

Phylogenetic Distinctions Between Three Species of *Eritrichium* from Alaska

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Introduction

Objective: To phylogenetically delineate the three Alaskan species of the genus *Eritrichium* (*E. chamissonis*, *E. splendens*, and *E. aretioides*), part of the Boraginaceae family. **Work done to date:** Flora of North America project (by David Murray in collaboration with M. Garrouette, UAF) included these species. Additional work on *Eritrichium* was done by investigators at UAF, Dr. Andreas Tribsch, Dr. Steffi Ickert Bond (2007), Monte Garrouette (2010), and 2010 RAHI II students. The techniques used to fulfil our objective were as follows: DNA extraction, PCR amplification, gel electrophoresis, DNA sequencing and phylogenetic analysis.

Materials and Methods

- DNA extraction was performed on three species of *Eritrichium* using the Qiagen Dneasy plant mini kit.

Table 1. Summary of sample collection information.

Sample name and collection number	Sample condition	Collector	Location	Date
<i>E. chamissonis</i> (#410)	Pressed & dried	Bill Pyle	Kodiak NWR	8/11/2008
<i>E. chamissonis</i> (#411)	Pressed & dried	Chris Peterson	Baldy Village Rd. Izembek NWR Hilltop	7/16/2010
<i>E. chamissonis</i> (#412)	Pressed & dried	Chris Peterson	Baldy Village Rd. Izembek NWR Hilltop, some pink flowers	7/16/2010
<i>E. chamissonis</i> (#413)	Pressed & dried	Chris Peterson	Izembek NWR Outer Marker Rd. 6 mile Barrens along road	7/16/2010

- Phylogenetic analyses used Maximum Parsimony (MP) in PAUP* (Swofford 2003) and a model-based approach using Maximum Likelihood (ML) available on the CIPRES Science Gateway, http://www.phylo.org/sub_sections/portal/.

Results

- Phylogenetic results show that *E. splendens* ends up as an outer taxon.
- Three of the branches containing Alaskan taxa were strongly supported by maximum likelihood bootstrap values for tree based on rps16 (Fig. 1).
- One of the branches including Alaskan taxa was strongly supported for the tree based on three genes (Fig. 2).

Figure 1. Phylogenetic Tree showing placement of *Eritrichium chamissonis*, *E. splendens*, and *E. aretioides* with gene rps16.

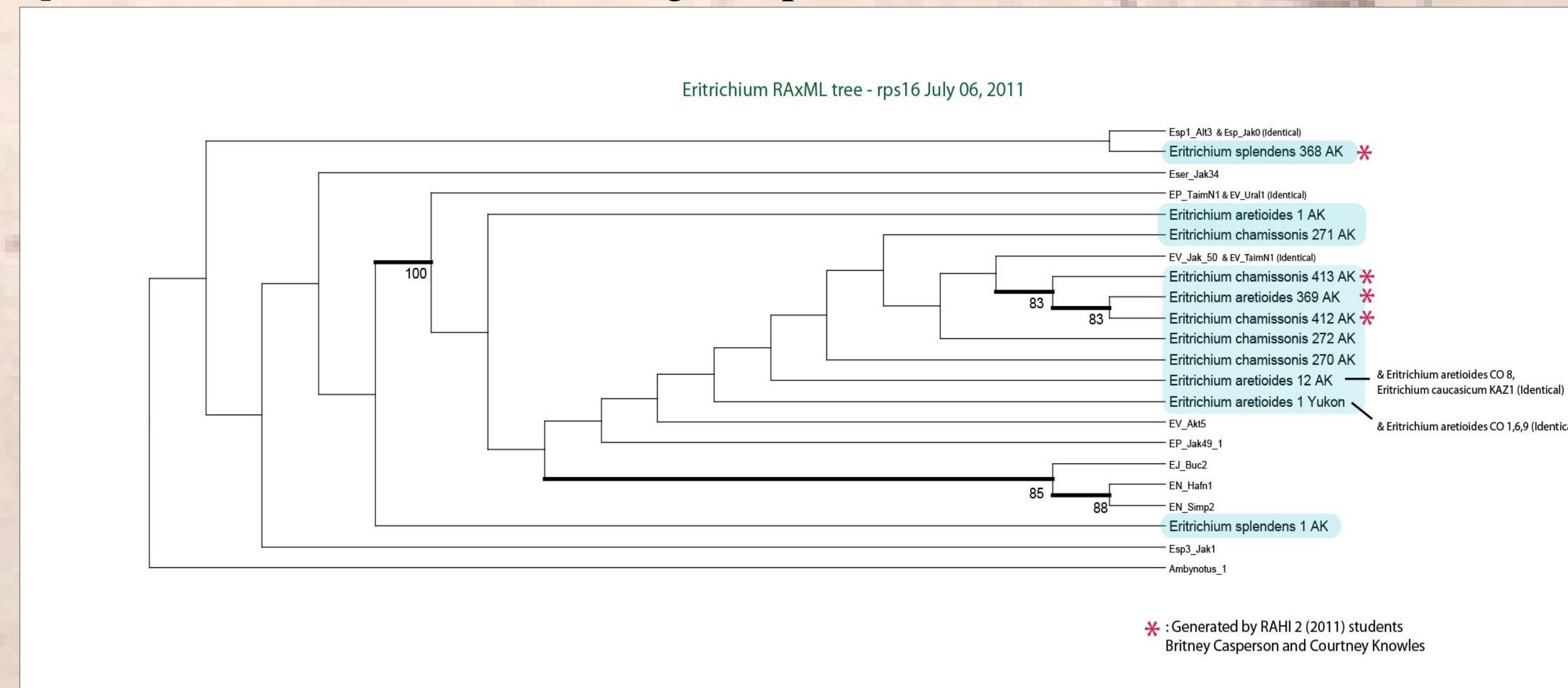
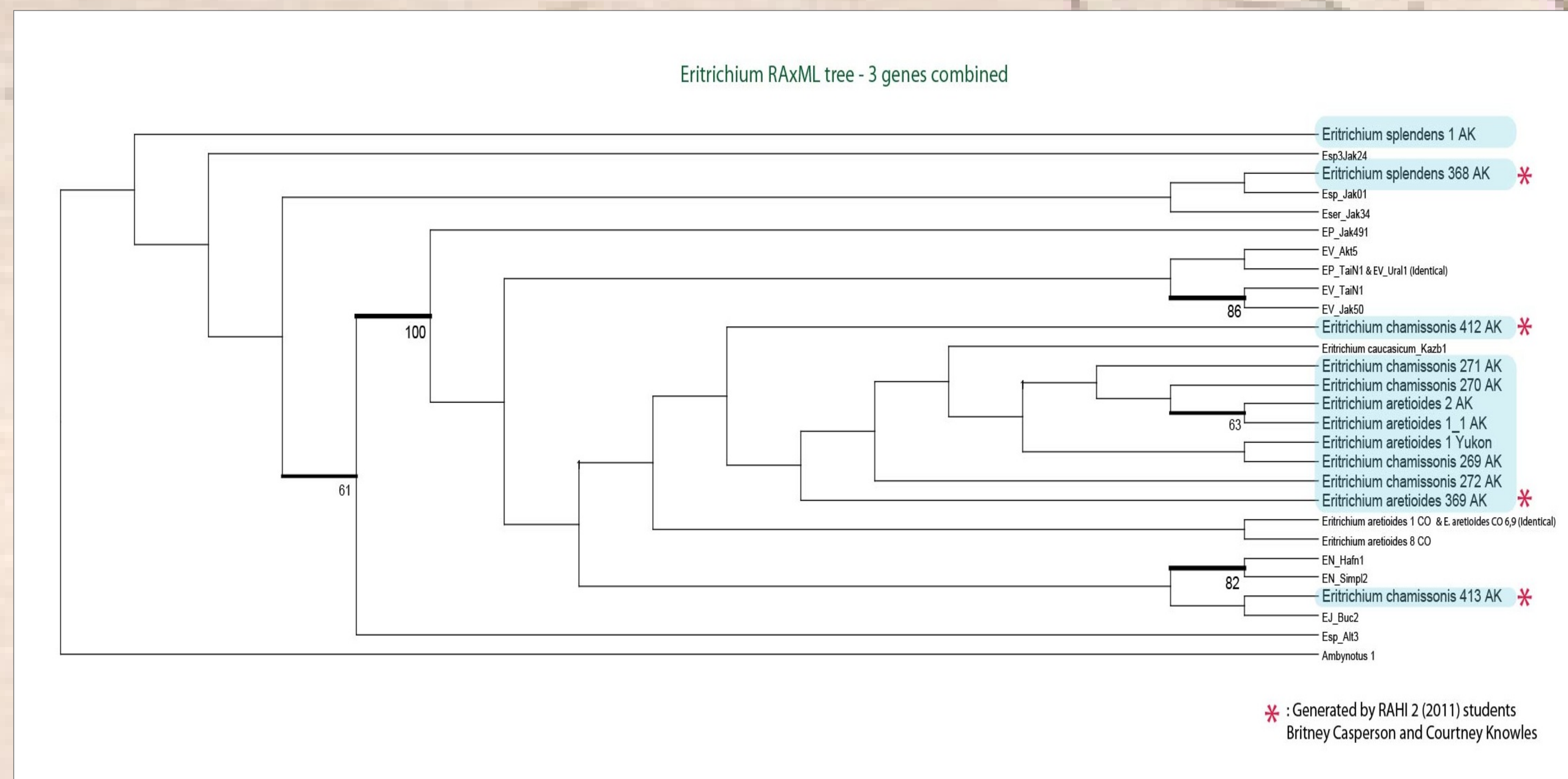


Figure 2. Phylogenetic tree depicting the Alaskan species of *Eritrichium* with three genes combined.



Discussion and Conclusion

Phylogenetic results show that *E. splendens* ends up as an outer taxon. This was surprising, because we thought *E. splendens* and the other two species of Alaskan *Eritrichium* would all be closely related. In other words, supporting the hypothesis that there was a single *Eritrichium* introduction to Alaska from which the three species evolve. However, it looks like *E. chamissonis*, *E. aretioides*, and *E. aretioides* from Colorado (CO) all are jumbled together. This suggests that *E. splendens* is more distantly related to the other Alaskan species of *Eritrichium* and that *E. aretioides* and *E. chamissonis* is very closely related if not the same species, including the Rocky Mountain *E. aretioides* which we thought would be different!

Conclusion:

E. Splendens is not genetically similar to the other two Alaskan species, but *E. aretioides* and *E. chamissonis* are phylogenetically the same.

Literature Cited

- Garrouette, M. September, 2010. Systematics of *Eritrichium* in Alaska. Powerpoint presentation
- Ickert-Bond, S. 2007. Comparative Infructescence Morphology in Altingia (Altingiaceae) and Discordance Between Morphological and Molecular Phylogenies. *American Journal of Botany* 94(7): 1094–1115

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