The *Usnea rigida* group in California and the Pacific Northwest. Jesse E. D. Miller, kawriver@gmail.com, 1036 Adams, Eugene, OR 97520

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ABSTRACT: The *Usnea rigida* group, which is uncommon to rare in California and the Pacific Northwest, has historically been recognized as a complex of morphologically similar species that are distinguished by chemistry. However, some researchers have recently recognized North American members of this group as a single species with multiple chemotypes. Sources in the literature are inconsistent in their treatment of this group, and further work is needed to clarify variations in taxonomic treatments.

KEYWORDS: *Usnea arizonica, Usnea florida, Usnea rigida* group, *Usnea intermedia, Usnea quasirigida*

The *Usnea rigida* species complex is uncommon to rare on the west coast of North America, where it has been documented in California, Washington, and British Columbia (Brodo et al. 2001, McCune and Geiser 2009). This species group has a tufted growth form and is distinguished from other *Usnea* species on the west coast by the presence of abundant apothecia and the absence of soredia or isidia (McCune and Geiser 2009). Although *Usnea florida* is also fertile and lacks vegetative propagules, reports of this species from the west coast of the USA are believed to be misidentified members of the *U. rigida* group (Tucker and Ryan 2011, pers. com. Tucker). Other west coast *Usnea* species may occasionally be fertile, but these generally have isidia or soredia.

Usnea has long been recognized as one of the most taxonomically challenging lichen genera, and the taxonomy of the *U. rigida* species complex is still poorly understood at this time (Halonen 1998; Lendemer and Tavares 2003). Lichens of the *U. rigida* species complex are morphologically similar and are distinguished by chemistry. This group includes several historically-recognized species whose taxonomic merit is dubious; further work is needed to determine whether these distinct chemotypes warrant specific status (Clerc 2007; Lendemer and Tavares 2003; pers. com. James Lendemer).

Two species of the *U. rigida* group, *Usnea quasirigida* (syn. *U. rigida*) and *Usnea intermedia* (syn. *Usnea arizonica*), are widely recognized on the temperate west coast of North America. *U. quasirigida* is rarely reported from low-elevation, mesic sites in northern Washington state and southern British Columbia (McCune and Geiser 2009); *U. intermedia* is well-documented in Northern California on the west slope of the Coast Range from Humboldt County to San Francisco, and there are several records from farther south along the coast as well (Brodo et al. 2001; pers. com. Curtis Bjork and Bruce McCune). *U. retifera* is another historically-recognized member of this group reported from interior California near Fresno (Tucker and Ryan 2011); Tavares (1997) considers it to be synonymous with *U. intermedia*.

U. intermedia contains salazinic acid and is distinguished from *U. quasirigida,* which contains protocetraric acid, by its K+ yellow to orange reaction (Clerc 2003; Lendemer and Tavares 2003; McCune and Geiser 2009). However, there are reports of uncommon K-, P- forms of *U. intermedia* (Clerc 2003; Brodo 2001) that would key as *U. florida* in McCune and Geiser's most recent key to macrolichens (2009); these have been collected in Humboldt County, California (pers. com. Tom Carlberg). The relationship between *U. florida* and the *U. rigida* group has apparently been a matter of confusion for some time; Lendemer and Tavares (2003) defined *U. florida* and *U. florida* var. *rigida*,

which contain thamnolic and hypothamnolic acid, as synonymous and distinct from *U. rigida* sens. lat. and *U. quasirigida.*

Although there are numerous reports of *U. florida* in California, it appears that all of these are actually misidentified members of the *U. rigida* group (Tucker and Ryan 2011; pers. com. Shirley Tucker), probably *U. intermedia.* In the first edition of *Macrolichens of the Pacific Northwest* (McCune and Geiser 1997), all fertile *Usnea* spp. lacking soredia and isidia keyed as *U. florida*, which was the name McCune used to represent the entire *U. rigida* group (pers. com. Bruce McCune). All reports of *U. florida* that I encountered were collected before 1950 (pers. com. Shirley Tucker), when other names for the *U. rigida* group on the west coast were apparently not well established, or between 1997 and 2009, when McCune and Geisers's first edition was in use. McCune and Geiser's second edition (2009) keys *U. florida* as well as *U. quasirigida* and *U. intermedia*, but lists *U. florida* as unconfirmed in the Pacific Northwest. Clerc (2007) indicated that, in North America, *U. florida* occurs only in Mexico.

Clerc (2007) placed *U. rigida, U. arizonica,* and *U. retigera* in synonymy with *U. intermedia* based on their morphological similarity, but other sources in the literature are inconsistent in regards to the taxonomy of these species (Brodo et al. 2001; Lendemer and Tavares 2003; McCune and Geiser 2009). Many lichenologists and sources in the literature continue to make specific distinctions between the salazinic and protocetraric chemotypes, but the placement of the *U. arizonica* and *U. retigera* in synonymy with *U. intermedia* is widely accepted (Esslinger 2010; McCune and Geiser 2009; pers. com. James Lendemer).

Lendemer and Tavares (2003) introduced the name *U. quasirigida* to replace the historically troubled and confusing *U. rigida.* However, some lichenologists on the west coast do not recognize the name *U. quasirigida* and continue to use *U. rigida* because Lendemer and Tavares (2003) did not examine specimens from the west coast, which may be chemically distinct from the European type specimens they examined (pers. com. Curtis Bjork). Lendemer and Tavares (2003) give only a general description of *Usnea rigida* sens. lat. (which they say "probably has included *U. intermedia"*) and do not give detailed descriptions of the chemistry and range of the different chemotypes (or species). It appears that there will be no clear answers regarding the taxonomy of this group until further studies that include genetic analysis are completed.

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