

A photograph of a field of yellow flowers, likely Lomatium, growing in a grassy area. In the background, there is a small stream or pond. The text is overlaid on the image.

*Lomatium - Taxonomic Confusions &
Contusions*

***A Brief Taxonomic Primer Designed To
Alleviate Distress And Anxiety***

A Bit Of History

- *name first proposed by Constantine Rafinisque in 1819 but not widely accepted as a valid name until 1920*
- *three monographs published regarding the genus*
 - *John Coulter and Joseph Rose in 1900 as part of broader Umbelliferae (Apiaceae) treatment*
 - *Mildred Mathias in 1938*
 - *Mark Schlessman in 1984 – tuberous taxa only*
- *the genus has resisted all attempts at morphologic systematic approaches that make sense – molecular genetic data is providing a new and useful calibration*

Facts & Figures

- *approximately 120 species when most recent molecular data is taken into account*
- *approximately 40% of genus comprised of narrow endemics, whether listed rare or not*
- *44 species and subtaxa presently listed by various western states heritage programs (CA, ID, NV, OR, UT, WA)*
 - *2 listed federally endangered under ESA (*L. bradshawii* & *L. cookii*)*
- *tend to be strongly habitat specific*
 - *very useful as a field-based approach to addressing the genus*

Further Facts & Figures

- in general are not efficient seed dispersers
 - *this plays a significant role in promoting narrow endemism*
 - *number of viable seeds produced per mature plant tends to be low*
 - *largely reliant upon hydrologic and secondarily upon rodent cache dispersal mechanisms*
 - *not fully known, but apparently do not – or have short-lived – seed banks*
- many – but certainly not all – have strong aromatic secondary compounds
 - *inhibit herbivory, and indirectly also dispersal*
 - *of medicinal value – possible anthropogenic dispersal?*
- many are edible and of importance to native peoples

Even Further Facts & Figures

- *a rapidly evolving and speciating group*
- *the genus apparently readily establishes firm reproductive barriers between species*
 - *hybridization has never been documented in the genus or in Apiaceae subfamily Apioideae*
- *as far as is known speciation appears to be primary, but some reticulate evolution may play a role as well – investigation needed*
- *apparent morphological plasticity in the genus that has led to taxonomic heartburn; species are actually largely narrowly defined morphologically. A generally applicable rule: if it looks different it is probably a separate species*
 - *L. triternatum complex in particular has historically been fractious*

And Further Facts & Figures

- *all long-lived native perennials – some >> 100 years*
- *none are ‘weeds’ but some are increasers*
- *many of the rarest species species thrive on disturbance – an inherently unstable niche*
 - *e.g. L. bradshawii / L. cookii / L. pastorale / L. tarantuloides*

Final Further Facts Figures & Figments

- *Lomatium in general doesn't translate particularly well to herbarium sheets – 3D characters can be very important (e.g. leaves planar or not)*
- *It is relatively straightforward to develop a good gestalt feel for most species in the field based upon morphology and habitat*

18 *Lomatium* Taxa Described Since 1973

- *L. junceum* Holmgren & Barneby – 1979
- *L. quintuplex* Schlessman & Constance – 1979
- *L. stebbinsii* Schlessman & Constance – 1979
- *L. attenuatum* Evert – 1983
- *L. erythrocarpum* Meinke & Constance – 1984
- *L. shevockii* R.L. Hartman & Constance – 1988
- *L. packardiae* Cronq. – 1992
- *L. observatorium* – Constance & Ertter - 1996
- *L. ochocense* Helliwell – 2010
- *L. tamanitchii* Darrach & Thie – 2010
- *L. bentonitum* Carlson & Mansfield – 2011
- *L. pastorale* Darrach & Wagner – 2011
- *L. ravenii* var. *paiutense* Carlson & Mansfield – 2011
- *L. brunsfeldianum* McNeill – 2012
- *L. knokei* Darrach – 2014
- *L. swingeriae* McNeill – 2014
- *L. tarantuloides* Darrach & Hinchliff - 2014
- *L. basalticum* Mansfield & M. Stevens – 2016

Lomatium Taxa Still Needing Publication

- *L. "ski-hill"* – Chelan Co., WA
- *L. mathiasanum* – Grant Co., OR
- *L. "Boise foothills"* – Ada Co., ID
- *L. "serpentine"* – Curry, Douglas, Josephine Cos., OR
- *L. "Hart Mountain"* – Lake Co, OR
- *L. "pugetensis"* – Island, Jefferson, King, Kitsap, Lewis, Pierce, Thurston Cos., WA
- *L. "papilioniferum"* – widespread in w. ID, w. MT, e. WA – formerly *L. grayi*
- *L. "wowii "* – higher elevations King, Pierce, Yakima Cos., WA
- *L. cf. packardiae* – Morrow Co., OR
- *L. cf. farinosum var. hambleniae* – Crook Co, OR

Almost Certainly Others Yet To Be Found – Particularly In PNW

Molecular Investigations

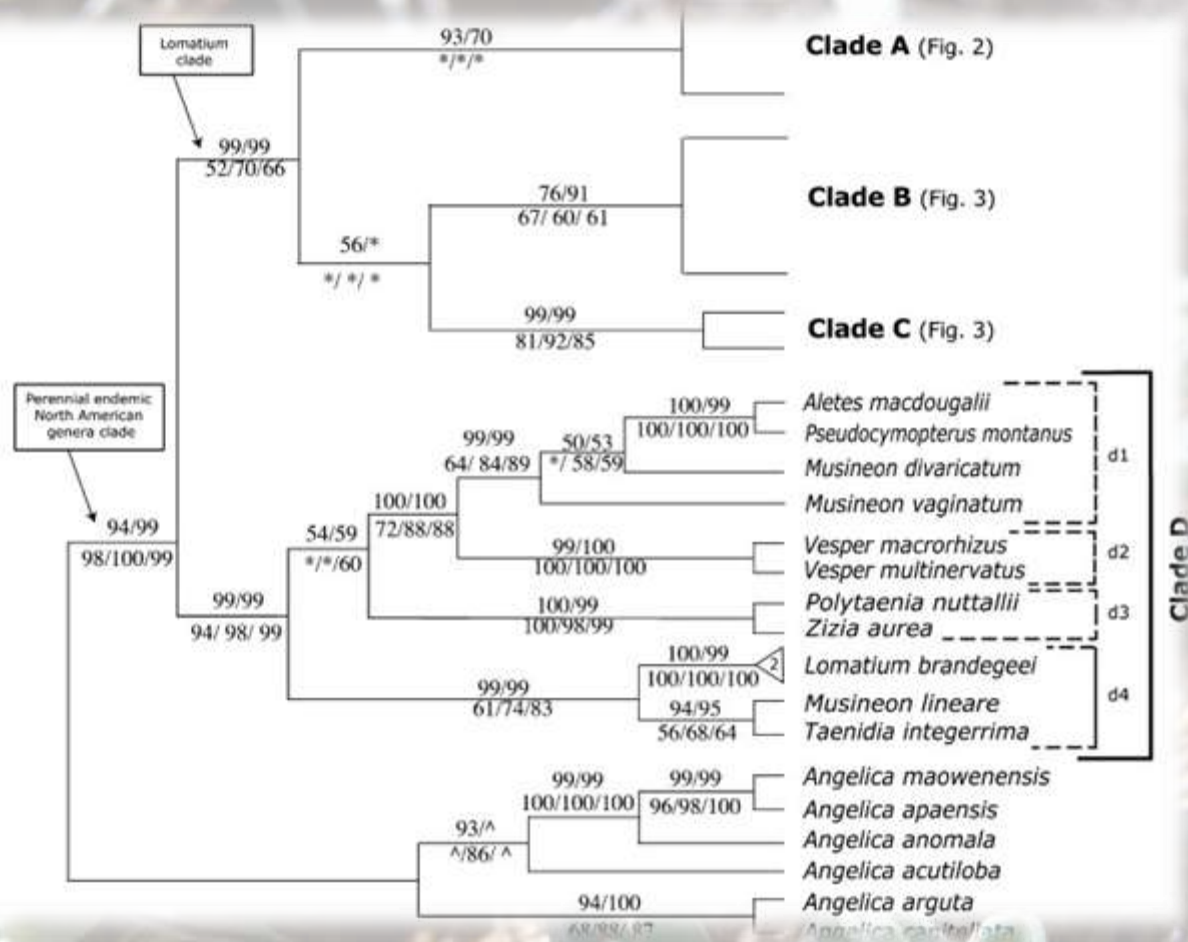
Sequenced ITS/*rpl32-trnL/rps16* intron/ETS/*cp trnD-T/cp rpl32-ndhF/cp psbA - trnH* spacer
Support For Clades: MP/ML bootstrap/BI Posterior Probabilities

- *Sun et al. 2004*
 - *Lomatium & Cymopterus polyphyletic, but resolution poor*
- *George et al 2014* – a semi-comprehensive genetic treatment of the genus and related subfamily *Apioideae* genera
 - *Far better resolution than previous studies – sampled 96 taxa in Apioideae out of approximately 200 taxa*
 - *Some genera as presently defined are polyphyletic*
 - *Homoplasy as a result of evolutionary convergence*
 - *Character states used to define genera morphologically were/are erroneous*

fruit morphology and ornamentation has been a mainstay of taxonomic delineation, but has proved to be scrambled across the clades

- *Smith et al. unpublished*
 - *closer looks at confusing Lomatium complexes*

George et al. – The Longer View



George et al. – The Lomatium Clade

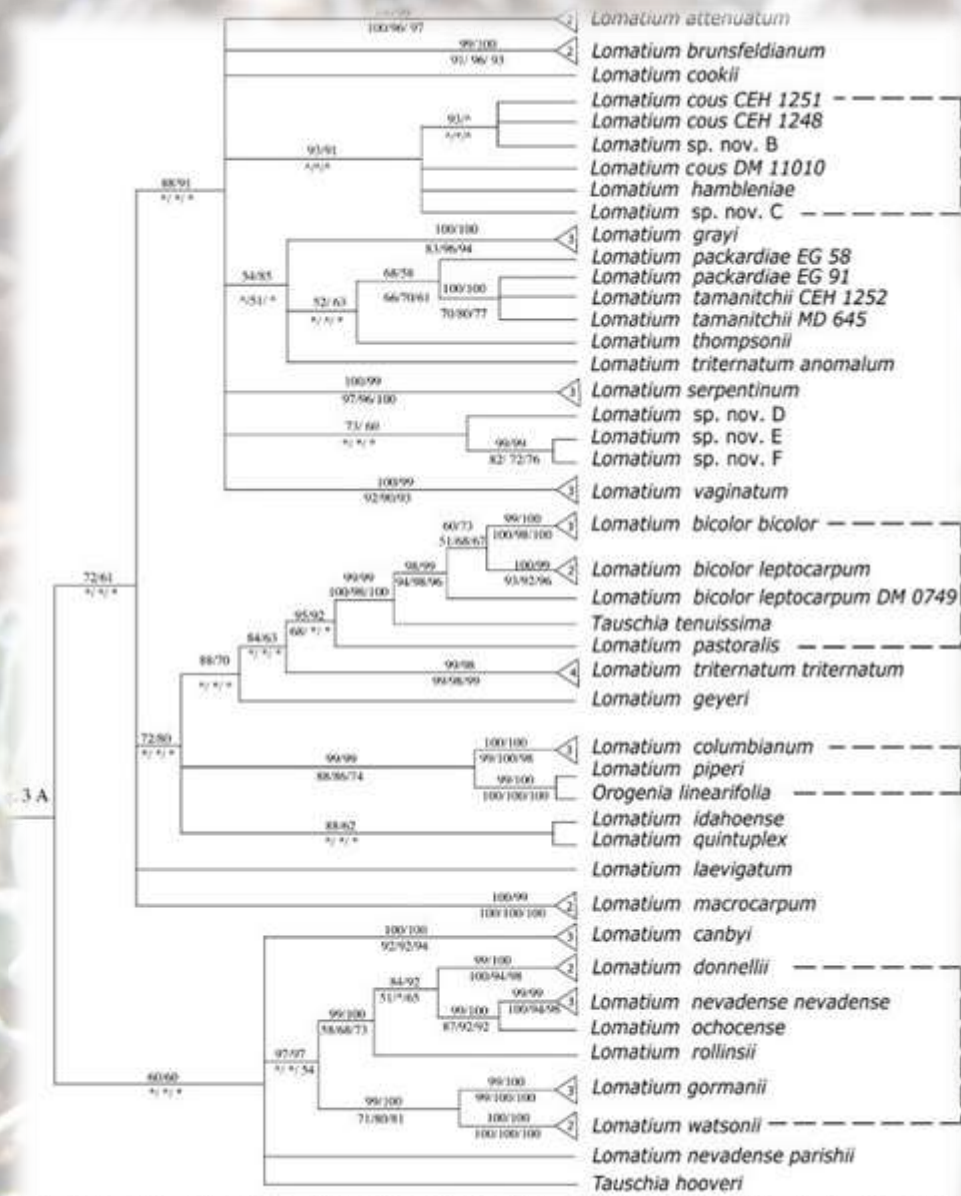


FIG. 3B. Majority rule consensus from the Bayesian inference partition (BIP) model analysis showing complete sampling of the remainder of the clade.

With this new understanding what can we say about the Lomatium triternatum complex and other complexes?

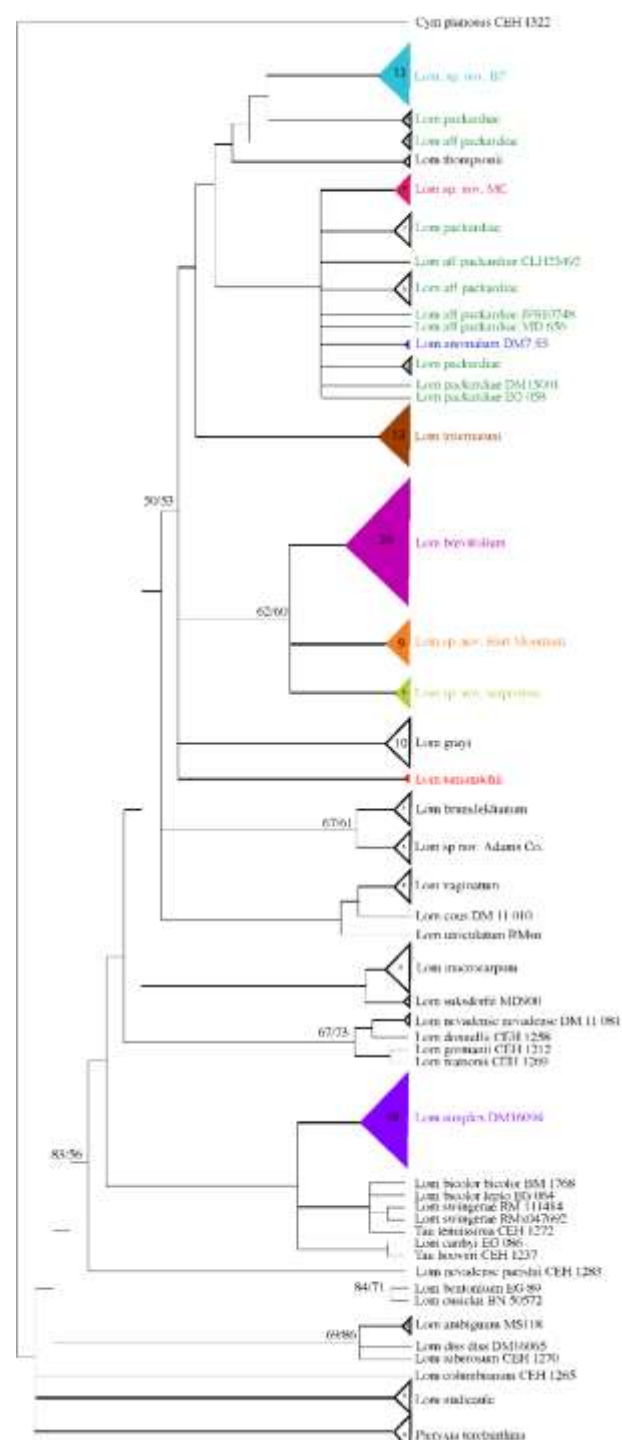
- *L. triternatum* var. *platycarpum* = *L. simplex* – a good monophyletic well-supported species confirming previous morphologic analysis
- *L. triternatum* var. *brevifolium* = *L. triternatum* var. *macrocarpum* based upon analysis of the type specimens
- *L. triternatum* var. *brevifolium* = *L. brevifolium* complex
- *L. triternatum* var. *triternatum* = *L. triternatum* – a good species!
 - range: northeast Oregon & far eastern Washington across Idaho and into western Montana
- *L. triternatum* var. *anomalum* still messy
 - incomplete lineage sorting?; at least 2 spp.
- *L. packardiae* still messy
 - possibly 3 spp., but further data needed
- *L. thompsonii* messy as well

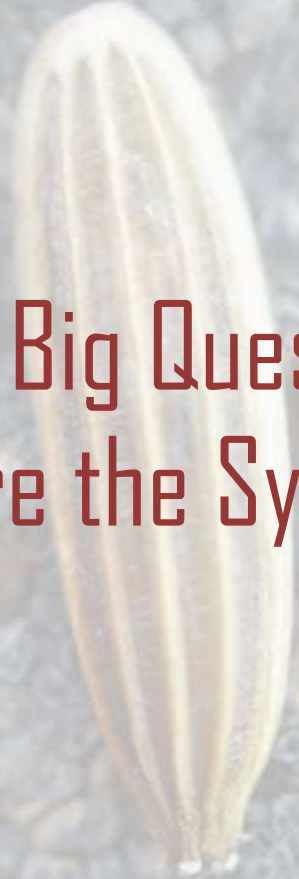


Smith et al. Unpublished Molecular Work




Don Mansfield contemplates L. sp. nov. – Klamath Co.,OR





The Big Question.....
Where is/are the Synapomorphies?



The Big Answer.....
We Dinna Have A Clue...

- there is nothing that is clear morphologically
- possibly expressed in secondary compound signature?

Lomatium Toolbox

- *know which species make sense in your area!*
 - *recall the tendency for the genus to exhibit narrow endemism*
- *become familiar with the most useful suite of characters*
 - *habitat preferences – often underutilized as a field tool*
 - *roots regularly , irregularly tuberous or taproot*
 - *leaves planar or 3-D (e.g. *L. grayi*)*
 - *mature fruit outline (aspect ratio is useful)*
 - *plant and fruit hairyness or lack thereof*
 - *mature fruit pedicel length and angulation relative to fruit*
 - *character and width/length of leaf divisions*
 - *involucel bracts on umbellets fused, broad, narrow, absent or asymmetric*
 - *smell and taste (no *Lomatiums* are known to be toxic - yet)*
 - *leaves caulescent or acaulescent*



Lomatium minus – Morrow Co., Oregon