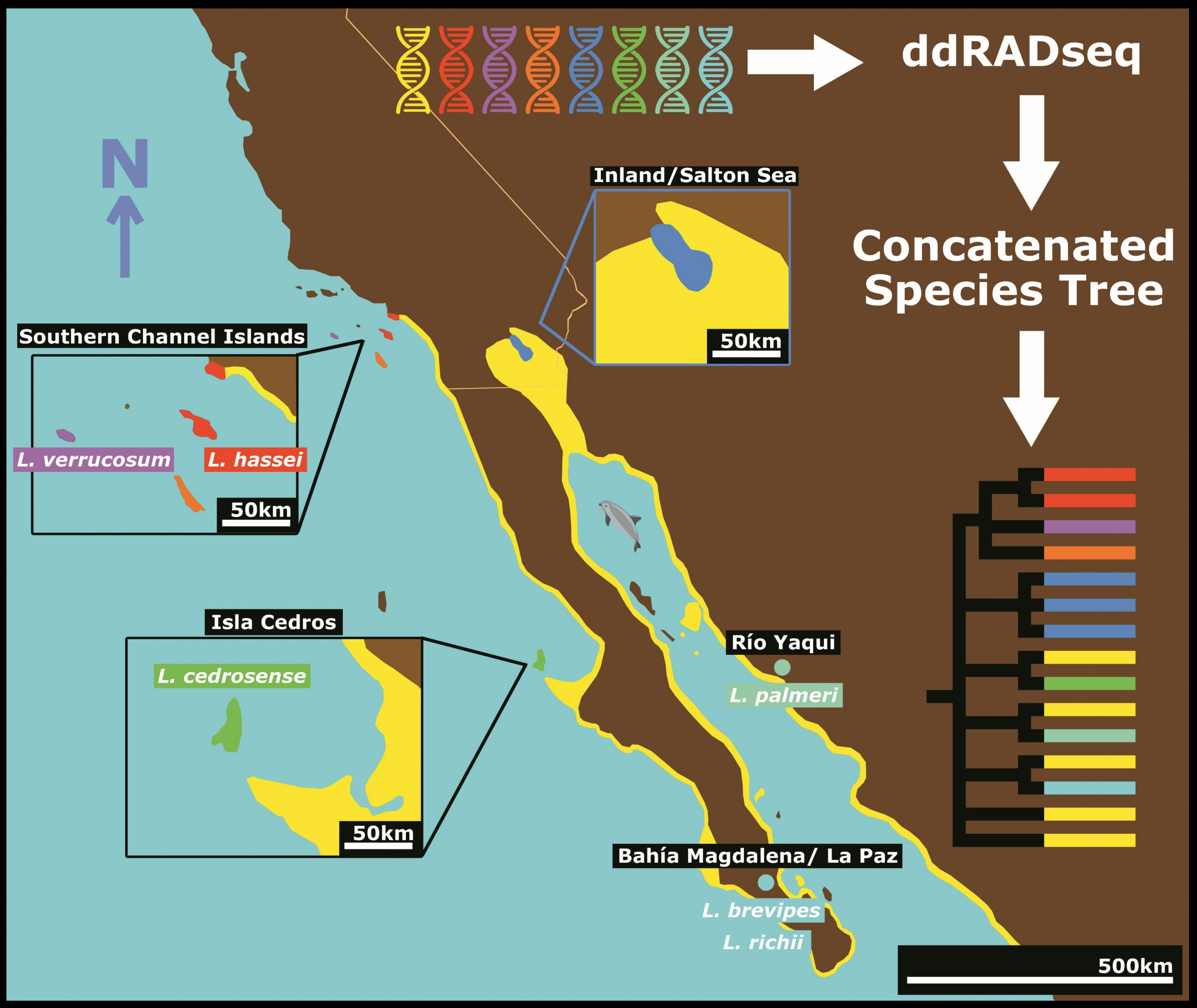


Evaluating Thorny Taxonomy with Phylogeography: A Study of Baja Desert-Thorn (*Lycium brevipes*)

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Graphical abstract and natural distribution of *Lycium brevipes sensu lato*. **Yellow:** known distribution of *L. b. s.l.* **Orange:** San Clemente Island, California **Red:** Palos Verdes Peninsula and Santa Catalina Island, California (*Lycium hassei* Greene type locality) **Purple:** San Nicolas Island, California (*Lycium verrucosum* Eastwood type locality) **Blue:** Salton Sea **Green:** Isla Cedros, Baja California Sur (*Lycium cedrosense* Greene type locality) **Teal:** Río Yaqui, Sonora (*Lycium palmeri* Gray type locality) **Light Blue:** Bahía Magdalena (*Lycium brevipes* Bentham type locality) and La Paz, Baja California Sur (*Lycium richii* Gray type locality)

Background Ecological and Morphological Diversity

Baja Desert-Thorn (*Lycium brevipes sensu lato*) is an armed, woody shrub found on coastal bluffs, sand dunes, and saline soils along the Pacific Coastline from Los Angeles County, California to Mazatlán, Sinaloa; and inland around the Salton Sea, California. Concurrent with its ecological diversity, *L. brevipes* s.l. is morphologically diverse across its range. The purple-to-white corollas may have symmetries of (3–)4–5 on the same inflorescence, and corolla and calyx dimensions vary between populations — the latter character has been used to distinguish between heterotypic synonyms and close relatives of *L. brevipes* in past taxonomic treatments (Chiang-Cabrera, 1981; *Jepson eFlora*, 2024; Levin & Miller, 2005). Additionally, *Lycium carolinianum* Walter, the sister species to *L. brevipes* s.l. (Yisilam et al., 2025.), was found to display strong genetic structuring that correlated with geography (Levin & Miller, 2021). This same pattern of structuring may also exist within *L. brevipes* s.l.

Taxonomic History

Prior taxonomic treatments of North American *Lycium* (Hitchcock, 1932; Chiang-Cabrera, 1981) synonymized many taxa without review of voucher specimens and acknowledged significant morphological and ecological variation within *L. brevipes* s.l. Noting such variation, Hitchcock (1932) recognized that an alternative taxonomic preference could define up to four distinct varieties of *L. brevipes*. The *Flora of North America* (and most recent) treatment of NA *Lycium* (Levin & Miller, 2005) proposes a broad definition of *L. brevipes* and does not recognize infraspecific identities. This contrasts with the *Jepson eFlora* (2024) recognition of *L. brevipes* var. *hassei* (Greene) C.L. Hitchcock (CRPR 3.1: review list, rare) and *L. verrucosum* (CRPR 1A: presumed extinct) as taxonomically distinct.

Lycium hassei was described based on insularity (Santa Catalina Island) and “calyx-lobes 2 to 4, [...] unequal, much longer than the campanulate tube.”

Lycium verrucosum was described based on insularity (San Nicolas Island), “anthers sessile in the throat of the corolla”, and “branchlets verrucose at leaf axils”. The *L. verrucosum* holotype is surmised to be a mutant of *L. brevipes* in some taxonomic treatments (Hitchcock, 1932 ;Chiang-Cabrera, 1981).

Aim and Broader Impacts

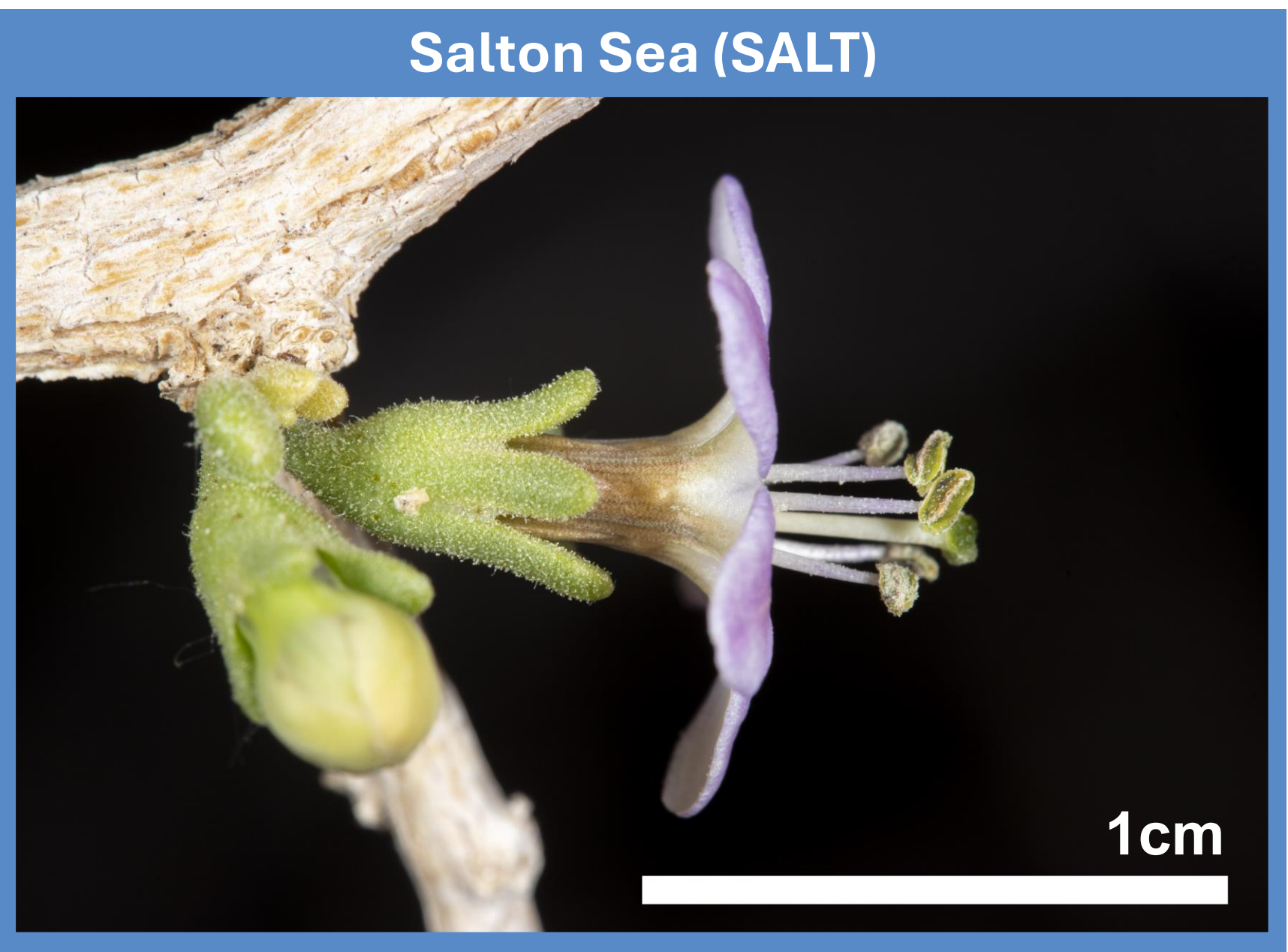
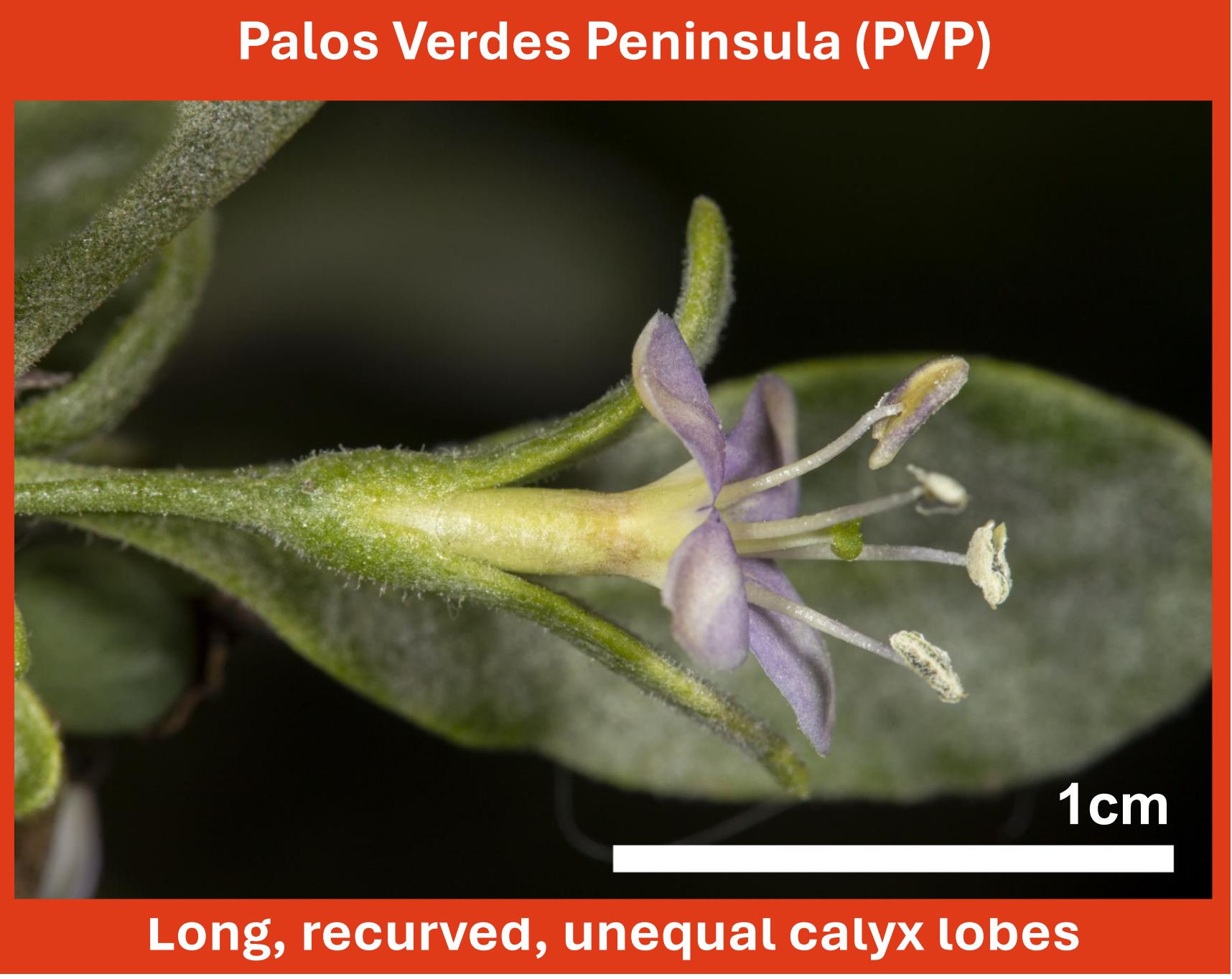
This work will result in a **taxonomic revision and updated identification key** of *L. brevipes* s.l. and inform conservation strategies by identifying threatened and genetically distinct populations. This work is especially important to the conservation of *L. b. var. hassei* which has been extirpated from Santa Catalina Island and only tentatively persists on Palos Verdes Peninsula (A.C. Sanders 989; pers. obs.), *L. verrucosum* (known only from San Nicolas Island), and *L. cedrosense* (known only from Isla Cedros).

Molecular Methods

Sampling: Across the geographic range of *L. brevipes* s.l., with dense sampling from heterotypic type localities and insular populations. **DNA extraction:** modified CTAB protocol (Doyle & Doyle, 1987). **ddRADseq:** MseI + ecoRI. **Sequencing:** NextSeq 2000 P4 at UCR. **Assembly:** *de novo* (Tripp et al., 2017). **Concatenated species tree:** RAxML (Stamatakis, 2014) and SVDQuartets (Chifman et al, 2014). **Population structure:** STRUCTURE (Pritchard et al, 2000).

Acknowledgements

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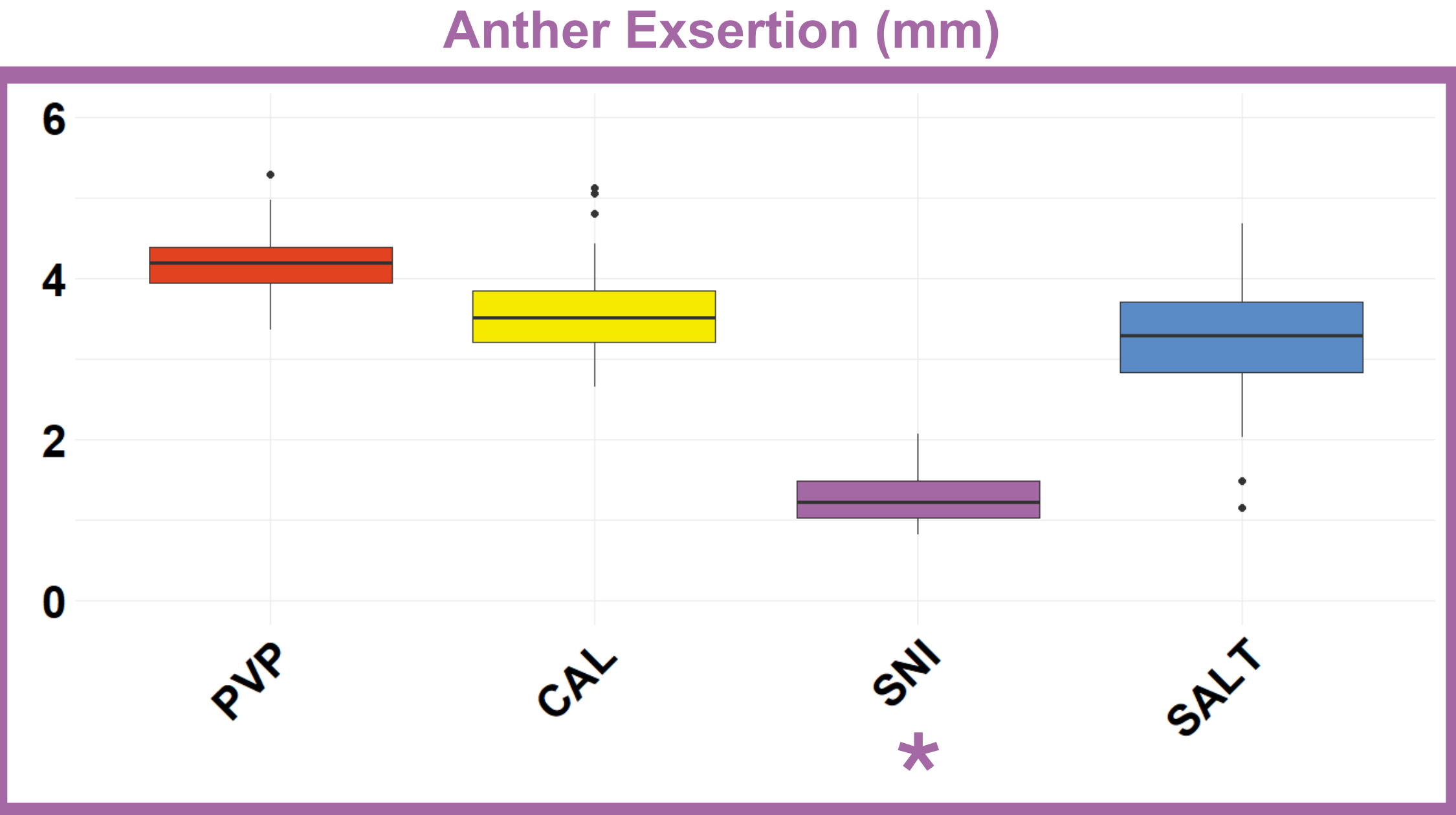
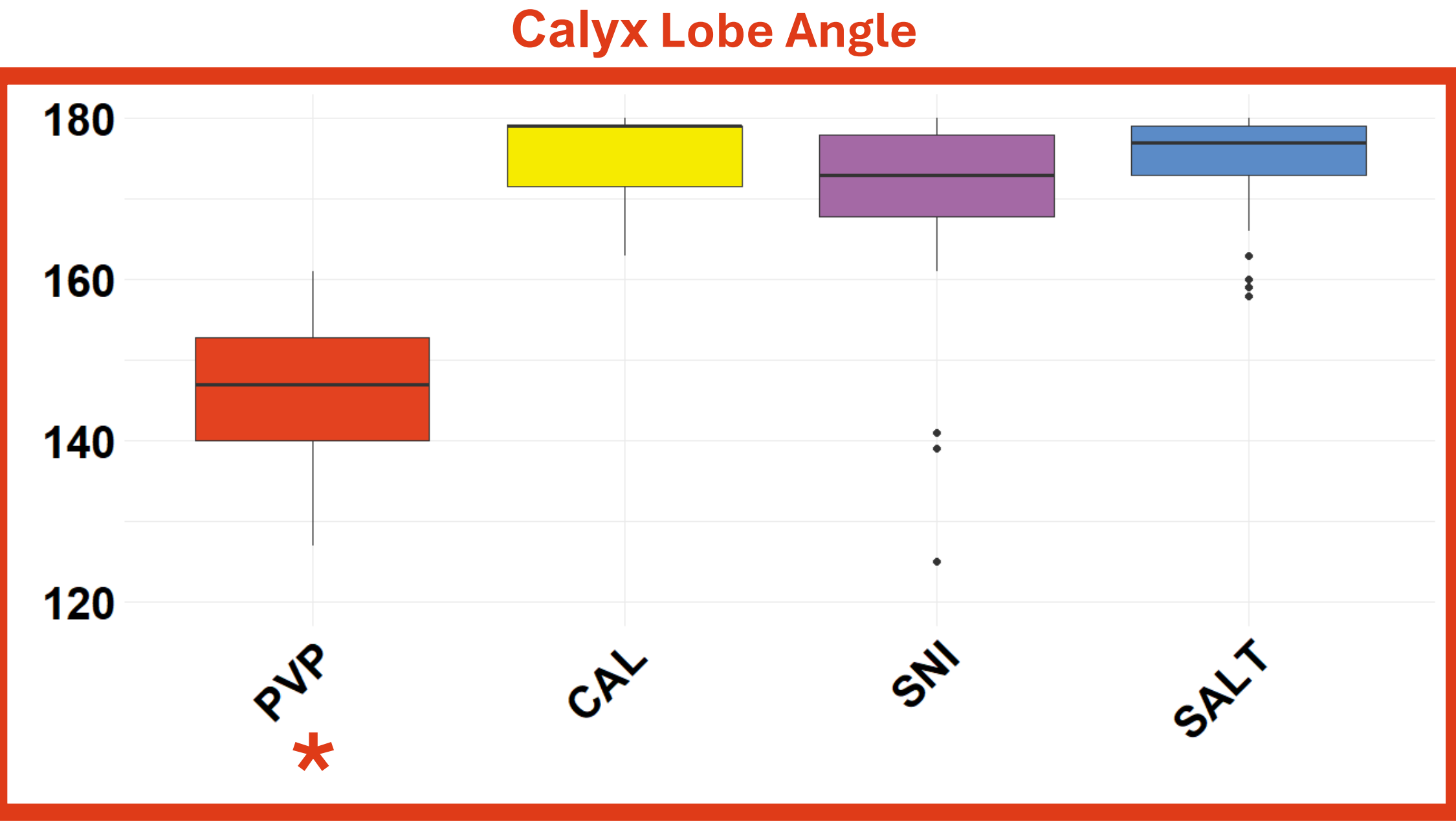
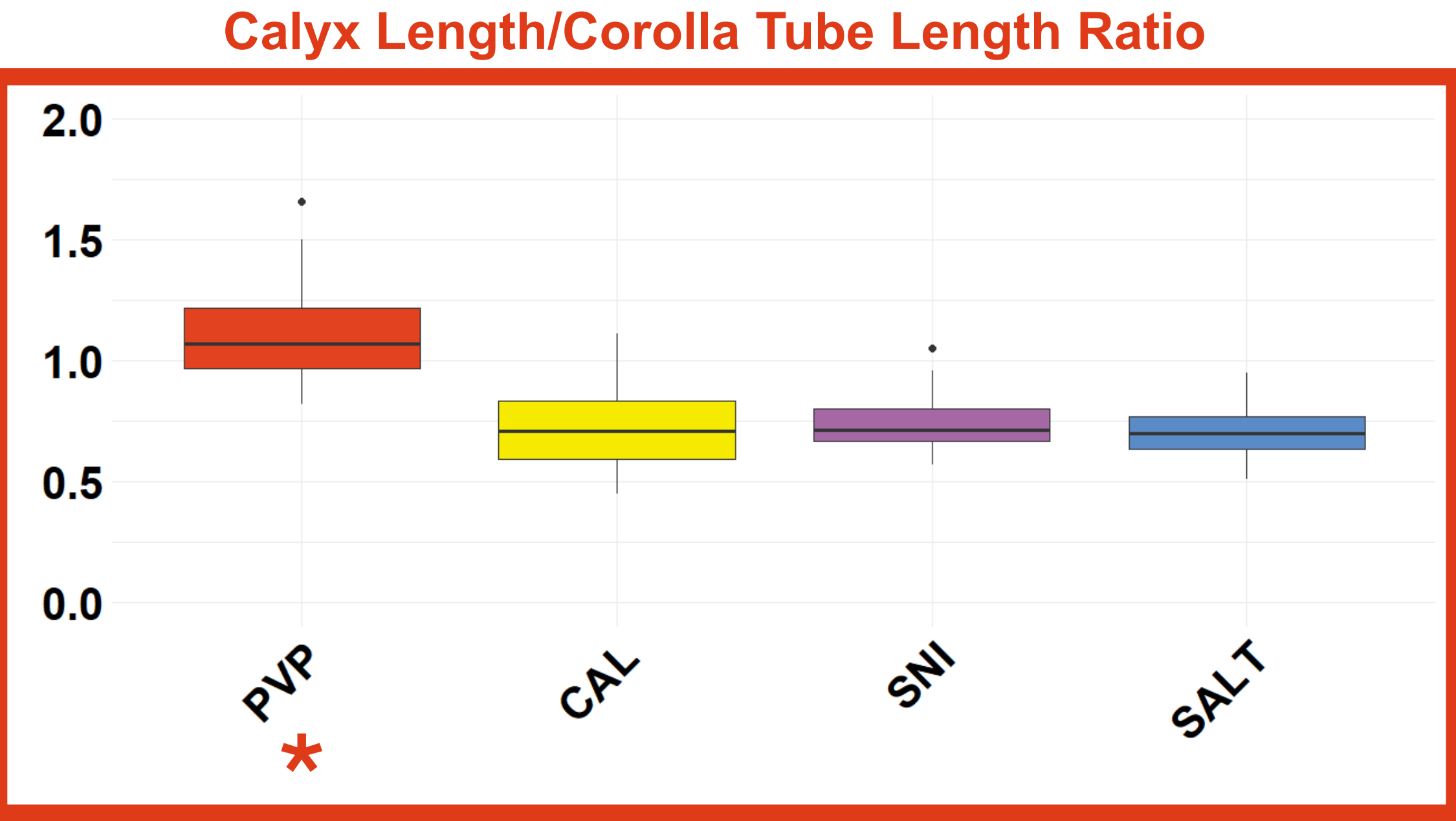
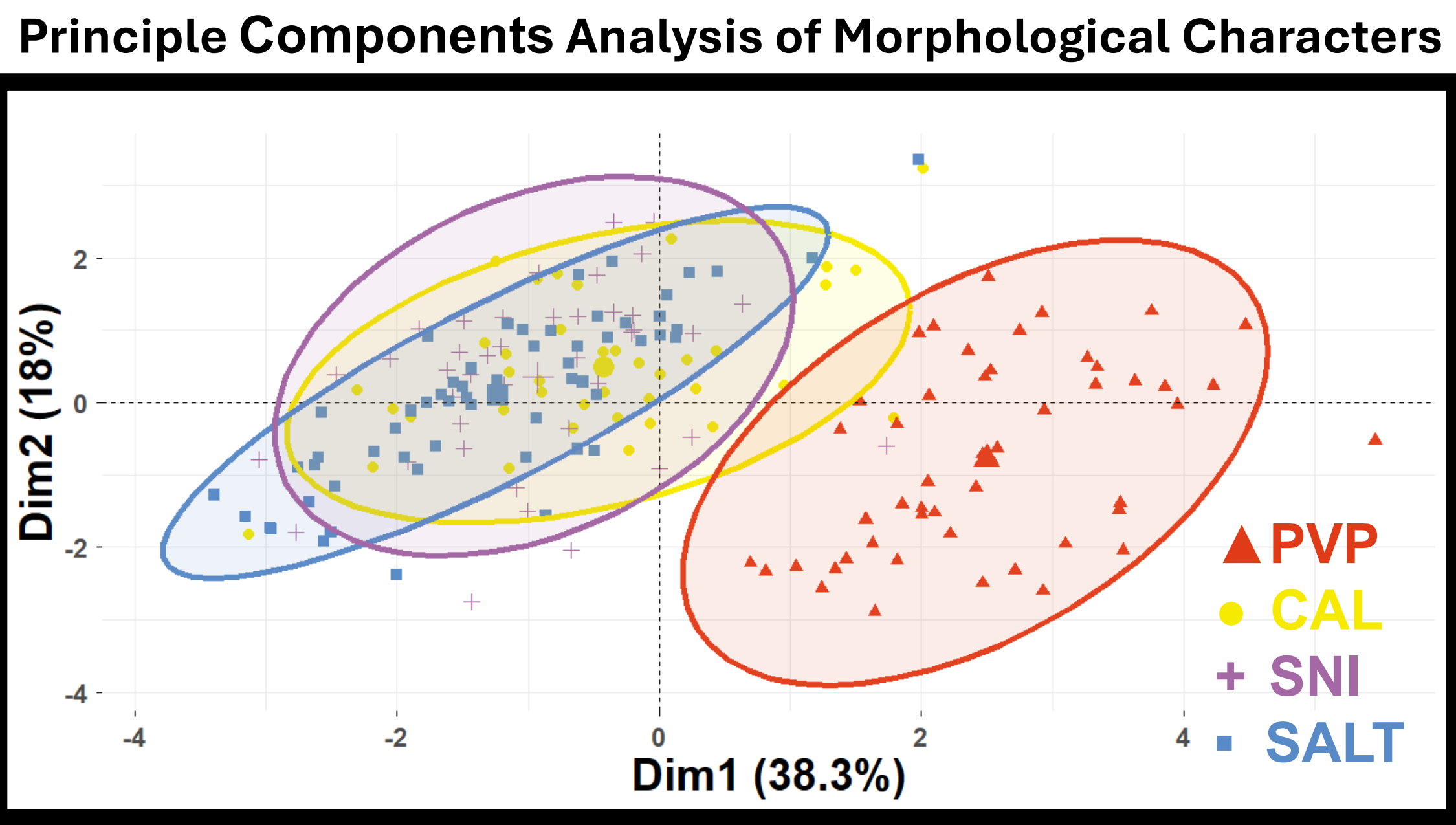
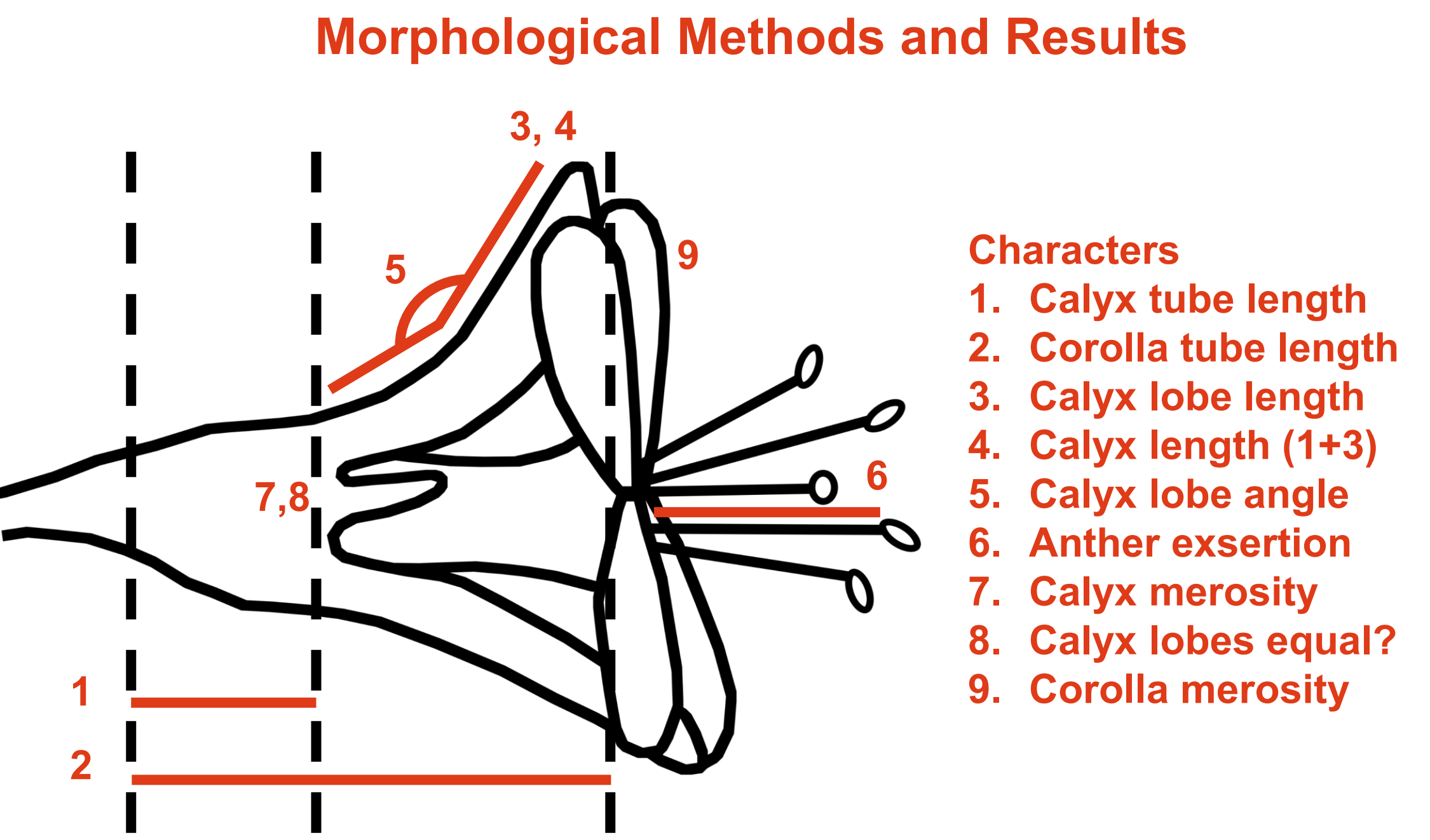


Tentative Identification Key to *L. brevipes sensu lato* in California

1. Calyx lobes reflexed, lobes 2–4, unequal when >2, calyx generally = to > corolla, flowers pale purple, Santa Catalina Island & Palos Verdes Peninsula..... ***L. hassei***
1'. Calyx lobes ± parallel, lobes (2-)4, ± equal, calyx generally < corolla, flowers pale purple to purple.....2
2. Anthers exerted, corolla adaxially unicolored to weakly marked, leaves foliose to succulent, mainland.....***L. brevipes***
2'. Anthers weakly exerted to sessile, corolla with adaxial purple patches at base of lobes, leaves foliose to subsucculent, San Nicolas Island.....***L. brevipes* SNI**

References

Chiang-Cabrera, 1981; Chifman et al., 2014; Doyle & Doyle, 1987; Hitchcock, 1932; Jepson eFlora, 2024; Levin & Miller, 2005, 2021; Pritchard et al., 2000; Revell, 2012; Stamatakis, 2014; Tripp et al., 2017; Yisilam et al., 2025



* denotes significant difference from all other sampled populations