

A REVIEW OF THE GENUS *HARFORDIA*
(POLYGONACEAE: ERIOGONOIDEAE)

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ABSTRACT

The genus *Harfordia* has been generally defined to consist of two species, *H. macroptera* of the mainland and the Cedros Island endemic, *H. fruticosa*. The revised genus is now considered to be monospecific but composed of three varieties: the var. *macroptera* restricted mainly to the Magdalena Bay region of Baja California Sur, the insular var. *fruticosa* and the more northern and common var. *galioides* ($n = 20$) mainly in Baja California Norte, México.

KEY WORDS: Polygonaceae, taxonomy, *Harfordia*, México.

INTRODUCTION

The genus *Harfordia* was proposed by Greene and Parry in an article published by Parry (1886) shortly after Greene (1885) had recognized *Pterostegia galioides* and *P. fruticosa* as distinct from the previously described *P. macroptera* (Bentham 1844). At the time, *Pterostegia* was defined as a genus of Polygonaceae Juss. (tribe Pterostegieae Torr. & A. Gray) characterized by a remarkably winged involucre surrounding the achene. When Bentham proposed *P. macroptera* he described the species as a "much stronger and stiffer plant" than the type of the genus, *P. drymarioides*, but it is obvious he was uncertain if his new species was an annual (like the type) or a perennial. The realization that *P. macroptera* and its related species in Baja California were shrubby perennials and that the large, bladderly inflated involucral bracts were unique, Greene and Parry decided to establish *Harfordia* and restrict it to just two species, *H. macroptera* of the mainland and the Cedros Island endemic *H. fruticosa*.

Harfordia has been generally defined since 1886 to consist of two species. When Wiggins (1964) prepared a flora of the Sonoran Desert, he accounted for only *H. macroptera*, citing Greene's *Pterostegia galioides* in synonymy. At that time he did not have to consider the species endemic to Cedros Island and therefore did not mention *H. fruticosa*. It is suggested that his failure to dispose of *H. fruticosa* when he wrote the flora of Baja California (Wiggins 1980) was simply an oversight.

While reviewing *Harfordia* (Polygonaceae Juss. subf. Eriogonoideae Meisner), it became obvious that the three entities recognized by Greene were distinct. The type of the genus, *H. macroptera*, is a low, spreading perennial that generally forms distinct shrubs with broad leaves. The Cedros Island endemic, *H. fruticosa* is most closely related to var. *macroptera* but is a more sprawling shrub with shorter and broader leaves. To the west and north is a larger and an even more sprawling shrub; it was this expression readily distinguished by its narrow leaves that Greene (1885) called *Pterostegia galioides*. When *Harfordia* was proposed, *P. galioides* was submerged into *H. macroptera*. These expressions do not overlap except on

the extreme western tip of the Desierto el Vizcaíno in northwestern Baja California Sur. Here the distinction between all three is marred by the existence of a series of morphological intermediates. For this reason, the formerly bispecific genus is now considered to be monospecific with three varieties.

TAXONOMY

Harfordia E. Greene & C. Parry in C. Parry, Proc. Davenport Acad. Nat. Sci. 5: 26. 1886. Polygonaceae Juss. subtribe Harfordiineae H. Gross, Bot. Jahrb. Syst. 49: 329. 1913. *Pterostegia* Fischer & C. Meyer sect. *Harfordia* (E. Greene & C. Parry in C. Parry) Roberty & Vautier, Boissiera 10: 108. 1964. —LECTOTYPE: *Harfordia macroptera* (Benth. in Hinds) E. Greene & Parry in Parry, selected here.

Sprawling to spreading, suffruticose to shrubby, sparsely pubescent, monoecious or more commonly dioecious woody perennials with numerous slender to stout stems arising from a woody taproot; *leaves* cauline, opposite, exstipulate, short petiolate, the blades linear to oblanceolate or elliptic to obovate-spatulate, entire, glabrous or pubescent with slightly curled hairs, thin to thickish and more or less succulent, the petioles basally connate at the slightly swollen nodes; *flowering stems* slender to thick, the new growth arising from the axils of previous year's leaves, dichotomously branched, green to red or gray, often densely pubescent with appressed curly hairs, becoming glabrous with age and bearing an exfoliating grayish bark; *branches* numerous, dichotomously branched throughout; *inflorescences* cymose with the flowers arranged in an axillary cluster or, on perfect or female plants, occasionally on short, stout peduncles; *bracts* lacking; *peduncles* when present, stout, erect, usually densely pubescent, restricted to perfect or female plants, arising from the lower nodes in the upper part of the inflorescence; *involucres* composed of a highly modified involucre bract, this situated lateral of and basal to a slender to stout pedicel, surrounding but basal to the immature female or perfect flower with the immature modified sheath of the bract reflexed until after fertilization then elongating and surrounding the achene, the lateral saccate wings basal to the immature sheath, gradually inflating with age, and the whole structure greatly enlarging and becoming laterally bilobed, gibbously bisaccate and accrescent in fruit, hyaline and reticulated with deep red to red-purple veins, glabrous; *flowers* imperfect or perfect, sparsely pubescent along the midribs and base without, glabrous within, the tepals 6, petaloid, essentially monomorphic, lanceolate, united about one-third of their length; *male flowers* 1-5 per node, pale yellow, smaller than the female ones, occasionally with an aborted, imbedded ovary; *female flowers* 1-2 (3) per node, initially pale yellow but becoming red to rose, always with aborted stamens; *perfect flowers* mostly 2 per node, pale yellow to rose; *stamens* 9, those of the male flower slightly exerted on elongated, glabrous filaments bearing yellow oval anthers, those of the female flower on minute, glabrous filaments bearing minute aborted anthers; *achenes* strongly 3-angled, yellowish-brown to brown, glabrous, the narrow base tapering to a slightly winged apex, the embryo straight but with an excentric radicle, in abundant endosperm.

A monospecific genus with three essentially allopatric varieties in western Baja California, México, from San Vicente south to Magdalena Bay, and on the adjacent off-shore islands.

The remarkably altered involucre bract of the genus *Harfordia* is the one feature that almost immediately catches the attention of even the most casual collector. This large, bisaccate and bladderly inflated structure with deep red to red-purple veins is unmistakable. The sprawling

plants are often covered with these colorful bracts.

The bract undergoes a series of developmental changes. Initially the immature flower is atop a short, slender to stout pedicel with the immature bract subtending the pedicel. The bract is initially reflexed and composed of three individual segments joined only at the point of attachment on the top of the peduncle but at the base of the pedicel. As the bract matures the anterior segment expands from the base to form a single sheath surrounding the pedicel with the two lateral edges expanding so that they nearly touch. The two lateral laminar regions of the bract near the base of the sheath soon begin to swell between the single dorsal vein and the two lateral veins near the margins. The two lateral flaplike edges beyond the lateral veins begin to extend outwardly so as to produce the two distinctive thin flaps on each side of the pedicel and maturing flower. At this point the flower is still well exerted but once fertilization has occurred in the perfect or female flower, the two lateral laminar regions of the involucre bract rapidly expand both outwardly and upwardly.

When the two laminar expansions of the bract differentiate and begin to form the precursors of the inflated bladders, the inner lateral flaps around the pedicel begin to elongate so that as the fruit expands, these central flaps soon enclose the entire achene. The flaps, however, remain free of the pedicellate flower and fruit at the base of the involucre bract. Since the pedicel never elongates, while the lateral flaps soon overtop it and extend far beyond the fruit, the whole structure is now completely overtopping and encompassing the achene. The two laminar expansions continue to expand resulting in the characteristic enlarged, inflated and bladderly lateral portion of the involucre bract.

This modified involucre bract is certainly an aid in the dispersal of the achene. The inflated papery bract with its enclosed achene is easily detached from the parent plant and blown in the wind. In such instances the fully mature achene is readily transported to new areas. As the bract dries, it tends to deflate; but because it is vein-filled, the bract does not disintegrate rapidly. After a rain, the bract reinflates and in the winds associated with such convection storms, the inflated bracts can be moved once again. It appears that the bracts and their associated achenes can remain associated two to three years before the achene is finally liberated.

An aspect of dispersal that was considered but never observed is the possibility that birds might be an effective agent. The achene is often nearly full size before the involucre bract begins to enlarge significantly to obscure the fruit. In an immature state, the bract is typically a bright red-purple to blood red, in short an attractive "berry" that just might be taken by birds.

1. *Harfordia macroptera* (Benth. in Hinds) E. Greene & C. Parry in C. Parry

Dioecious or infrequently monoecious sprawling perennial shrubs or subshrubs 2-6 (10) dm high and 3-8 (14) dm across, dichotomously branched throughout, green to red or gray, the new growth often densely pubescent with appressed curled hairs, becoming glabrous with age; *leaves* opposite, linear to oblanceolate or elliptic to obovate-spatulate, 0.2-2 cm long, 0.5-6 mm wide, glabrous or pubescent with slightly curled hairs, thin to thickish and more or less succulent; *inflorescences* cymose with flowers in axillary clusters or in perfect or female plants on stout peduncles; *peduncles* stout, erect, 0.7-2 cm long, usually densely pubescent; *involucre*s lacking in male plants, those of perfect or female plants reduced to a highly modified involucre bract, this up to 3 cm across, laterally bilobed, gibbously bisaccate and accrescent at maturity, hyaline and reticulated with deep red to red-purple veins, glabrous; *flowers* imperfect or perfect, sparsely pubescent without, the tepals monomorphic, lanceolate,

the male ones 1-5 per node, pale yellow, 1.2-1.7 mm long, the perfect and female ones 1-2 (3) per node, pale yellow to rose or red, 0.5-2 mm long; *stamens* 9, mostly exserted, the filaments 0.8-1 mm long, glabrous, the anthers 0.2-0.3 mm long, oval, yellow; *achenes* yellowish-brown to brown, 3-5 mm long, the narrowly globose base tapering to a narrowly winged, strongly 3-angled beak.

Local and often common in sandy to gravelly soil on the western coast of Baja California from San Vicente to Magdalena Bay and on Cedros Island, associated with scattered shrubs from 15-2200 ft elev; flowering from Oct-Apr.

Key to the Varieties

- A. Leaves linear to narrowly oblanceolate, 0.5-2 (2.5) mm wide, (0.4) 0.8-2 cm long, pubescent; involucre bracts 2-3 mm wide at maturity; western coast of Baja California from San Vicente to the Desierto el Vizcaíno. ... 1a. var. *galioides*
- AA. Leaves broadly oblanceolate to spatulate, 2-6 mm wide, 0.2-1.5 cm long, glabrous; involucre bracts 1-2 cm wide at maturity; western coast of Baja California and adjacent islands from Desierto el Vizcaíno south to Magdalena Bay.
- B. Leaves 2-4 mm wide; Cedros Island. 1b. var. *fruticosa*
- BB. Leaves 2-6 mm wide; Magdalena Bay. 1c. var. *macroptera*

As here defined *Harfordia macroptera* is divided into three morphologically weakly defined, yet geographically distinct varieties.

- 1a. *Harfordia macroptera* (Benth. in Hinds) E. Greene & C. Parry in C. Parry var. *galioides* (E. Greene) Rev., comb. et stat. nov. *Pterostegia galioides* E. Greene, Bull. Calif. Acad. Sci. 1: 213. 1885.—TYPE: on the bluffs of Cape San Quintín, Baja California Norte, México, 10 May 1885, *Greene s.n.* (lectotype: US!; duplicates of the lectotype: UCI, selected here).

Large and often sprawling shrubs mostly 3-6 (10) dm high and 4-8 (14) dm across; *leaves* linear to narrowly oblanceolate, (0.4) 0.8-2 cm long, 0.5-2 (2.5) mm wide, pubescent with slightly curled hairs, thin; *involucre bracts* 2-3 cm across at maturity; $n = 20$.

Local and common in sandy to gravelly soil on the western coast of central Baja California from San Vicente to Desierto el Vizcaíno, from 15-2200 feet elev; flowering from Oct-Apr.

Representative Specimens.—MÉXICO. BAJA CALIFORNIA NORTE: 2 mi N of San Simón, near San Quintín Bay, 22 Mar 1949, *Bocigalupi 3036* (DS, JEPS, RSA, UC); San Borja, 1889, *Brandege s.n.* (GH, PH, UC, US); near Río del Rosario, 11 km E of El Rosario, 6 Nov 1947, *Carter et al. 1863* (DS, F, GH, K, MEXU, US); NW slope of Las Amarillas, 6 mi N of the American Smelter Company mine, 4 Feb 1935, *Chisaki & Bell 518* (CAS, COLO, DS, F, GH, K, MEXU, MICH, MO, NY, OKL, RM, SD, SMU, UC, US, UTC, W, WS); 15 mi SW of Punta Prieta, 10 Feb 1935, *Epling & Robison s.n.* (DS, GH, LA, MICH, NY, UC); S of San Agustín, 1 Feb 1935, *Epling & Robison s.n.* (DS, F, GH, K, LA, MICH, POM, RM, SMU, UC); canyon in the foothills of Sierra Lino, 25 mi S of Punta Prieta, 6 Mar 1947, *Gentry 7343* (ARIZ, ASU, DS, MICH, RSA, SD, UC, US); 13 mi E of El Rosario, 30 Nov 1957, *Klein et al. 3* (DS, GH, RSA, UC, UT); 2 mi S of Rancho Ibarra, 23 Mar 1970, *Moran 16821* (ARIZ, ENCB, LL, MICH, MSC, OKL, SD); N slope of Cerro San Juan de Dios, 1 May 1973, *Moran 20692* (MO, MSC, POM, SD, UC); 2 mi N of San Antonio del Mar, 19 May 1975, *Moran 22012* (DS, PH, SD); San Telmo, Apr 1886, *Orcutt 1374* (B, DS, F, G, GH, ISC, K, LE, MIN, MO, NDG, NY, PH, UC, US, VT); San Quintín Bay, Jan 1889, *Palmer 696* (ARIZ, F, GH, K, LE, LL, MICH, NY, PH, UC, US); 14 km NW of Colonia Guerrero, 4 Apr 1958, *Raven et al. 12205* (CAS, DS, GH, K, LA, SMU, UC); Arroyo Socorro, 20 May 1988, *Reveal 6829* (BM, BR, BRY, CAS, CLEM, G, K, KW, LE, MARY, MEXU, MO, NY, OKL, OSC, RM, RSA, SMU, US, UTC, VT, WIS, Z); Jaraguay Grade, 23 Mar 1988, *Reveal et al. 6728* (CAS, MARY, MO, NY, RSA, US); Cañada las Palomas, 24 Mar 1988, *Reveal et al. 6754* (CAS, MARY, MO, NY, RSA); near Hamilton Ranch, 3 Feb 1935, *Shreve 6837* (ARIZ,

F, GII, MICH, MO); 9.8 mi N of Colonia Guerrero, 25 Mar 1954, *Straw & Ownbey 527* (COLO, MEXU, RSA); near Aguajito Ranch, 18 mi from El Rosario, 23 Feb 1963, *Thorne & Henrickson 32545* (MICH, RSA, Z); 10 mi S of El Rosario, 9 Mar 1983, *West et al. 383-52* (ARIZ, COLO, OBI, SD, TEX, UCR); between San Telmo and the road to San Quintín, 1 Mar 1930, *Wiggins 4282* (ARIZ, CAS, DS, GH, K, MICH, NO, NY, POM, SMU, UC, US, WTU); Playa Santa Catarina, 10 Mar 1930, *Wiggins 4459* (CAS, DS, GH, LA, MICH, NY, POM, UC, US); near San Vicente, 5 Apr 1950, *F. Wylie s.n.* (SD). BAJA CALIFORNIA SUR: Las Huevitas, 1889, *Brandege s.n.* (GII, PII, UC, US); Rinconado de San Hipólito, Vizcaíno Desert, 15-17 Nov 1947, *Gentry 7804* (ARIZ, DS, MICH, RSA, UC); Arroyo del Portezuelo, 9.5 mi S of San Jose de Castro, 5 Feb 1973, *Moran & Reveal 19818* (SD, US); at the pass at the head of Arroyo Largo, 8 Feb 1973, *Moran & Reveal 19948* (ARIZ, ENCB, RSA, SD, US). A total of 110 collections were examined.

The var. *galioides* is the more common expression of the species, being found along the western coast of peninsular Baja California from the San Vicente area just below Ensenada southward on the coastal mesas and in the adjacent mountains to the Desierto el Vizcaíno of northwestern Baja California Sur. Here the generally pubescent, long, narrow leaved phase of var. *galioides* gives way to a slightly broader phase that approaches that seen in var. *macroptera*.

Plants of var. *galioides* are widely scattered and often not obvious except when the inflated involucre bracts are fully expanded and numerous. The size of the individual is often dependent upon what species of plants the var. *galioides* is able to sprawl over. When not on another plant, most individuals are less than 5 dm high, and if subjected to onshore winds, the plants can be less than 1 dm high. The numerous, thin branches make for intricate and highly branched individuals. The flowering portions tend to be on the exterior of the shrub so that below this level the plant can seem to be a never ending array of red to grayish twigs.

At present, only the var. *galioides* has been counted. The voucher for the number, $n = 20$, is *Reveal et al. 6728*. The count is the first for the genus.

1b. *Harfordia macroptera* (Benth. in Hinds) E. Greene & C. Parry in C. Parry var. *fruticosa* (E. Greene) Rev., comb. et stat. nov. *Pterostegia fruticosa* E. Greene, Bull. Calif. Acad. Sci. 1: 212. 1885. *Harfordia fruticosa* (E. Greene) E. Greene & C. Parry in C. Parry, Proc. Davenport Acad. Nat. Sci. 5: 28. 1886.—TYPE: Cedros Island, Baja California Norte, México, 1 May 1885, *Greene s.n.* (lectotype: US!; duplicates of the lectotype: ISC, MIN, MO, UC!, selected here).

Large sprawling shrubs mostly 1-3 (6) dm high and 2-4 (8) dm across; leaves broadly oblanceolate to obovate-spatulate, 0.2-0.8 (1) cm long, 2-4 mm wide, essentially glabrous, thick and succulent; involucre bracts 1-2 cm across at maturity.

Local and common in gravelly soil on Cedros Island, Baja California Norte, México, from 15-200 feet elev; flowering from Dec-Mar.

Representative Specimens.—MÉXICO. BAJA CALIFORNIA NORTE: all Cedros Island: Mar-Jun 1897, *Anthony 285* (BM, COLO, DS, E, F, GH, K, MIN, NESH, POM, SD, UC, US, VT); 2 mi S of the lighthouse on the E side, 23 Feb 1977, *C. Davidson 5487* (F, NY, RSA, SD); canyon in San Agustín Mountains, 22 Feb 1939, *Haines & Hale s.n.* (ARIZ, CAS, COLO, K, LA, LL, MICH, MO, NY, POM, SD, SMU, UC, US, WTU); South Bay, 17 Aug 1932, *J.T. Howell 10704* (CAS, DS, F, GH, POM, US); arroyo in middle of E coast, 16 Apr 1963, *Moran 10683* (DS, RSA, SD, UC); canyon on E side, 4 mi from N end, 25 Jun 1968, *Moran 15148* (MICH, RSA, SD, UC); pine ridge at the head of Gran Cañon, 18 Jun 1960, *C.H. Muller 10805* (SBBG, SD, UCSB); 18-20 Mar 1889, *Palmer 704* (ARIZ, F, GH, K, MEXU, MICH, NY, UC, US, VT); Punta Prieta, 28 Nov 1976, *Philbrick & Benedict B7674* (SBBG); 10 Mar 1911, *Rose 16114* (NY, US). A total of 28 collections were examined.

The isolated nature of the var. *fruticosa* has certainly contributed to the evolution of this

expression. It is a more compact phase of the species compared to the southern var. *macroptera*.

The recent discovery of several of the Cedros Island endemics on the mainland indicates that the previously assumed marked isolation of that island is not as significant as once thought. The weak morphological distinction between the var. *fruticosa* and the var. *macroptera* is probably a manifestation of both the recentness of the isolation of Cedros as well as the possibility that even the minor differences are due more to the insular habitat than to any real biological difference. Additional collections of *Harfordia* from the Bahía de Tortugas region would be useful. The mainland plants are all from a relative restricted area in the mountains east of Bahía de Tortugas. Further study of these plants may reveal that they might better be referred to var. *fruticosa*.

The accepted date the var. *fruticosa* was collected is 1 May 1885 as this is the date commonly found on specimens. The holotype at US, however, is dated 30 Apr 1885. This is regarded as an error and all the duplicates cited above are considered to be isotypes.

1c. *Harfordia macroptera* (Benth. in Hinds) E. Greene & C. Parry in C. Parry, Proc. Davenport Acad. Nat. Sci. 5: 28. 1886, var. *macroptera*. *Pterostegia macroptera* Benth. in Hinds, Bot. Voy. Sulphur 44. 1844. —LECTOTYPE: Magdalena Bay, Baja California Sur, México, Nov 1839, *Hinds s.n.* (lectotype: K!; duplicates of the lectotype: BM, GH!, selected here).

Large sprawling shrubs mostly 2-4 (6) dm high and 4-6 (8) dm across; *leaves* broadly oblanceolate to spatulate, 0.5-1.5 cm long, 2-6 mm wide, essentially glabrous, thick and succulent; *involucral bracts* 1-2 cm across at maturity.

Local and common on gravelly soil in the Magdalena Bay region, Baja California Sur, from 15-200 feet elev; flowering from Dec-Mar.

Specimens Examined. —MÉXICO. BAJA CALIFORNIA SUR: Magdalena Bay, Oct-Nov 1839, *Barclay 3083* (BM, K); Magdalena Bay, 12 Jan 1889, *Brandegee s.n.* (DS, GH, NY, PH, RSA, UC, US); Santa Magdalena Island, Cabo San Lazaro, 26 Apr 1973, *C. Davidson 2044* (RSA); Magdalena Bay, without date, *Lung 29* (UC); Santa Maria Bay, 30 Mar 1952, *Moran 3544* (DS); hill near Santa Maria Lagoon, Magdalena Island, 20 Apr 1979, *Nakai 480* (CAS, MEXU); Margarita Island, 29 Nov 1905, *Nelson & Goldman 7301* (GH, US); Magdalena Island, Mar 1917, *Orcutt 16* (NY, US).

On the voyage of *H.M.S. Sulphur* were two major plant collectors, Richard Brinsley Hinds, ship's surgeon, and George Barclay, botanist sent by the Royal Botanic Garden at Kew. The ship traveled southward from San Diego arriving at Magdalena Bay on 2 November. Here the collectors were greeted by a variety of plants in full flower and they made the best of the some three weeks the ship remained at the Bay (Lindsay 1955). Bentham (1844) had access to both the Hinds and Barclay collections (McKelvey 1955) so it is not always possible to determine exactly upon whose specimens he established his names. In this instance a lectotype has been selected on that element that is most in agreement with Bentham's description.

No specimens of var. *macroptera* have yet been found on the mainland. A lack of botanical activity is likely the cause of this rather than a natural restriction of the taxon to Isla Santa Margarita and Isla Magdalena.

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