

# PARALLEL PLEISTOCENE AMPHITROPICAL DISJUNCTIONS OF A PARASITIC PLANT AND ITS HOST

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# Introduction

- Hemiparasites supplement resources taken from host by photosynthesis
- Holoparasites (Root parasites) obtain all energetic demands from other plants
- *Grindelia* and *Aphyllon* genus restricted to New World with amphitropical disjunction
- American Amphitropical Disjunctions (AADs)
  - Most commonly studied
  - Long-distance dispersal

# Purpose

- "This current study was motivated by a desire to test this apparent case of parallel host-parasite American Amphitropical Disjunction and infer the relative timing of colonization." - Schneider 2017
- Timing and Processes Unknown
  - Infer divergence times
  - Hypothesize two colonizations of SA by NA *Aphyllon* and one colonization by *Grindelia*
  - Compare timing of colonization events

# The Parasite and The Host

*Aphyllon* (Orobanchaceae)



*Grindelia* (Asteraceae)



# Method

- Chronograms using fossil and secondary calibration points to reconstruct the biogeography of *Aphyllon*, *Grindelia*, and relatives
  - Time-calibrate the gene tree and the branch lengths
  - Time elapse between node calibration and fossilization
- Horizontal gene transfer (HGT) is the movement of genetic information between organisms
- DEC+J for ancestral geographic ranges
  - Orobancheae: six biogeographic regions, 8000 iterations
  - *Grindelia*: five regions, 2000 iterations





Clade	Crown age (Ma)	
	Mean	95% HPD
Orobanchaceae (incl. Rehmanniaceae)	30.2	25.6–36.0
Parasitic Orobanchaceae	27.7	23.5–33.1
Holoparasitic Orobancheae	16.5	13.7–19.7
<i>Orobanche</i> s.l. (incl. <i>Diphelypaea</i> )	13.9	11.0–15.8
<i>Aphyllon</i> + <i>Phelipanche</i>	10.4	8.4–12.7
<i>Aphyllon</i>	7.3	5.8–8.9
<i>Aphyllon</i> sect. <i>Aphyllon</i>	4.49	3.40–5.66
<i>Aphyllon</i> sect. <i>Nothaphyllon</i>	2.92	2.15–3.74
<i>A. ludovicianum</i> complex <sup>a</sup>	1.43	0.99–1.90
<i>A. chilense</i> + <i>A. tacnaense</i> + <i>A. ludovicianum</i> + <i>A. multiflorum</i>	0.40	0.19–0.65
<i>A. chilense</i> + <i>A. tacnaense</i>	0.14	0.02–0.28
<i>Grindelia</i>	1.40	0.71–2.43
North American <i>Grindelia</i>	1.18	0.57–2.04
Western North American <i>Grindelia</i>	0.63	0.26–1.17
California and Oregon <i>Grindelia</i>	0.16	0.04–0.25
South American <i>Grindelia</i>	0.93	0.41–1.36

# Discussion and Conclusion

- Conclusion: Lag time between *Grindelia* and *Aphyllon*, Host first
  - Geographically and temporally parallel amphotropical disjunctions show link between ecology and biogeography
- Environmental changes shaped ranges of extant species
  - Eurasia and Africa
    - Additional studies
- *Grindelia* may have been longer before *Aphyllon*
- Discrepancies: Calibrations, Samples, In-depth
- Author Critic: Organization, Simplification

# Questions?

- References

- [http://ashipunov.info/shipunov/school/biol\\_330/presentations/schneider\\_2017\\_parasite\\_host\\_dsjunct.pdf](http://ashipunov.info/shipunov/school/biol_330/presentations/schneider_2017_parasite_host_dsjunct.pdf)
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