattered, usually minute.

U. chaetophora (see above)

18b Branches with few annular cracks (0-8 per cm), those present mainly near the base

19a Main branches with raised wrinkles which may be widely scattered or dense and reticulating with intervening flat or depressed spots; branches uneven in thickness, ± swollen, often sinuose; cortex thin (2-8% of radius). Thallus to 50 cm long; main branches often with few fibrils (but sometimes heavily fibrillose); branches with raised warts that become isidiate; papillae usually weakly developed; medulla usually lax, K+Y to O (salacinic acid) or K- (usnic acid only); widespread, boreal and montane; mesic montane forests, with more old-growth affinity than *U. filipendula*

U. scabrata Nyl. sens. lat.

(including *U. alpina* Motyka, *U. barbata* (L.) F. H. Wigg., *U. catenulata* Motyka, ? *U. graciosa* Motyka, ? *U. intermedia* (Mass.) Jatta, *U. prostrata* Räsänen, *U. scabiosa* Motyka, *U. sylvatica* Motyka)

["a highly polymorphic species in which many intergrading morphotypes occur. These polymorphic characters, which are seemingly controlled mostly by environmental parameters, include the morphology of the papillae, the occurrence of foveoles, the density of branching and fibrils, and the thickness of the branches" (Halonen et al. 1998). Furthermore, they relegated *U. scabiosa* Motyka to a synonym of *U. scabrata*: "described from New Mexico, has a rugose, abundantly foveolate thallus and it probably represents *U. scabrata* sens. str." Tavares (1997), however, stated "these species are very distinct and do not seem to be closely related." Tavares separated *U. scabiosa* as having "papillae short, thick, cylindrical or slightly tapered" vs. "papillae usually tall and cylindrical" for *U. scabrata* and *U. filipendula*. The usnic-only chemotype is more common inland (this has been called *U. scabrata* ssp. *nylanderiana* Motyka) while west of the Cascades the salacinic chemotype is most common. Tavares (1997) also separates the *U. pendulina* - *U. graciosa* group as having distinctly inflated branch segments and sinuose fibrils, with small, thin, low papillae and cross-sectional proportions about the same as *U. scabrata*. She stated "California specimens allied to *U. pendulina* Motyka,

described from Italy, and *U. graciosa* Motyka, described from Sweden, include some individuals with strongly fusiform segments that may belong to a distinct taxon."]

19b Main branches cylindrical throughout, not ridged; cortex moderately thick (8-14% of radius)

20a Fibrils usually abundant; papillae usually tall, cylindrical, and abundant; isidio-soralia tuberculate, often arising from scars of detached fibrils; medulla K+Y-O, P+O (salacinic acid). Thallus to 60 cm long; base blackened or not; main branches with abundant papillae and tubercles, the latter producing isidia; isidia usually abundant; central axis rather thick (30-45% of diameter); medulla with salacinic acid (UV-, K+R, P+O) or usnic acid only (K-, P-). On both hardwoods and conifers in low to mid elevation forests, mainly in mesic to dryish sites west of the Cascades, mesic sites east of the Cascades; BC to California inland to w Montana

U. filipendula Stirton

[Other names that have been commonly applied in this group are *U. plicata* and *U. dasypoga* (Ach.) Shirley]

20b Fibrils absent to sparse; papillae short warty bumps; soralia plane to tuberculate, arising from small tubercles; medulla UV+ white, K-, P+Y (squamatic and baeomycesic acids)

U. pacificana (pendulous morphotype; see below)

Group 3 Fertile, NIS; tufted

This group is poorly studied and rare in the PNW; the chemically-based dichotomies below are sure to be replaced as our information improves. In general this group is abundantly papillate and fibrillose, the thallus erect to subpendent, with mainly anisotomic branching, a thin, loose medulla and a thick central axis.

24a Medulla K+Y or K+O

25a Medulla K+ deep Y, P+O, UV-, containing thamnolic acid with accessory alectorialic acid; presence in the PNW is questionable; Halonen et al (1998) refer BC reports to *U. rigida* thamnolic chemotype of *U. florida* (L.) F. H. Wigg.

25b Medulla K+Y -> O, P+O; containing salacinic acid. Papillae narrow, short to intermediate in height; fibrils tapering from base; California (Tavares 1997)

U. arizonica Motyka

U. retifera Motyka is synonymous? (Tavares 1997)

24b Medulla K-

26a Medulla P-, UV+, containing squamatic acid, with accessory alectorialic acid squamatic chemotype of *U. florida* (L.) F. H. Wigg.

26b Medulla K-, P+R, UV-, containing protocetraric acid in high quantities; BC (Mayne Island and lower Fraser River valley, Halonen et al.) European chemotypes include usnic-only and usnic+salacinic acid, which in this chemically based key would lead to *U. arizonica*; more characters are needed!

U. rigida (Ach.) Motyka s. lat.

Group 4

Tufted; Cigar-shaped Branch Segments

This is the *U. fragilescens* group, characterized by a tufted thallus; glossy, usually thin, often foveolate cortex; a thick, loose medulla; thin central axis; and cigar-shaped branch segments that are constricted at the nodes

30a Papillae present

31a Soralia numerous, minute, less than half the branch diameter, although often confluent into larger patches; thallus often large (5-15 cm long). Thallus tufted to subpendent; branching mainly anisotomic dichotomous, branching often widely divergent giving the thallus a broadly bushy appearance; foveoles sparse to numerous; base pale or blackened; isidia are minute to tall, sometimes appearing to precede the formation of soredia; fibrils sparse or abundant; cortex noticeably brittle when dry; often heavily isidiate; medulla K+Y or K+R, rarely K-, P+Y, O, or R (chemotypes include (1) salacinic acid, (2) salacinic acid with various compounds of the stictic acid group; (3) stictic acid group without salacinic, and (4) psoromic acid, \pm 2'-o-demethylpsoromic and/or protocetraric acids; (5) thamnolic and protocetraric acid; on both conifers and hardwoods; widespread in oceanic climates; very common on the immediate coast, increasingly sporadic inland; unknown east of the Cascades

U. cornuta Körber sens. lat.

U. inflata (Duby) Motyka

[*U. occidentalis* Motyka has chemotype 4 and was included under *U. cornuta* sens. lat. by Halonen et al.; chemotype 5 was reported from California (Clerc & Herrera-Campos 1997)]

31b Soralia larger than half the branch diameter when mature; thallus smaller, usually < 6 cm long

32a Base distinctly blackened (rarely pale); thallus usually subpendent, rarely shrubby, to 20 cm long. Thallus sparsely branched; isidia present; soralia present on both terminal and secondary branches; arising from low tubercles; papillae low and numerous, but sometimes indistinct, rarely absent; fibrils sparse to abundant; chemistry variable: (1) most commonly with the stictic acid group (K+Y or R, P+Y or O), occasionally with (2) salacinic acid \pm stictic acid group (K+Y or R, P+Y or O), (3) usnic acid only (K-, P-), (4) psoromic acid (K-, P+ deep Y), or (5) squamatic acid (K-, P-, UV+ white); on both conifers and hardwoods; very common in the hypermaritime zone in BC, decreasing in frequency southward and inland (sporadic in the Oregon Coast Range)

U. fragilescens var. *mollis* (Vainio) Clerc

32b Base pale to slightly blackened; thallus usually shrubby, to 7 cm long

33a Central axis normally pale yellow (sometimes the color is very pale or even lacking – check several places on the thallus); isidia sometimes present; cortex often sparsely red spotted. Thallus small to medium, usually < 7 cm diam; cortex often with reddish spots; soralia P+Y, K-; mediterranean, oceanic; common w Cas

U. flavocardia Räsänen

U. wirthii Clerc

33b Central axis white (sometimes discoloring orangish from breakdown products of salacinic acid); isidia absent; cortex not red spotted. Thallus shrubby or less often subpendent, to 8 cm long; base pale and not constricted; branch apices characteristically recurved; soralia plane to slightly concave, sometimes confluent; papillae distinct, numerous; fibrils usually abundant; medulla K+R, P+Y or O (salacinic, bourgeanic, \pm constictic acid); California to BC, infrequent in Oregon, rare in BC; mainly in the Coast Ranges and near the coast

Usnea esperantiana Clerc

[*U. cornuta* is typically larger, isidiate, and with small soralia, while *U. esperantiana* is smaller, non-isidiate, and with larger soredia. *U. esperantiana* appears like a papillate form of *U. glabrata*, but it also differs in chemistry.]

30b Papillae absent or sparse

34b Thallus large, often 5-15 cm long; base blackened or pale. (In these species main branches usually papillose, but uncommon epapillose forms may key here)

35a Soralia usually small, less than half the branch diameter but sometimes coalescing into larger patches.

U. cornuta (see above)

35a Soralia usually larger, usually more than half the branch diameter

U. fragileszens var. *mollis* (see above)

34b Thallus < 5 cm long; base pale to slightly blackened; soralia often > ½ the branch diameter. Branch apices straight to recurved; soralia mostly near the apices, usually large and tuberculate, often confluent; isidia lacking but spinules may be present around the soralia; soralia when mature large and wrapping around the branches; two primary chemotypes: K-, P+O-R (protocetraric, ± fumarprotocetraric, ± barbatic, ± other accessory compounds), less often K-, P- (usnic acid only or usnic with barbatic acid); widespread, common west of the Cascades, uncommon east of the Cascades; low to mid elevations both sides of Cascades

U. glabrata (Ach.) Vainio

U. kujalae Räs.

U. florida var. *pilina* Vainio

[Tavares (1997) considered *U. kujalae* distinct from *U. glabrata*. In her key they separate on the presence of papillae, being absent in *U. glabrata*]

Group 5

Tufted; Cylindrical Branch Segments

40a Main branches weakly to strongly foveolate, lacking papillae, generally fibrillose, typically isidiate but sometimes with indistinct soredia; base never blackened. Medulla K-, P- (usnic acid ± fatty acids related to murolic acid) or K+Y-R, P+O (norstictic, usnic, and fatty acids); widespread, boreal, temperate, and montane; in our area more common east of the Continental Divide but also in dry forests west of the Continental Divide

U. hirta (L.) F. H. Wigg.

40b Main branches never both foveolate and lacking papillae; isidia and/or soredia present; base blackened or not

41a Soralia becoming strongly concave, often exposing the central axis, the edges of the ruptured cortex flexed outward, eventually the soralia often wrapping around the branches; isidia often lacking (though sometimes with short spinules on the soralia)

42a Branching mostly isotomic dichotomous; branches cylindrical; base conspicuously blackened; medulla thin to moderately thick (8-22% of radius)

43a Narrow fibrils often ascending; medulla about 13% of radius; axis about 50% of diameter; medulla dense, without distinct interhyphal spaces; black base often splitting into right-angled segments. Thallus shrubby; terminal branches tapering; papillae usually warty; soralia at least partly isidiate; thallus with barbatic and/or salazinic acid, or lacking both of these (K-, P- or K+Y-O, P+Y-O); Apparently rare in western Washington, Oregon, and California (Tavares 1997)

U. wasmuthii Räs.

43b Fibrils and lateral branches more divergent; medulla about 21% of radius; axis about 36% of diameter; medulla less dense, with interhyphal spaces; black base rarely splitting into

right-angled segments. Medulla K+Y-R, P+Y to O (norstictic, cryptostictic, stictic, and menegazziaic acids); common w Cas, reports from RM need to be confirmed

U. glabrescens (Vainio) Vainio sens. lat

U. fulvoreaegens (Räs.) Räs.

U. glabrescens var. *fulvoreaegens* Räs.

- 42b Branching mostly anisotomic dichotomous; branches often deformed (with foveoles or irregularly swollen); base pale or blackened; medulla moderately thick (12-30% of radius). Chemistry variable but never with the stictic acid group; medulla thick and loose; medulla K- or K+Y or O (most commonly usnic only or usnic and salacinic acids; occasionally with accessory barbatic, protocetraric, or psoromic acids or terpenoids) boreal and continental montane, also on *Artemisia* and other shrubs in steppe; by far the commonest *Usnea* in the northern Rockies; on hardwoods and conifers, lowland to subalpine, also present in outlying mountains east of the Continental Divide

U. lapponica Vainio

- 41b Soralia tuberculate to slightly concave, but never strongly concave; isidia often present

- 44a Cortex translucent, distinctly glossy; fibrils often in fascicles of two to four; papillae low, indistinct to nearly absent; soralia tuberculate when present. Branching mainly anisotomic; base pale to blackened; branches often segmented by annular cracks; cortex thin (6-12% of radius; medulla lax to dense; medulla containing either (1) norstictic acid with accessory salacinic, protocetraric, and stictic acids or (2) psoromic with accessory 2'-*O*-demethylpsoromic acid; on both conifers and hardwoods; apparently rare; BC to Oregon on the immediate coast and in the Coast Ranges

U. nidulans Motyka

[“Bundles of spinulose fibrils are occasionally found also in other species... but *U. nidulans* s. lat. has, in any case a distinct suite of morphological and chemical characters (Halonen et al. 1998).]

- 44b Cortex opaque, slightly glossy to matte; fibrils single, never in fascicles; papillae always present, usually distinct; soralia tuberculate to excavate

- 45a Mature soralia punctiform to slightly enlarged, often \pm tuberculate; isidia often numerous

- 46a Cortex thin, usually $< 10\%$ of radius; papillae usually cylindrical; terminal branches \pm similar in diameter over entire length, tapering only near tips. Thallus tufted to frequently subpendent; branches \pm irregularly swollen, slender, sometimes with foveoles and depressions; branching mostly anisotomic-dichotomous, often sinuose, not all of the same length; base pale or blackened; medulla K+Y-R, P+Y-O, with salacinic \pm barbatic acid. papillae short to cylindrical, variable in abundance; fibrils variable; cortex thin, medulla lax to dense and very variable in thickness; on bark and wood; widespread, occasional, on both sides of the Cascades but more common west

U. diplotypus Vainio

[Small individuals of *U. filipendula* will typically key here; these tend to have long, tapered tips and anisotomic branching. *U. substerilis* is closely related but differs in its large and superficial soralia, and isidia that are short or lacking]

- 46b Cortex relatively thick, usually $> 10\%$ of radius; papillae usually warty; terminal branches tapering

- 47a Branching mainly anisotomic dichotomous; soralia punctiform and tuberculate; thallus containing squamatic and baeomycesic acids \pm barbatic acid (medulla K-, P+Y, UV+ blue-white). Thallus initially erect, becoming pendent, to 20 cm long; mature thallus often pendent; base slightly to distinctly blackened; annular cracks common near base, with white, everted medullary rings common on main branches; cortex thick (11-19% of radius); medulla dense and thin, 4-20% of radius; axis thick, 36-58% of diameter; fibrils sparse to abundant; soredia usually sparse; isidia short to long, occurring on at least young soralia, but easily

abraded and lost; on both hardwoods and conifers, to at least 1100 m elevation;
BC to n Cal, w Cas

U. pacificana Halonen

47b Branching mainly isotomic-dichotomous; soralia tuberculate to slightly excavate,
minute to enlarged; thallus never with baeomycesic acid, otherwise chemistry
various

48a Cortex with many annular cracks, especially at the base; thallus becoming
pendent; thallus containing salazinic acid (medulla K+Y or R, P+Y or O) with
various accessory substances

U. silesiaca (see above in pendent group)

48b Cortex with few to scattered annular cracks; thallus rarely becoming pendent;
thallus chemistry various

49a Mature soralia often rounded; longitudinal cracks rare at base; medulla
containing squamatic and/or thamnolic acids; medulla K-, P-, UV+ blue-
white or rarely K+ deep Y, P+Y or O. Thallus shrubby or rarely
pendent; base conspicuously blackened; Cortex 9-15% of radius;
medulla usually dense, 8-19% of radius; axis thick, 40-54% of diameter;
white medullary rings occasional; soralia borne on tubercles, varying
from minute to enlarged, raised to slightly concave; fibrils often
abundant near the base; branches sometimes sparsely foveolate;
papillae warty to cylindrical; on conifers and hardwoods, rarely on rock;
widespread; in our area fairly common at low to mid elevations in and
west of the Cascade Range, rare east of the Cascades; a name widely
misapplied in N Am;

U. subfloridana Stirton

49b Mature soralia often elongated; longitudinal cracks common at basal
part; medulla containing barbatic and/or salacinic acids, or sometimes
neither of these (K-, P- or K+Y-O, P+Y-O)

U. wasmuthii (see above)

45b Mature soralia enlarged, plane to slightly excavate, not tuberculate; isidia absent to
numerous

50a Branching mostly anisotomic-dichotomous (occasionally isotomic); branches often \pm
deformed and/or foveolate, sometimes irregularly swollen; base pale or blackened;
mature soralia slightly excavate, but remaining superficial, irregular, usually isidiate at
least when young; soredia usually granulose; medulla never with stictic acid group.
Thallus shrubby to rarely subpendent; fibrils often abundant, even near the apices;
soralia borne on tubercles and low pustules; papillae low to cylindrical, usually
numerous; cortex \pm thin; medulla variable but usually thick; central axis \pm thick;
medulla K+Y or O, P+Y or O (salacinic acid with accessory barbatic acid) or rarely K-,
P- (usnic acid only or usnic + barbatic acids); usually on conifers, occasional on
deciduous trees and shrubs; widespread, occasional in our area, more common in
boreal forests; in our area in *Pinus ponderosa* savanna to montane forest, both sides
Cont Div

U. substerilis Motyka

U. stuppea (Räsänen) Motyka

[Shrubby forms of *U. filipendula* may key here, but it has cylindrical, non-foveolate
branches. *U. subfloridana* usually has a more distinctly blackened base, shorter
papillae, and usually less fibrillose terminal branches. *U. diplotypus* has smaller
soralia, often a more pendant thallus, and abundant tall isidia.]

50b Branching mostly isotomic dichotomous; branches cylindrical, not swollen; base
conspicuously blackened; mature soralia slightly to distinctly excavate, often
rounded, rarely isidiate when young; soredia usually farinose; medulla normally with
stictic acid group

U. glabrescens (see above)

Other reports:

U. dasaea Stirt. (= *U. undulata* Stirt.) From Santa Barbara, California (Clerc & Herrera 1997). Mainly corticolous but occasionally saxicolous.

U. fibrillosa from Centralia, Washington, det. Halonen (herb. Siuslaw NF)

U. mutabilis rare from southern California (Tavares 1997).

U. occidentalis from near Newport, Oregon, det. Halonen (herb. Siuslaw NF) and California (Tucker & Jordan 1979)

U. subcornuta group from California (Tavares 1997).

Key Emphasizing Lichen Substances

1a Thallus lacking stictic, norstictic, and salacinic acids

2a Thallus lacking identifiable substances other than usnic acid and fatty acids

Chem Group 1

2b Thallus containing thamnolic, squamatic, protocetraric, psoromic, diffractaic, or barbatic acids

Chem Group 2

1b Thallus containing stictic, norstictic, or salacinic acid

3a Thallus containing stictic and/or norstictic acids or other compounds from the stictic acid group

Chem Group 3

3b Thallus containing salacinic acid or salacinic + compounds from the stictic acid group

Chem Group 4

Chem Group 1

Lacking identifiable substances other than usnic acid and fatty acids

1a Cortex blackening; always on rock

U. sphacelata

1b Cortex yellowish to greenish, rarely on rock

2a Thallus pendulous

3a Papillae lacking

xa Central axis very thick, I+B

U. longissima

xb Central axis medium to thin, I-

5a Main branches becoming strongly pitted (foveolate) and ridged, bluntly angular in cross-section

rare chemotype of *U. cavernosa*

5b Main branches not or only weakly pitted

6a Main branches ridged or wrinkled; isidia usually abundant; papillae often present but weakly developed; annular cracks few

U. scabrata

6b Main branches smooth, cylindrical; isidia and soralia sparse to almost lacking; annular cracks common

U. chaetophora

3b Papillae present

7a Branches with abundant annular cracks (typically 6-15 cracks per cm) that sometimes expose the medulla; papillae usually sparse and low, mainly on the thickest branches; soralia absent to scattered, usually minute

U. chaetophora

7b Branches with few annular cracks (0-8 per cm), those present mainly near the base

8a Main branches with raised wrinkles which may be widely scattered or dense and reticulating with intervening flat or depressed spots; branches uneven in thickness, \pm swollen, often sinuose; cortex thin (2-8% of radius).

U. scabrata

8b Main branches cylindrical throughout, not ridged; cortex moderately thick (8-14% of radius)

U. filipendula

2b Thallus tufted

10a Thallus with inflated cigar-shaped branches and loose medulla; papillae lacking

U. glabrata

10a Thallus with cylindrical branches and loose or dense medulla; papillae usually present

11a Main branches weakly to strongly foveolate, lacking papillae, generally fibrillose, typically isidiate but sometimes with indistinct soredia; base never blackened

U. hirta

11b Main branches never both foveolate and lacking papillae; isidia and/or soredia present; base blackened or not

12a Soralia becoming strongly concave, often exposing the central axis, the edges of the ruptured cortex flexed outward, eventually the soralia often wrapping around the branches; isidia often lacking (though sometimes with short spinules on the soralia)

13a Branching mostly isotomic dichotomous; branches cylindrical; base conspicuously blackened; medulla thin to moderately thick (8-22% of radius). Narrow fibrils often ascending

U. wasmuthii

13b Branching mostly anisotomic dichotomous; branches often deformed (with foveoles or irregularly swollen); base pale or blackened; medulla moderately thick (12-30% of radius).

U. lapponica

12b Soralia tuberculate to slightly concave, but never strongly concave; isidia often present

14a Mature soralia punctiform to slightly enlarged, often \pm tuberculate; isidia often numerous

U. wasmuthii

14b Mature soralia enlarged, plane to slightly excavate, not tuberculate; isidia absent to numerous. Salacinic acid with accessory barbatic acid or rarely usnic acid only or usnic + barbatic acids

U. substerilis

Chem Group 2

Thamnolic, squamatic, psoromic, protocetraric, diffractaic, or barbatic acids

1a Thallus containing psoromic, diffractaic, or barbatic acid

2a Thallus containing psoromic acid

3a Thallus with cigar-shaped branch segments and loose medulla

4a Central axis yellow. Norstictic acid and/or other stictic acid group compounds or rarely psoromic acid

U. flavocardia Räsänen

4a Central axis white

5a Soralia numerous, minute, less than half the branch diameter, although often confluent into larger patches; thallus often large (5-15 cm long)

U. cornuta

5b Soralia larger than half the branch diameter when mature; thallus smaller, usually < 6 cm long

Usnea fragileszens var. *mollis*

3b Thallus with cylindrical branch segments and loose or compact medulla

6a Soralia becoming strongly concave, often exposing the central axis, the edges of the ruptured cortex flexed outward, eventually the soralia often wrapping around the branches; isidia often lacking (though sometimes with short spinules on the soralia)

U. lapponica

6b Soralia tuberculate to slightly concave, but never strongly concave; isidia often present

7a Cortex translucent, distinctly glossy; fibrils often in fascicles of two to four; papillae low, indistinct to nearly absent; soralia tuberculate when present. Ppsoromic with accessory 2'-O-demethylpsoromic acid

U. nidulans

7b Cortex opaque, slightly glossy to matte; fibrils single, never in fascicles; papillae always present, usually distinct; soralia tuberculate to excavate

2b Thallus containing diffractaic and/or barbatic acid

xa Cortex eroding on main branches; medulla I+B

U. longissima

xb Cortex intact or with annular cracks; medulla I-

10a Central axis reddish, pinkish brown, or rose; diffractaic and barbatic acids, plus accessory substances

U. ceratina.

10a Central axis white

11a Thallus with cigar-shaped branch segments and loose medulla; papillae lacking. Barbatic acid.

U. glabrata.

11b Thallus with cylindrical branch segments and loose or compact medulla; papillae various

12a Soralia becoming strongly concave, often exposing the central axis, the edges of the ruptured cortex flexed outward, eventually the soralia often wrapping around the branches; isidia often lacking (though sometimes with short spinules on the soralia)

13a Branching mostly isotomic dichotomous; branches cylindrical; base conspicuously blackened; medulla thin to moderately thick (8-22% of radius). Narrow fibrils often ascending

U. wasmuthii

13b Branching mostly anisotomic dichotomous; branches often deformed (with foveoles or irregularly swollen); base pale or blackened; medulla moderately thick (12-30% of radius).

U. lapponica

12b Soralia tuberculate to slightly concave, but never strongly concave; isidia often present

Nothing here???

1b Thallus containing protocetraric, thamnolic or squamatic acid

20a Thallus containing protocetraric acid as the main lichen substance

21a Thallus pendulous

U. schadenbergiana

21b Thallus tufted

- 22a Thallus fertile, lacking isidia and soredia. *U. rigida*
- 22b Thallus with isidia and/or soredia *U. glabrata*
- 20b Thallus lacking protocetraric acid, containing squamatic or thamnolic acid
- 23a Thallus fertile, lacking isidia and soredia. Containing either squamatic or thamnolic acid *U. florida*
- 23b Thallus with isidia and/or soredia
- 24a Thallus with cigar-shaped branch segments and loose medulla
- 26a Soralia numerous, minute, less than half the branch diameter, although often confluent into larger patches; thallus often large (5-15 cm long). Thamnolic and protocetraric acid. rare chemotype of *U. cornuta*
- 26b Soralia larger than half the branch diameter when mature; thallus smaller, usually < 6 cm long. Squamatic acid. rare chemotype of *Usnea fragilesceus* var. *mollis*
- 24b Thallus with cylindrical branch segments and loose or compact medulla
- 27a Thallus containing squamatic and/or thamnolic acids; medulla K-, P-, UV+ blue-white or rarely K+ deep Y, P+Y or O *U. subfloridana*
- 27b Thallus containing squamatic and baeomycesic acids ± barbatic acid *U. pacificana* Halonen

Chem Group 3

Stictic acid group

- 1a Cortex or central cord distinctly reddish, brown, yellow, or blackening
- 2a Central axis yellow or brown
- 3a Central axis yellow; thallus tufted, containing the stictic acid group. Norstictic acid and/or other stictic acid group compounds or rarely psoromic acid *U. flavocardia* Räsänen
- 3b Central axis brown; thallus pendulous, containing constictic, trace salacinic, trace diffractaic *U. trichodea*
- 2b Central axis white
- 1b Cortex yellow green to green and central cord white
- 5a Thallus with cigar-shaped branch segments and loose medulla
- 6a Soralia numerous, minute, less than half the branch diameter, although often confluent into larger patches; thallus often large (5-15 cm long) *U. cornuta*
- 6b Soralia larger than half the branch diameter when mature; thallus smaller, usually < 6 cm long *Usnea fragilesceus* var. *mollis*
- 5b Thallus with cylindrical branch segments and loose or compact medulla
- 7a Main branches weakly to strongly foveolate, lacking papillae, generally fibrillose, typically isidiate but sometimes with indistinct soredia; base never blackened *U. hirta*
- 7b Main branches never both foveolate and lacking papillae; isidia and/or soredia present
- 8a Soralia becoming strongly concave, often exposing the central axis, the edges of the ruptured cortex flexed outward, eventually the soralia often wrapping around the branches; isidia often lacking (though sometimes with short spinules on the soralia) *U. glabrescens*

8b Soralia tuberculate to slightly concave, but never strongly concave; isidia often present.
Cortex translucent, distinctly glossy; fibrils often in fascicles of two to four; papillae low, indistinct to nearly absent; soralia tuberculate when present. Norstictic acid with accessory salacinic, protocetraric, and stictic acids

U. nidulans

Chem Group 4

Salacinic acid or salacinic + stictic acid group

1a Cortex distinctly reddish; thallus containing salacinic and the stictic acid group

U. rubicunda

1b Cortex yellow green to green

2a Thallus pendulous

3a Papillae lacking

4a Cortex eroding on main branches; central axis I+B

rare chemotype of *U. longissima*

4b Cortex not eroding, except for pseudocyphellae and soredia; central axis I-

5a Base blackened; cortex with abundant annular cracks, especially at the base; cortex thick (10-20% of radius); medulla compact, thin (7-15% of radius); soralia typically larger than ½ of the branch diameter, isidiate at least when young.

U. silesiaca

5b Base blackened or not, but if blackened, then with fewer annular cracks; cross section and propagules various

6a Main branches becoming strongly pitted (foveolate) and ridged, bluntly angular in cross-section

U. cavernosa

6b Main branches not or only weakly pitted

7a Main branches ridged or wrinkled; isidia usually abundant; papillae often present but weakly developed; annular cracks few

U. scabrata

7b Main branches smooth, cylindrical; isidia and soralia sparse to almost lacking; annular cracks common

U. chaetophora

2b Papillae present

10a Branches with abundant annular cracks (typically 6-15 cracks per cm) that sometimes expose the medulla; papillae usually sparse and low, mainly on the thickest branches; soralia absent to scattered, usually minute.

U. chaetophora

10b Branches with few annular cracks (0-8 per cm), those present mainly near the base

11a Main branches with raised wrinkles which may be widely scattered or dense and reticulating with intervening flat or depressed spots; branches uneven in thickness, ± swollen, often sinuose; cortex thin (2-8% of radius)

U. scabrata

11b Main branches cylindrical throughout, not ridged; cortex moderately thick (8-14% of radius). Containing salacinic and usnic acid or only usnic acid

U. filipendula

2b Thallus tufted

14a Thallus fertile; isidia and soredia lacking

U. arizonica

14b Thallus with isidia and/or soredia

15a Thallus with cigar-shaped branch segments and loose medulla

- 16a Papillae present
- 17a Soralia numerous, minute, less than half the branch diameter, although often confluent into larger patches; thallus often large (5-15 cm long)
U. cornuta
- 17b Soralia larger than half the branch diameter when mature; thallus smaller, usually < 6 cm long
- 18a Base distinctly blackened (rarely pale); thallus usually subpendent, rarely shrubby, to 20 cm long
Usnea fragilesceus var. *mollis*
- 18b Base pale to slightly blackened; thallus usually shrubby, to 7 cm long. Thallus with salacinic, bourgeanic, ± constictic acid
Usnea esperantiana
- 16b Papillae absent or sparse
- 19a Soralia usually small, less than half the branch diameter but sometimes coalescing into larger patches.
U. cornuta (see above)
- 19b Soralia usually larger, usually more than half the branch diameter
Usnea fragilesceus var. *mollis* (see above)
- 15b Thallus with cylindrical branch segments and loose or compact medulla
- 21a Soralia becoming strongly concave, often exposing the central axis, the edges of the ruptured cortex flexed outward, eventually the soralia often wrapping around the branches; isidia often lacking (though sometimes with short spinules on the soralia)
- 22a Branching mostly isotomic dichotomous; branches cylindrical; base conspicuously blackened; medulla thin to moderately thick (8-22% of radius). Narrow fibrils often ascending
U. wasmuthii
- 22b Branching mostly anisotomic dichotomous; branches often deformed (with foveoles or irregularly swollen); base pale or blackened; medulla moderately thick (12-30% of radius).
U. lapponica
- 21b Soralia tuberculate to slightly concave, but never strongly concave; isidia often present
- 25a Mature soralia punctiform to slightly enlarged, often ± tuberculate; isidia often numerous
- 26a Cortex thin, usually < 10% of radius; papillae usually cylindric; terminal branches ± similar in diameter over entire length, tapering only near tips. Containing salacinic ± barbatic
U. diplotypus
- 26b Cortex relatively thick, usually > 10% of radius; papillae usually warty; terminal branches tapering
- 28a Cortex with many annular cracks, especially at the base; thallus becoming pendent; thallus containing salazinic acid (medulla K+Y or R, P+Y or O) with various accessory substances
U. silesiaca
- 28b Cortex with few to scattered annular cracks; thallus rarely becoming pendent; thallus chemistry various. Barbatic and/or salacinic acids, or sometimes neither of these
U. wasmuthii (see above)
- 25b Mature soralia enlarged, plane to slightly excavate, not tuberculate; isidia absent to numerous. Salacinic acid with accessory barbatic acid or rarely usnic acid only or usnic + barbatic acids
U. substerilis

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