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A NEW COMBINATION IN THE CALIFORNIA CHANNEL ISLANDS WOODY *GALIUM* COMPLEX (RUBIACEAE)

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ABSTRACT

Recent phylogenomic work has shed light on the evolutionary relationships among the taxa of the Channel Islands Woody *Galium* Complex (Rubiaceae), which includes *G. buxifolium*, *G. catalinense* subsp. *acrispum*, and *G. catalinense* subsp. *catalinense*. Preliminary results of this recent work strongly suggest that *G. catalinense* is non-monophyletic. Here a new combination is made — **Galium acrispum** (Dempster) Guilliams & Hasenstab, **comb. et stat. nov.** — so that only monophyletic groups are recognized within the woody *Galium* complex.

Galium L. (Rubiaceae), commonly known as bedstraw, is one of the most taxonomically rich genera of vascular plants occurring on the California Channel Islands (Guilliams et al. 2021). With 12 minimum-rank taxa across the archipelago, it is equivalent in taxonomic richness to *Bromus* and *Phacelia* and eclipsed only by *Acmispon* (15 taxa), *Trifolium* (15 taxa), *Atriplex* (13 taxa), and *Malacothrix* (13 taxa).

The California Channel Islands are well-known for their vascular plant endemism (Schoenherr et al. 1999; Harrison 2013; Baldwin et al. 2017), and six of the minimum-rank island *Galium* taxa have distributions wholly within the archipelago. Three of these island endemic *Galium* taxa have been assumed to be closely related due to shared habit, along with vegetative and reproductive characteristics. Hereafter referred to as the Channel Islands Woody *Galium* Complex (abbreviated WGC), these taxa include *G. buxifolium* Greene, *G. catalinense* A. Gray subsp. *acrispum* Dempster, and *G. catalinense* subsp. *catalinense*. *Galium buxifolium* has been documented on the northern Channel Islands of San Miguel, Santa Rosa, and Santa Cruz. *Galium catalinense* taxa are known from the southern Channel Islands, where subsp. *acrispum* grows on San Clemente Island and subsp. *catalinense* on Santa Catalina Island. Although *G. buxifolium* is presently treated at the species rank due to morphological differences and a distinct geographic distribution, it has been treated as a synonym of *G. catalinense* in some early works, and Dempster (1958 and references therein) recognized *G. buxifolium* as a variety of *G. catalinense*.

The evolutionary history of the WGC has been studied on two occasions using modern molecular phylogenetic approaches. Soza and Olmstead (2010) included one member of the WGC (*G.*

catalinense subsp. *acrispum*) in their phylogenetic study of New World *Galium*, recovering it as sister to a section *Lophogalium* (in part) clade comprising samples of *G. angustifolium* A. Gray subspecies along with *G. jepsonii* Hilend & Howell and *G. hallii* Munz & Johnst. Guided by the tree topology recovered by Soza and Olmstead, Guilliams and Hasenstab-Lehman (2023; in preparation) performed a targeted phylogenomic study of the WGC for the purpose of evaluating relationships among the three WGC taxa, determining the number, directionality, and timing of island colonization events, and evaluating the WGC as an instance of insular gigantism/woodiness (Carlquist 1974). Using a dataset derived from the high-throughput, double digest Restriction site Associated DNA sequencing (ddRADseq) approach (Peterson et al. 2012), they performed a RAxML (Stamatakis 2014) maximum likelihood phylogenetic analysis that resulted in a well-supported estimate of the phylogeny of the target group. A simplified version of this phylogeny is presented in Figure 1. Samples of WGC taxa are recovered in a clade with maximum statistical support (maximum likelihood bootstrap value [BS] = 100) sister to a sample of *G. hallii*. WGC samples form clades by taxon, each with maximum statistical support (BS = 100). *Galium catalinense* is non-monophyletic; the *G. catalinense* subsp. *acrispum* clade is sister to the *G. buxifolium* clade with strong support (BS = 100). *Galium catalinense* subsp. *catalinense* is sister to the clade [*G. catalinense* subsp. *acrispum* + *G. buxifolium*].

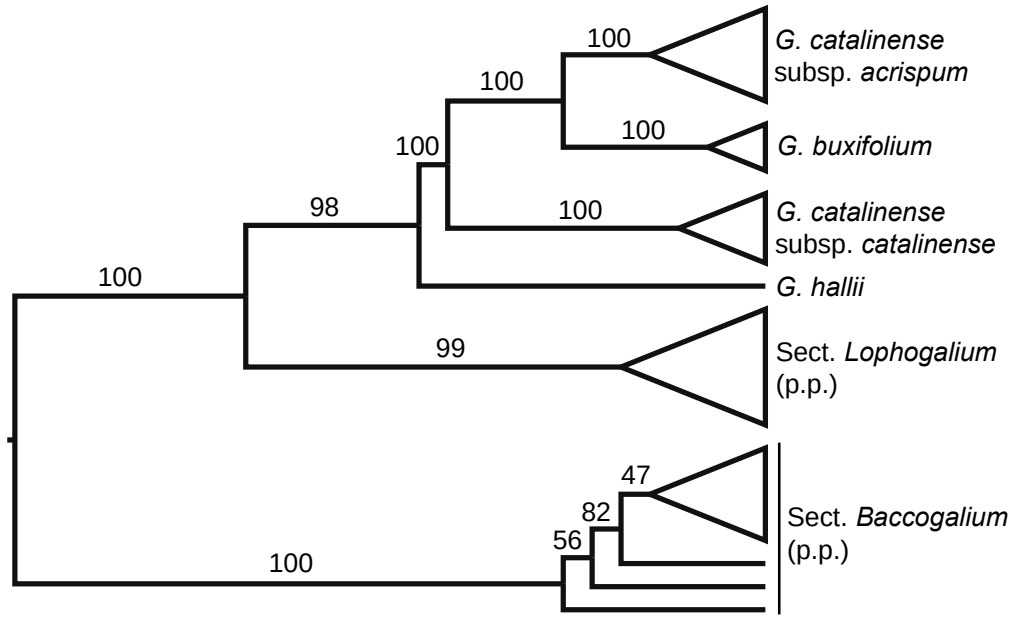

Figure 1. Simplified phylogenetic tree diagram for the Woody *Galium* Complex and close relatives resulting from maximum likelihood analysis of DNA data from the double digest Restriction site Associated DNA sequencing approach. Sampling collapsed to emphasize relationships among Woody *Galium* Complex taxa. Numbers above branches are maximum likelihood bootstrap values. Non-monophyly of *Galium catalinense* is strongly supported.

While the primary research findings of Guilliams and Hasenstab-Lehman will be published elsewhere, the finding of non-monophyly of *Galium catalinense* requires a nomenclatural adjustment so that only monophyletic groups are recognized taxonomically. This paper makes the appropriate new combination so that new names can be utilized in upcoming publications focusing on the flora of the California Channel Islands. Owing to the strong phylogenetic pattern coupled with differences in morphology and non-overlapping geographic distributions, we elect to recognize all minimum-rank taxa of the WGC at the species rank.

GALIUM ACRISPUM (Dempster) Guilliams & Hasenstab, **comb. et stat. nov.** *Galium catalinense* A. Gray subsp. *acrispum* Dempster, Univ. Calif. Pub. Bot. 64: 11. 1973. **TYPE: USA. California.** Canyon wall near Lemon Tank, San Clemente Island, 9 Apr 1923, *P.A. Munz 6682* (holotype: UC284132, image!; isotypes GH, image!, POM).

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