



The Genus *Nolina* (Asparagaceae) of the Baja California Peninsula, and the Recognition of a New Species Combination

Authors: Hernández-Sandoval, Luis, and Rebman, Jon P.

Source: Systematic Botany, 43(3) : 717-733

Published By: The American Society of Plant Taxonomists

URL: <https://doi.org/10.1600/036364418X697436>

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

The Genus *Nolina* (Asparagaceae) of the Baja California Peninsula, and the Recognition of a New Species Combination

Luis Hernández-Sandoval^{1,3} and Jon P. Rebman²

¹Biología, Facultad de Ciencias Naturales, Universidad Autónoma de Querétaro, Avenida de las Ciencias s/n. Juriquilla, Querétaro, C.P. 76230, Mexico

²Department of Botany, San Diego Natural History Museum, 1788 El Prado, San Diego, California 92101, USA

³Author for correspondence (luishs@uaq.mx)

Communicating Editor: Sven Buerki

Abstract—The genus *Nolina* on the Baja California peninsula has not been critically studied. Most of the taxonomic literature dealing with this group is older or incomplete in nature. Taxonomic problems with this genus arise because it is not easy to make herbarium specimens from plants in the field and the taxa are not well represented in collections. Species in this genus are difficult because they are dioecious, generally have large rosettes with many leaves, leaf margins that often cut skin, and the plants have large inflorescences. On older herbarium specimens, it is common to find only a leaf and an inflorescence fragment, and labels often do not provide taxonomically important information such as the plant's growth habit type. Consequently, distinctive inflorescence characters are usually missing from the specimen or from the label data. It is rare to find a complete specimen collection that includes all of the needed species-relevant data. Decisions for delimiting species in this genus are not easy, and in this case, were based mostly upon their morphological character consistency, geographic distribution, and environmental factors. Five species of *Nolina* are now registered for the Baja California peninsula: *N. beldingii*, *N. bigelovii*, *N. interrata*, *N. palmeri*, and the new nomenclatural combination *N. brandegeei* (Trelease) L. Hern. This paper includes: a species identification key, species taxonomic descriptions, ecological and geographical information, common names, taxonomic discussions of species, and pictures for species recognition of all taxa in the Baja California region.

Keywords—Mexico, *Nolina brandegeei*, taxonomy.

Resumen—El género *Nolina* en la península de Baja California no ha sido estudiado críticamente. La mayoría de las referencias que consideran al género son viejas o incompletas. Sus problemas taxonómicos se originan por la dificultad de coleccionar plantas y hacer ejemplares completos, por lo que muestras de estas especies no están bien representadas en los herbarios. Las especies tienen plantas dioicas, inflorescencias, brácteas y rosetas grandes, muchas hojas y márgenes denticulados que cortan la piel. En ejemplares antiguos es común encontrar sólo tienen fragmentos de hojas, así como de inflorescencia y raramente las etiquetas tienen información sobre hábito o características particulares de la planta. Por tanto, no se cuenta con caracteres distintivos de la inflorescencia o datos de estas en las etiquetas de herbario. Es raro encontrar ejemplares completos que incluyan todos los datos específicos relevantes, por lo que las decisiones para delimitar especies en el género no son fáciles y se basan en la consistencia de caracteres morfológicos, distribución geográfica y factores ambientales. Se registran cinco especies: *Nolina beldingii*, *N. bigelovii*, *N. interrata*, y *N. palmeri*, incluyendo la propuesta de combinación de un nuevo nombre *N. brandegeei* (Trelease) L. Hern. Se presenta una clave de identificación para las especies, su descripción taxonómica, datos ecológicos, de distribución, nombres comunes, una discusión taxonómica, así como fotografías para reconocerlas.

Palabras clave—México, *Nolina brandegeei*, taxonomía.

The genus *Nolina* Michx. on the peninsula of Baja California, Mexico has not been critically studied. Most of the taxonomic references relating to this genus are old or incomplete (Brandege 1889; Trelease 1911; Wiggins 1980). For example, the Flora of Baja California by Wiggins (1980) included four species of *Nolina* with three varieties. He considered *N. parryi* S. Watson as present in Baja California, but no herbarium specimens or any other legitimate record has been found to scientifically substantiate this report. He also recognized *N. beldingii* Brandege var. *deserticola* Trelease, which is considered here as a synonym for *N. bigelovii* (Torrey) S. Watson, but he did not mention *N. beldingii* which occurs in the Cape Region. A detailed revision of the specimens and their localities is required to know and understand the species of *Nolina* on the peninsula of Baja California. Recently, Rebman and Roberts (2012) published a new edition of a field guide for the Baja California plants, reporting just three species and two varieties of one species (*Nolina beldingii*; *N. bigelovii*; *N. palmeri* S. Watson var. *palmeri*; and *N. palmeri* var. *brandegeei* Trelease).

Problems with the taxonomy of *Nolina* arise from the fact that it is not easy to make taxonomically complete herbarium specimens from field plants, and consequently, the plants are not well represented in herbarium collections. Most species in this genus have large rosettes with many leaves, large inflorescences, and are dioecious with separate staminate and pistillate individuals. On older herbarium specimens, it is common to find only a leaf and an inflorescence fragment and the labels do not typically have information such as the exact

locality or the plant growth habit. Furthermore, since most *Nolina* rosettes are big, coarse, and have denticulate leaf margins that can hurt or cut skin when working with them, many botanists just collect young and immature leaves. As a result, the leaves on herbarium vouchers have been incorrectly considered mature ones yielding different color ranges and leaf sizes. Finally, since *Nolina* inflorescences are so large, most of the time the few reproductive structures that are present in plant collections are inflorescence branches or only small parts of the branch segments. Taxonomically important characters such as inflorescence size, shape, scape size and diameter, inflorescence bracts, number of branches, branch bracts, branchlets, branchlet bracts, and in several cases the apical branchlet or end of a branch, are usually missing from specimens and are not recorded in the label data. When studying vouchers of the same species from many different herbaria, it is rare and fortunate to find specimens that include mature leaves, inflorescence and floral bracts, staminate flowers, pistillate flowers, and mature fruits. As a result, decisions for species delimitations are not easy in this group.

For this study, most of the information was obtained from literature (Brandege 1889; Trelease 1911; Moran 1952; Gentry 1972; Wiggins 1980; Hochstätter 2010; Rebman and Roberts 2012), specimen studies in herbaria (ASU, BM, BCMEX, CAS/DS, GH, HCIB, K, MEXU, MO, SD, and TEX), data from the bajaflores.org website (including the Baja California Botanical Consortium specimen records from six different herbaria in both the USA and Mexico), and fieldwork. The species

circumscriptions in this study were based upon the consistency of their morphological characters, geographic distribution, and environmental factors. It is interesting to note that most species in the Baja California region occur in high elevation areas of the sierras in both states on the peninsula. However, even though the populations are separated on mountain sky islands, it is possible to envision a coherent distribution of each species based upon geological substrates (Martín Barajas 2000). As a result, five species are considered to occur on the peninsula of Baja California with no infra-specific categories recognized. In addition to the four previously recognized species, *Nolina beldingii*, *N. bigelovii*, *N. interrata*, and *N. palmeri*, a new nomenclatural combination is proposed for an additional species, *Nolina brandegeei* (Trelease) L. Hern.

NOLINA MICHX

Plants dioecious, arborescent or acaulescent plants with leaf rosettes at the apices of stems and branches. Leaves linear, flat

or concave, green or glaucous green, with leaf margins microdenticulate or fibrous. Inflorescences a panicle with a scape and branches subtended by deltoid or triangular to linear bracts. Second order branches or branchlets subtended by triangular to linear papery bracts. Flowers campanulate, in fascicles or secondarily solitary, surrounded by lacinate or dentate membranaceous bracteoles; tepals 6 in two series, whitish, the midvein apparent, trichomes at the apex; staminate flowers with six stamens, anthers introrse, sagittate, ovary not developed and functioning as a nectary, tepals reflexed at maturity; pistillate flowers with a 3-carpelar ovary, rounded; stigmas sessile, 3-branched or 3-lobed; staminodes 6, septal nectaries present; ovules basal, two per carpel, sometimes subtended by a shelf-like or a small protruding structure. Fruits 3-lobed, dry, indehiscent, with an apical notch that bears the persistent stigmas; tepals persistent, all reflexed or at least the external ones. Seeds round, 1–2(–3) per fruit, in any case, one per locule or none if ovules abortive, exposed at maturity or not; testa smooth, microreticulate or reticulate, brown or gray.

KEY TO THE SPECIES OF *NOLINA* ON THE BAJA CALIFORNIA PENINSULA

1. Plants acaulescent, stems subterranean, horizontal or vertical, then short and almost aerial 2.
 2. Stems horizontal, subterranean, leaves glaucous, flat, coiled, apex erect, inflorescence branches loose and lax, seeds not protruding from the fruit lobe *Nolina interrata*.
 2. Stems vertical, leaves green, concave in cross section, erect, apex coiled, inflorescence branches dense and stiff, seeds protruding from the fruit lobe *Nolina palmeri*.
1. Plants caulescent, stems typically more than 1 m tall, shrubby or arborescent 3.
 3. Plants shrubby, leaf margins fibrose, seeds reticulate, grayish to light brown *Nolina bigelovii*.
 3. Plants arborescent, leaf margins denticulate, seeds microreticulate, brown 4.
 4. Leaf narrowing or with a constriction above the base, apex entire, leaf margins with simple teeth, fruits 0.9 cm long, 1.4–1.5 cm wide, seeds not exposed at maturity *Nolina beldingii*.
 4. Leaf not narrowing or without constriction above the base, apex shredded, leaf margins with branched, forked or multiple teeth, fruits 0.6 cm long, 1 cm wide, seeds exposed at maturity *Nolina brandegeei* comb. nov.

NOLINA BELDINGII Brandegee, Zoe 1: 305. 1890. TYPE: MEXICO: Baja California Sur, La Chuparrosa, 17 Oct. 1893, T. S. Brandegee s. n. (lectotype UC! (accession number: 142652); isolectotypes: BM!, GH!, KEW!, and the fragment at MO labeled as October 17, 1893).

Plants arborescent, 3 to 7 m high, trunk 50 cm diam, bark fissured forming rectangular blocks 10 to 25 cm long with ridges 5 cm deep, gray to maroon with age; branched with 1 to 26 apical leaf rosettes, 2 to 3 m diam, leaving persistent old leaves on at least half the size of the branches and trunk or even more. Leaves long linear, 0.75–1.15 m long, 1.4–2.0 cm wide at the middle, sometimes narrower or with a constriction above up the base, flat in cross section, smooth, dark green, sometimes reddish at the back; base long triangular, (4.5–)7 to 9 cm long, (3.5–)4 to 5 cm wide at the inferior part, 1.4 cm wide at the superior part; leaf apex entire; leaf margin denticulate, with very small teeth or denticles ca. 0.2 mm long, yellowish. Inflorescence paniculate, largely ovoid, 2 to 3(–3.5) m long, 20 to 70 cm diam, rachis undulate; scape 1 m, smooth, bracts linear, decreasing in size towards the apex from 60 to 40 cm; branches lax, curved to undulate, perpendicular to slightly ascending, 23 cm long, decreasing in size towards the apex to 15 cm, with two weak basal branchlets (ca. 1/5 the size of the branches), subtended by largely triangular papery bracts, 18 cm long, decreasing in size towards the apex to 3 cm, bract base blotched with red or purple; branchlets lax, 8 cm long, decreasing in size towards the apex to 2 cm long. Staminate flowers 2(–3) per node, campanulate, 4 to 6 mm diam on pedicels 2.5 to 3 mm long, articulated at or above the middle,

surrounded by membranaceous bracteoles 2 to 3 mm long with lacinate margins; tepals ovate to lanceolate, 3–4 mm long, 1.5–2 mm wide, the external ones with apiculate apices, all reflexed from the middle part at maturity; filaments 2–2.5 mm long; anthers 1–1.5 mm long. Pistillate flowers 2 per node, campanulate, on pedicels 4 to 8 mm long articulated near the base, surrounded by two membranaceous bracteoles 2 to 4 mm long, margins lacinate; tepals lanceolate, 3 to 3.5 mm long, 1.5 mm wide, light yellow to cream with the midvein reddish to purple; ovary 3-lobed, 2–4 mm diam; style 0.2–0.4 mm long; stigmas 3-lobed. Fruits 1(–2) per node, depressed, 0.9 cm long, 1.4 to 1.5 cm wide, with persistent tepals, reflexed at maturity; peduncles 9.5 to 11.5 mm, articulated near the base. Seed 1 per fruit, 4.5 mm long, 3 mm wide, ovoid, not exposed, and green to brown, grayish at maturity, hilum yellow. Figure 1.

Ecology and Distribution—This species occurs on steep slopes and cliffs at the highest areas in the Sierra de La Laguna, in the state of Baja California Sur, Mexico, in oak forests (*Quercus* species) with *Quercus tuberculata* Liebm., *Q. devia* Goldman, *Q. arizonica* Sarg., *Arbutus peninsularis* Rose & Goldman, *Sideroxylon peninsulare* (Brandegee) T. D. Pennington, *Buddleja crotonoides* A. Gray, *Randia capitata* DC., *Muhlenbergia* spp., *Opuntia* spp., *Croton* sp., from 1000 to 1800 m in elevation, on granite outcrops (Fig. 2). This species flowers from May to June and fruits from June to August.

At the time of the original species description (Brandegee 1890), Brandegee did not assign an actual type specimen, and did not mention any herbaria where specimens might be deposited. Even though he had his own herbarium, it seems

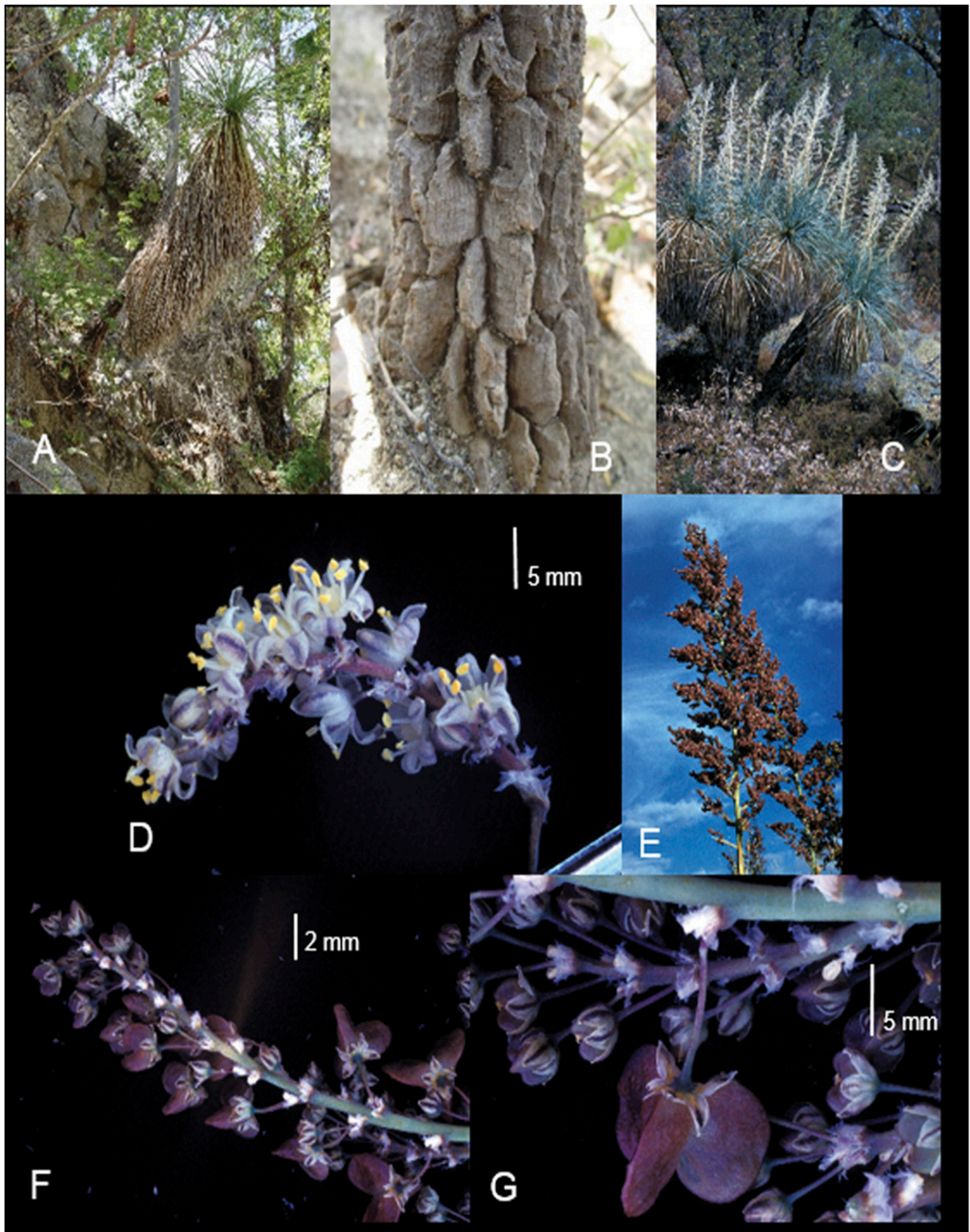


FIG. 1. *Nolina beldingii*. A. Habit showing leaf marcescence. B. Bark. C. Plant habit with staminate inflorescence. D. Staminate flowers. E. Infructescence. F. Fruit, infructescence branch. G. Immature fruit. Photos A–B Luis Hernández-Sandoval, C–G Jon Rebman.

that some vouchers were not deposited into others or at least at UC where the largest portion of Brandegee's herbarium collection is currently housed. He dedicated the specific epithet to Mr. L. Belding, but apparently did not see his specimen collection (*Belding 6* at GH, which represents a small individual), and just said that he "was the first to notice it in his ornithological expeditions to the Sierra la Laguna, several

years ago, and gave me directions as to the route by which I was able to find it." The best specimen collection for *N. beldingii* is at UC is from La Chuparrosa ("Chuparrosa" spelling variant), dated 17 October 1893, with duplicates at GH, BM, KEW, and MO. However, the voucher at MO is a mixed sheet with *N. brandegeei* from San Julio, 19–20 April 1889). There are also older specimens from the Sierra de San Francisquito,

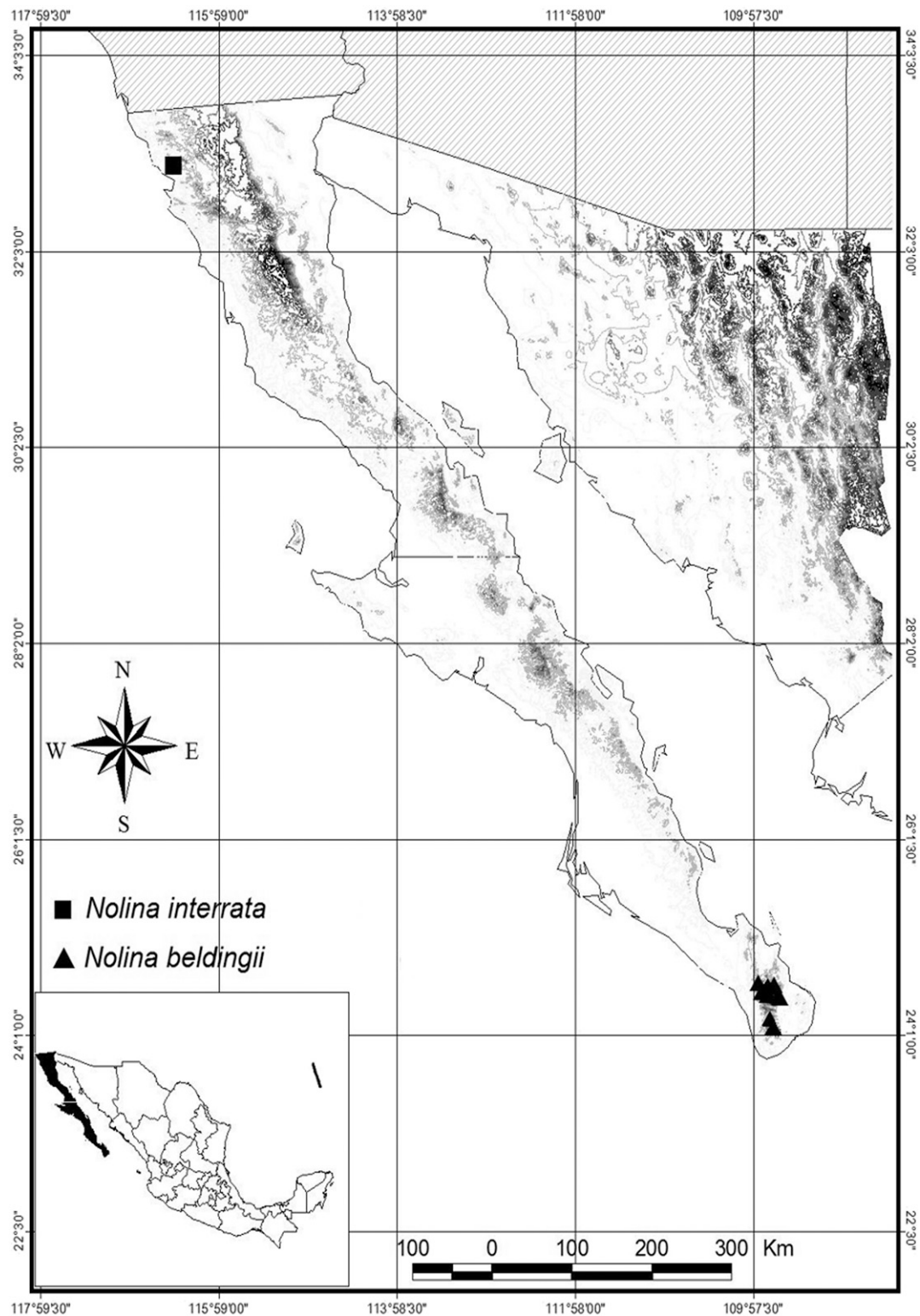


FIG. 2. Distribution of *Nolina interrata* and *N. beldingii* on the Baja California Peninsula.

labeled as *Brandegee* 583 but with different dates, the one at GH is from March 29, 1890 and the one at UC is from March 29, 1892. In the paper on Brandegee's itineraries, Moran (1952) considers the last date (1892) as the correct one, and it is the one accepted here. A voucher with a collection date after the original publication date cannot be considered an inferred type specimen, but since Brandegee did not mention any

specimen in his original publication, and since Belding's specimen and the collection from the Sierra de San Francisco are not complete, and also labeled with different dates, it seems best to assign the specimen from La Chuparrosa at UC as the lectotype, and the vouchers at BM, GH, KEW, and the fragment at MO labeled as October 17, 1893 as isolectotypes.

Nolina beldingii is an endemic species to the southern part of the Baja California peninsula which occurs only in the Sierra de La Laguna. Taxonomically, this species is close to *N. brandegeei*. They can be readily distinguished because *N. beldingii* has longer leaves (ca. 1 m) usually narrowing or with a constriction above the base, entire leaf apices, and larger fruits and pedicels. *Nolina beldingii* is locally known as "sotol" or "palmilla" and its leaves have been used for thatching (Fig. 1).

Representative Specimens Examined—Mexico.—BAJA CALIFORNIA SUR: Laguna. L. Belding 6, 3 Feb s/y (GH); Sierra de San Francisquito, 29 Mar. 1892, T. S. Brandege 583 (GH as 29 Mar. 1890, UC); La Chuparosa, 17 Oct. 1893, T. S. Brandege s/n (GH); La Laguna, Sierra de la Laguna, 21 Jan. 1906, E. Nelson & E. Goldman 7465 (US); La Laguna, Sierra La Laguna, 24 Mar. 1939, H. S. Gentry 4424 (CAS, GH, KEW, MO); Valle de la Laguna, 23 Aug. 1944, M. Martínez s/n (MEXU); Along trail to La Laguna, Sierra de La Laguna, E of Todos Santos, 28 Dec. 1947, A. Carter 2439 (US); Rancho Laguna and vicinity, Sierra Laguna, Cape District, 3 Oct. 1951, H. S. Gentry 11216 (MEXU); From San Jorge to San Francisquito and La Chuparosa, East of Sierra de la Victoria, 12 Apr. 1955, A. Carter 3331 (GH, MEXU, MO, SD, US); Cape Region, Potrero de Almenta near head of S fork canyon San Pedro, 9 May 1959, R. Moran 7369, 7369A (GH, MEXU, SD); Cape Region about La Laguna, 16 May 1959, R. Moran 7428 & 7428A (GH, MEXU, SD); La Laguna, Sierra de la Laguna, Huerigo Canyon, 24 Aug. 1959, C. H. Love 3064 & R. L. Turner 59–159 (MEXU, MO); At end trail La Burrera - La Laguna, Cape District, 21 Aug. 1972, A. J. Gilmartin 1840 (MEXU); Sierra de La Laguna, trail to La Laguna, ridge above tributary of Cañón la Burrera, just west of la Laguna, about 30 km (air) northeast of Todos Santos, 19 Mar. 1998, M. Fishbein 3167 (MEXU); Sierra de La Victoria, arriba de la zona del chalet de Cano, 7 Dec. 2007, J. L. de la Luz 7073 (HCIB, SD); Sierra de La Victoria, arriba de la cabaña de Cano, 17 Apr. 2008, J. L. de la Luz 8075 (HCIB, MEXU, SD); Cerrito El Encino frente al cerro el Picacho, zona núcleo de la Reserva de la Biosfera la Sierra de La Laguna, 17 Jun. 2009, A. García-Mendoza 9268 (MEXU).

NOLINA BIGELOVII (Torrey) S. Watson, Amer. Acad. Arts Proc. 14:247. 1879. TYPE: USA. Arizona, Bill Williams Fork, s/d. *Bigelow 1853–4* (holotype: NY; isotypes: GH!, KEW!, MO!, SD!).

Dasyllirion bigelovii Torrey. U. S. Exploration Miss. Pacific Rpt. 4:151. 1857.

Beaucarnea bigelovii (Torrey) Baker. Journal of Botany 10:326. 1872.

Nolina beldingii Brandege var. *deserticola* Trelease, Proc. Amer. Philos. Soc. 50:424. 1911.

Plants shrubby, with trunks or branches 1 to 3 m tall, branching from the base; rosettes with erect leaves, reflexed when old, persistent. Leaves linear, 0.8 to 1.2 m long, 1.5 to 3.5 cm wide, flat in cross section, green to glaucous green, if the latter then cerosc, scabrid, papillate trichomes might be apparent; leaf margins smooth when young, fibrose with age, brown to grayish. Inflorescence ovoid, 1.5 to 2.5 m long; scape 0.9 to 1.5 m long; branches at the base of the inflorescence 30 to 35 cm long with a peduncle 4 to 7 cm long, the rest of the branches 20 cm long, decreasing in size towards the apex to 7 cm, subtended by linear bracts 40 to 43 cm long, sometimes with fibrous margins; branchlets 4 to 5 mm long, subtended by largely triangular bracts 10 cm long, decreasing in size towards the apex to 4 cm, 1 to 2 cm wide at the base, papery. Staminate flowers 2 to 3(–4) per node, campanulate, 2 mm long, 3 mm wide, on pedicels 2 mm long, articulated at the middle, surrounded by membranaceous bracteoles, 1.5–2 mm long, persistent, margins lacinate; tepals oblong to lanceolate, 3 mm long, 1 mm wide, reflexed from the middle at maturity, midbase thickened. Pistillate flowers 2 per node, campanulate 3.5 to 4.0 mm diam, on pedicels 2.5–3.5 mm long, articulate above the

middle, surrounded by membranaceous bracteoles, the external one 3 to 4 mm long, the internal ones 2.0–2.5 mm long, persistent, margins lacinate; tepals oblong lanceolate, 2.5–3 mm long, 1 mm wide, apex short apiculate, reflexed from the base at maturity; ovules basal, supported by a small, round or shelf-like structure; stigmas sessile, 3-branched. Fruits 1(–2) per node, orbicular to oblongate, 6–7 mm long, 7 to 9(–10) mm wide, on peduncles 3.5 to 5 mm long, articulate above or at the middle; fruit lobes with margins, apically accrescent; stigmas persistent; tepals persistent. Seed 1(–2) per fruit, oblongate to ellipsoid, 3.5–4.5 mm long, 2–2.5 mm wide, not exposed at maturity, grayish to glaucous green, rarely reddish, reticulate. Figures 3, 4.

Ecology and Distribution.—Plants of *Nolina bigelovii* grow on steep slopes in forests and chaparrals at 540 to 1250 m elevation on granite outcrops of the sierras of the state of Baja California, such as at La Rumorosa in the Sierra de Juárez, Sierra de San Pedro Mártir, Cataviñá, Sierra de San Borja, and Isla Angel de la Guarda (Fig. 4). This species is also found in Sonora, Mexico, and in California and Arizona in the USA. It is locally known as "palma." Flowers are present May to June and fruits from June to November.

Representative Specimens Examined—Mexico.—BAJA CALIFORNIA: Cañón Cantillas, Jun., 1 Jul. 1884, C. Orcutt s/n (MEXU); Tule Mountains, Mexican boundary line, 11 Feb. 1894, E. A. Mearns 2797 (MO, US); Jaraguay, about 50 km SE of San Fernando, 9 Sept. 1905, E. W. Nelson & A. Goldman, 7130 (US); (J) Yaraguay, 16 Jul. 1941, Harbison C. 310 (SD); East end of Sierra San Luis; 26–30 mi north of Punta Prieta, 3 Apr. 1950, H. S. Gentry 8971 (MEXU, SD); Cantillas (Tantillas) Canyon, 8 Sept. 1952, C. Harbison s/n (SD); Summit of Cerro Quemazón, Sierra San Borja, 26 Mar. 1960, R. Moran 8074 (CAS, SD); Canyon above El Terminal, Sierra San Borja, 7 June 1962, R. Moran 9732 (CAS, SD, US); Arroyo de la mina de Santa Marta, 9 June 1962, R. Moran 9763 (SD); Cantu Grade, about 4 mi E of La Rumorosa, near Tecate-Mexicali road, 30 Junio 1962, I. Wiggins 438 (CAS, MEXU, US); Yubay, 10 Oct. 1962, C. Harbison s/n (SD); NW of Cerro San Luis, 2 Mar. 1963, R. Moran 10278 (CAS, SD); Peak ca. 4 miles SE of Refugio Bay, Isla Angel de la Guarda, 22 Mar. 1963, R. Moran 10479 (CAS, SD, US); Rancho La Suerte, San Pedro Mártir, 4 June 1963, R. Moran 11163 (BCMEX, CAS, SD); NE of Yubay, 30 Apr. 1964, C. Harbison s/d (SD); Just above trail down into Cantillas Canyon. El Progreso, Sierra Juárez, 11 Sept. 1965, C. Harbison 392 (SD); Cantillas Canyon, 11 Sept. 1965, Howe D. F. 4132 (SD); 6.9 km (by road) south of La Virgen, 15 Oct. 1966, Hastings J. R. 66–131a (SD); Mouth of Diablo Canyon, Sierra de San Pedro Mártir, 10 Mar. 1971, R. Moran 18313 (BCMEX, SD); ca. 15 mi W of San Felipe, along road to Valle Trinidad, 15 June 1973, H. S. Gentry 23291 (ASU, MEXU); 6 May 1978, R. Moran s/n (BCMEX); Cañón del Diablo, Sierra San Pedro Mártir, 6 May 1978, R. Moran 25657 (BCMEX, SD); 9 km NW of Rancho Santa Inés, 18 June 1979, W. H. Clark 3160 (BCMEX, CAS, MEXU); Sierra ca. 2 km NE of San Luis, 15 Nov. 1981, R. Moran 29900 (SD); Arroyo El Palmarito ca. 4.5 km NW of Cataviñá, 6 June 1984, J. Dice 467 (MEXU, SD); Arroyo El Palmarito ca. 4.5 km NW of Cataviñá, 6 June 1984, J. Dice 466 (SD); La Rumorosa grade, 23 Feb. 1986, E. Jonsson 1327 (SD); Cañón de Guadalupe, along canyon above resort area. 23 Mar. 1986, R. Thorne s/n (BCMEX); Arroyo Yubay. Ca. 0.4 km West of Tinajas de Yubay and ca. 2.3 km ENE of abandoned mine at El Desengaño, 22, June 1986, J. Dice 669 (SD); Sierra La Asamblea: southwest foot of the range near the W edge of Mesa Yubay and the SSW side of Mesa Cuerno de Borrego; ca. 7.0 road miles NNE of the abandoned site of El Desengaño, 3 May 1993, T. S. Ross 7088 (SD); Cañón El Cajón, west of main dirt road providing access to Cañón de Guadalupe, 15 Mar. 1995, J. Rebman 8730 (SD); Km 52 de la carr. La Rumorosa - Tecate, Nov. 2004, O. Ramírez s/n (QMEX); La Rumorosa, Nov. 2004, O. Ramírez s/n (QMEX); W. Hodgson 2656 (MEXU).

Nolina brandegeei (Trelease) L. Hern. comb. nov. TYPE: MÉXICO. Baja California, San Julio, 19–20 Apr. 1889 *Brandegee s/n* (holotype: MO; isotype: SD).

Nolina palmeri S. Watson. var. *brandegeei* Trelease Proceedings of the American Philosophical Society 50:209. 1911.

This taxon was previously recognized as an infraspecies (Trelease 1911) and as a synonym of *N. palmeri*, a species

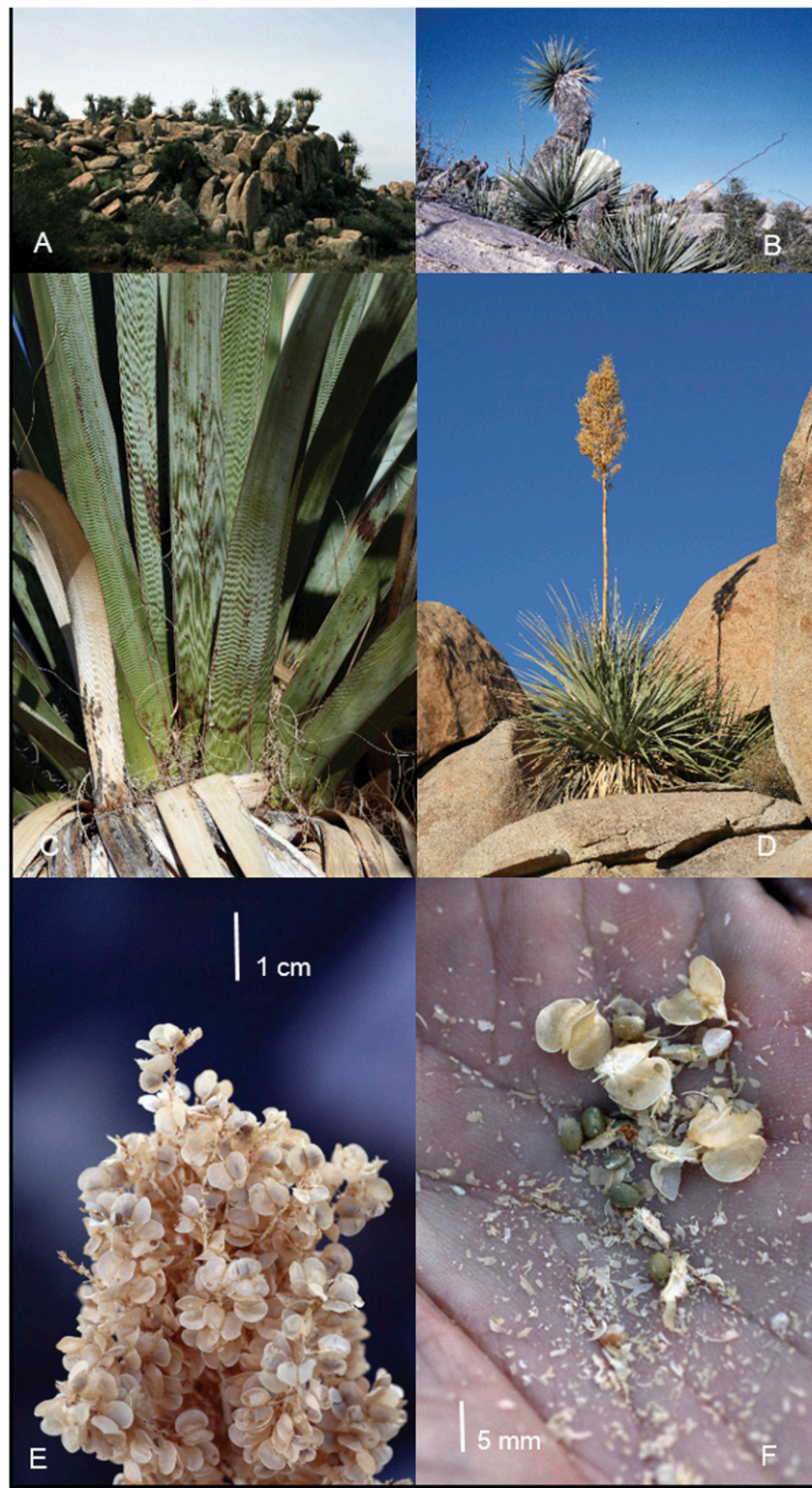


FIG. 3. *Nolina bigelovii*. A. Habitat. B. Habit. C. Leaf fibers. D. Inflorescence. E. Fruit inflorescence branch. F. Fruits and seeds. Photos Jon Rebman.

considered by Hochstätter (2010) and Thiede (2012) within the section *Microcarpae* with acaulescent plants, and narrow leaves with coiled tips, but our study found enough morphological differences to elevate in taxonomic rank to the species level.

Nolina brandegeei is quite different from *N. palmeri* because it is an arborescent plant with linear leaves that have no narrowing or constriction above the base, leaf margins with

erect and forked denticles, leaf tips shredded, fruits 0.6 cm long, 0.9 to 1 cm wide, fruit peduncles 6–12 mm long and articulated near the base, and flowers present in summer with fruits mature in fall, seeds exposed at maturity. This taxon resembles *N. beldingii*, but that species has leaves with a constriction above the base, leaf margin with curved and non-forking denticles (Fig. 5), leaf apices entire, fruits 1 cm in

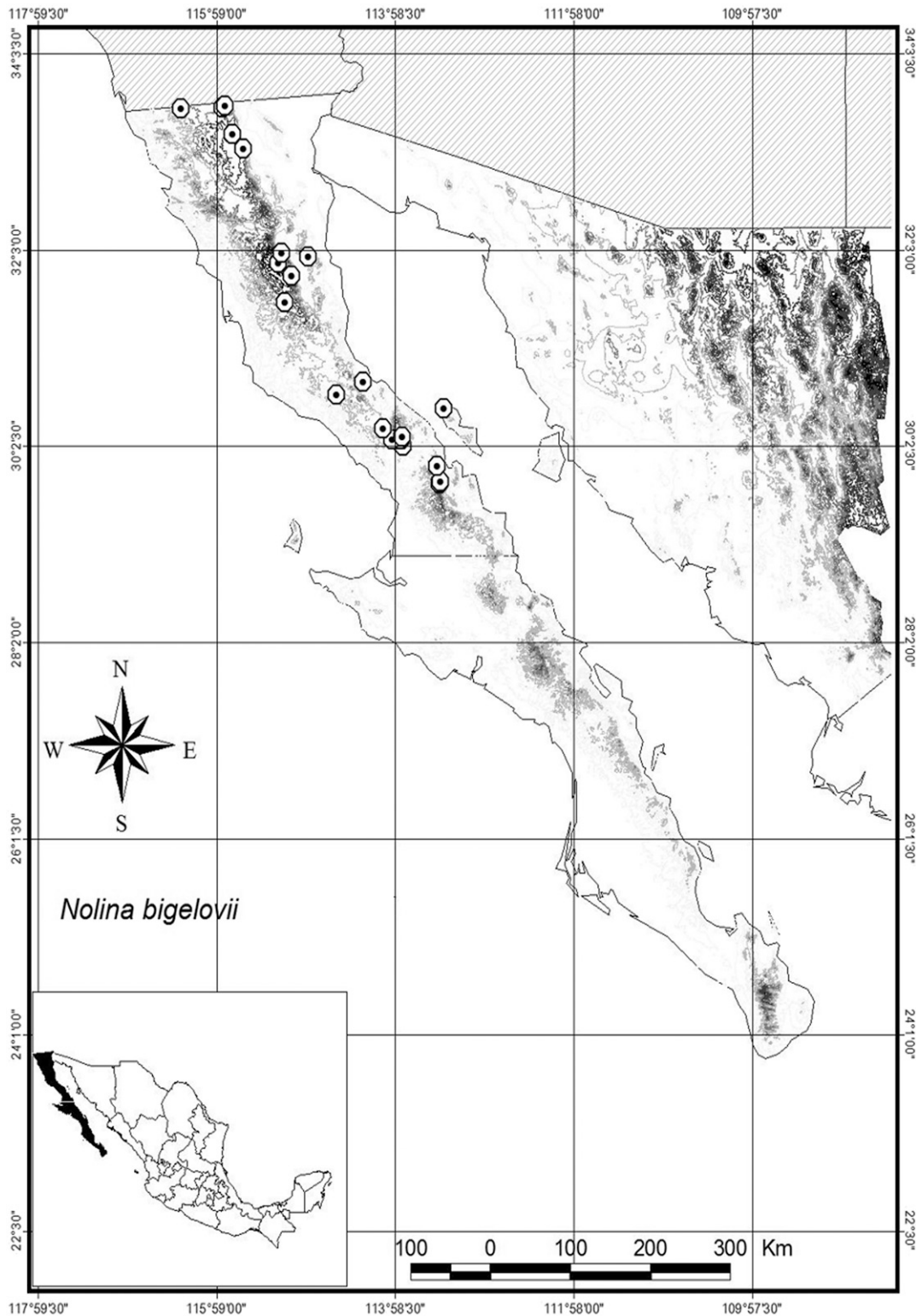


FIG. 4. Distribution of *Nolina bigelovii* in the Baja California Peninsula.

diameter or more, flowers produced in spring with fruits maturing in summer and seeds not exposed in mature fruits.

Arborescent plant, 2 to 6 m high, trunks 20–30 cm diam, usually branched with apical rosettes, old specimens much branched; branches separate from each other at 30° to 40°; bark gray, fissured, forming small rectangles. Rosettes massive ca. 1.5 m in diam, with erect leaves, reflexed at maturity, persistent and covering the branches, but not the trunk. Leaves

linear, not narrowing or constricted above the base, 95 to 120 cm long, 1.0–1.5 cm wide at the middle, flat in cross section, green to glaucous green; leaf bases triangular, 4.5–7 cm long, 5.0 at the base, and 1.3–1.7 at the top; margins denticulate; teeth 0.2 mm, erect to curved, forked or branched, sometimes fused. Inflorescence 1 to 3.5 m long, 30 cm wide, ovoid; scape 15 to 70 cm long, 1.5–2.0 cm diam; bracts linear to long triangular, 47 cm long decreasing apically in size to 20 cm;

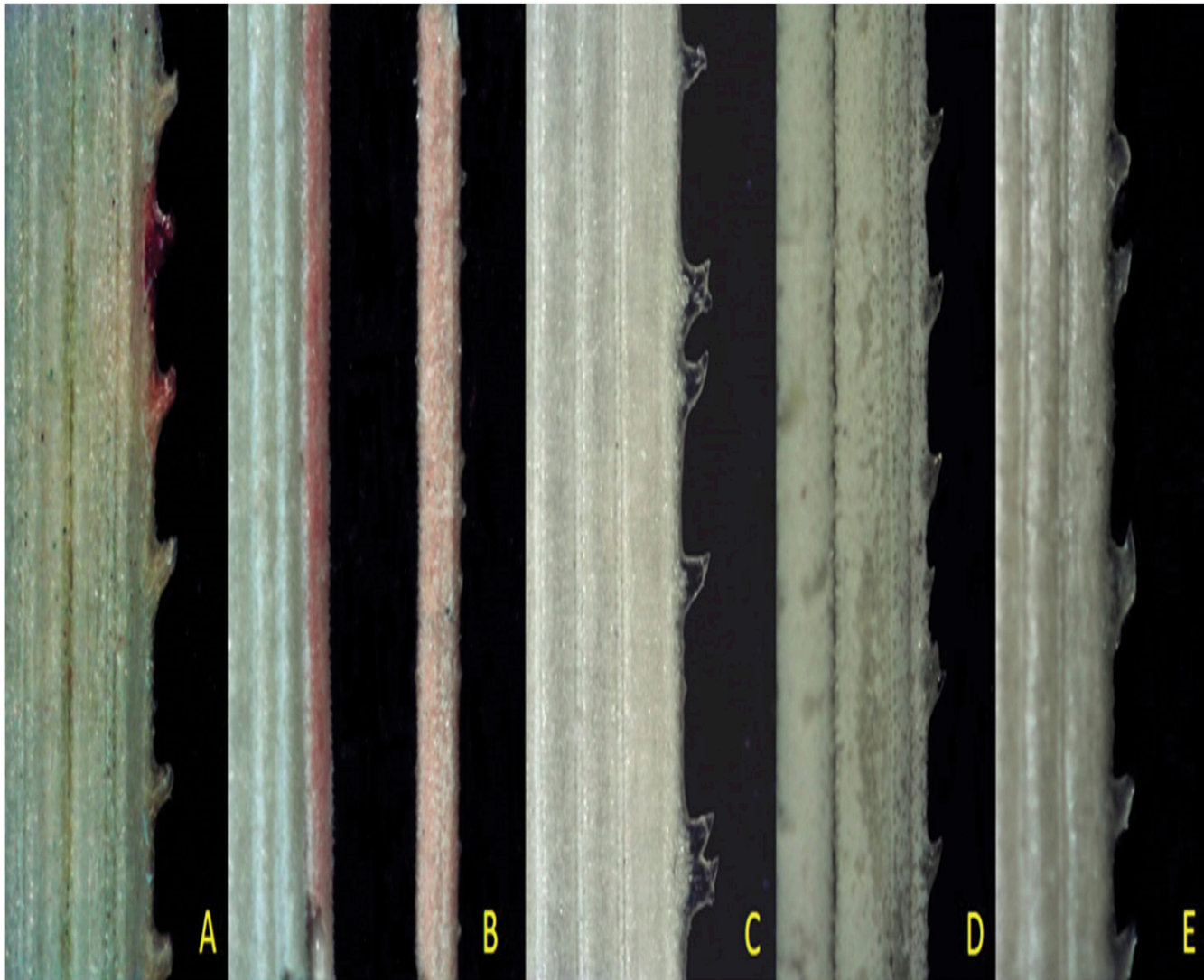


FIG. 5. Leaf margins. A. *Nolina beldingii*. B. *N. bigelovii*, with a separate leaf fiber. C. *N. brandegeei*. D. *N. interrata*. E. *N. palmeri*.

inflorescence branches perpendicular to ascending, up curved below the middle, 43 cm long, decreasing apically in size to 10 cm, subtended by bracts 17 to 6 cm long; branchlets 14 to 3 cm long, the final branchlets 5 to 8 cm long. Staminate flowers campanulate, 2.5 mm diam, 2 to 3 per node on pedicels 2 to 3.5 mm articulated below the middle, surrounded by wide lanceolate membranaceous bracteoles, 1.5 to 3 mm long, persistent, whitish to yellowish, margins lacinate; tepals oblong to oblong-lanceolate, 2.5 mm long, 1 mm wide, reflexed at maturity, apex with a glandular pilose area 0.1 mm long; filaments 1.5 mm long, anthers 1 to 1.2 mm long. Pistillate flowers campanulate, 2.5 mm diam, 1 to 2 per node, on pedicels 3 to 3.5 mm long, articulate below the middle, surrounded by lanceolate membranaceous bracteoles 1.5 to 3 mm long, persistent, yellowish, margins lacinate; tepals lanceolate, 2 mm long, 1.5 mm wide, thickened at the middle of the base, style very short, stigmas 3-branched; nectaries septal, at the base of the ovary. Fruits depressed, 1(–2) per node, 6 mm long, 10 mm wide, on peduncles 6 to 12 mm long, articulate near the base, tepals persistent, the internal adpressed covering the nectaries, the external reflex. Seed 1(2 or 3) per fruit, ovoid to ellipsoid, ca. 3.5 mm long, 2.5 to 3 mm wide, exposed at maturity, maroon. Figure 6; Table 1.

Ecology and Distribution—This species occurs on north-facing slopes, on steep hills and in canyons with alkaline igneous rocks in the sierras de La Giganta, San Francisco, Guadalupe, Las Palmas, and San Bruno in the state of Baja California Sur (Fig. 7). The plants grow mostly in *Quercus* forests and desert scrub with *Brahea brandegeei* (Purpus) H. E. Moore, *Fouquieria columnaris* (Kellogg) Curran, *Ebenopsis confinis* (Standl.) Barneby & J. W. Grimes, *Prosopis* sp., and *Croton* sp., from 700 to 1900 m altitude on volcanic rocks. The plants flower from June to September, and set fruits from October to December.

To assess the identity of the proposed taxon, a set of problems was found within the herbarium collections concerning the probability that this taxon could be either part of *N. palmeri* or of *N. bigelovii*. According to Brandegee (1889), he collected one specimen of an unknown *Nolina* at San Julio on April 19–20 of the same year. He stated that the plant has “leaves only of an arborescent branching species, 15 feet high with light green narrow leaves 3–4 feet long.” These details, and the fact that he also cited a young specimen of *N. bigelovii* from Ubi (Yubay), show evidence that he knew the species, and that it was a different taxonomical entity (Table 1). Recently, Hochstätter (2010)

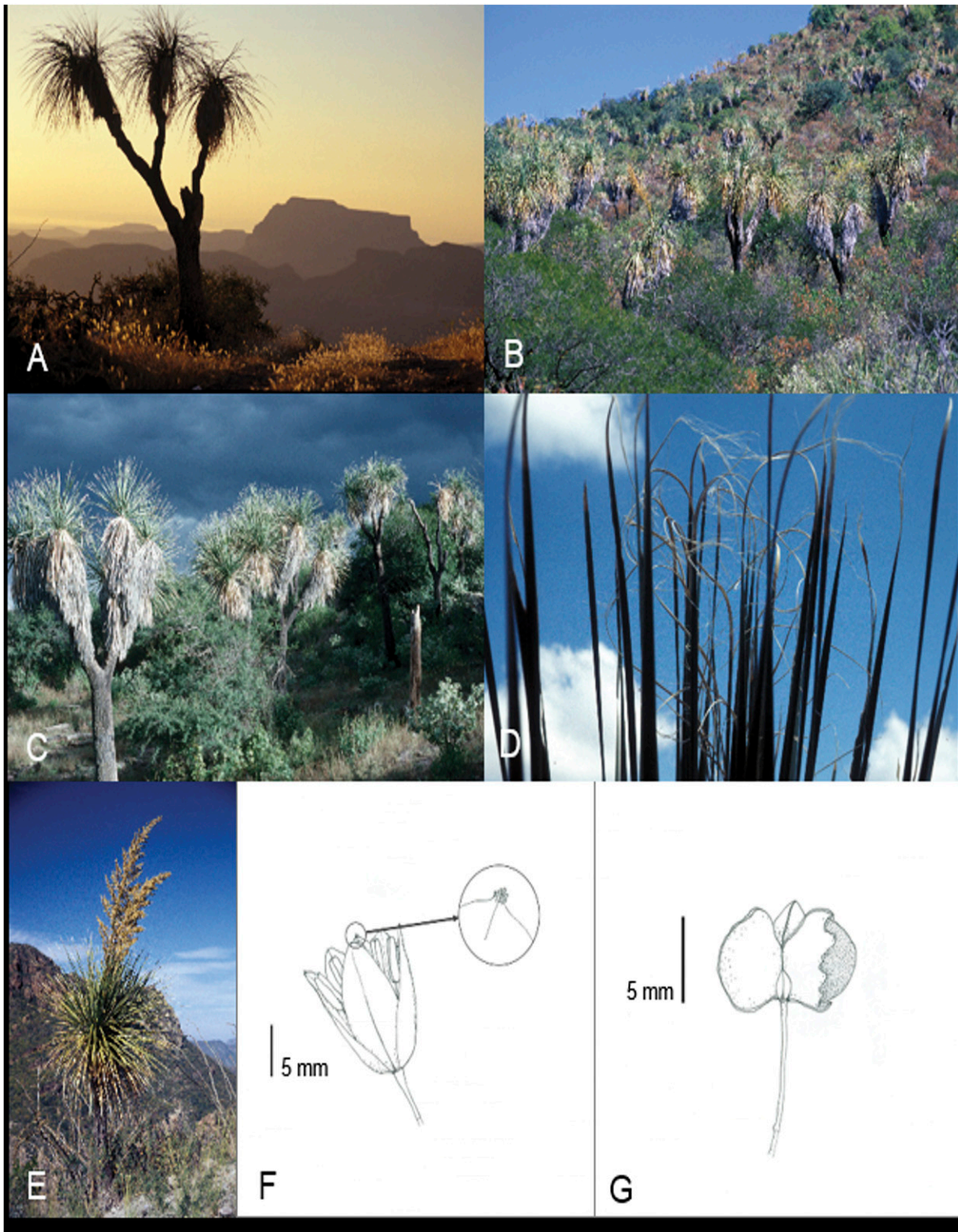


FIG. 6. *Nolina brandegeei*. A. Habitat. B. Plant habit. C. Solitary plant. D. Leaf apices. E. Plant habit with staminate inflorescence. F. Male flower showing the apical trichomes in the tepal (from voucher *J. Dice* 515). G. Fruit (from voucher *W. Hodgson* 9582). Photos: Jon Rebman. Illustrations: Luis Hernández-Sandoval.

presented an article on *Nolina*, considering *N. palmeri* var. *brandegeei* as a synonym for *N. palmeri*. But, the paper appears to be mainly a bibliographic revision and not a detailed taxonomic treatment. However, though *N. brandegeei* has similarities with *N. palmeri*, including the exposed seeds at maturity, it differs greatly in its arborescent habit,

larger and flat leaves, leaf margin denticles forked, shredded and not coiled leaf tips, and larger fruits (Fig. 4). In addition, the type specimen of *Nolina brandegeei* (Trelease) L. Hern. comb. nov. deposited at MO should be relabeled as collected at San Julio, Baja California Sur, on April 19–20, 1889.

TABLE 1. Differences between *Nolina beldingii*, *N. brandegeei* comb nov., and *N. palmeri* (Figs. 1, 5, 6).

Characters	<i>Nolina beldingii</i>	<i>N. brandegeei</i>	<i>N. palmeri</i>
Habit	Arborescent	Arborescent	Acaulescent
Bark plates	Deep elongated rectangles	Rectangular	Pyramidal polygons
Leaf	Flat	Flat	Concave
Leaf base	With constriction	Without constriction	Without constriction
Leaf margin denticles	Curved	Erect	Curved
Denticle	Entire	Forked	Entire, rarely forked
Leaf apex	Entire	Shredded	Slightly shredded
Staminate flowers per node	2(3)	2–3	1(2)
Stamen filaments size	2–2.5	1.5	1–1.2 mm
Fruit size	1 × 1.6 cm	0.6 × 1 cm	0.4 × 0.6 cm
Fruit peduncle size	9.5–11.5	6–12 mm	3–4 mm
Fruit peduncle articulation	Near the base	Near the base	At or below the middle
Seed	Not exposed at maturity	Exposed at maturity	Exposed at maturity
Seed size	4.5 × 3 mm	3.5 × 2.5–3 mm	3.5–4 × 3.5–4 mm
Flowering time	Spring	Summer	Spring
Fruiting time	Summer	Fall	Summer and fall

Representative Specimens Examined—Mexico.—BAJA CALIFORNIA SUR: San Julio, 11 Apr. 1889, *Brandegee s/n* (UC); Ubi, Agua Bonita, 8 May. 1889, *Brandegee s/n* (UC); Sierra La Giganta, above Los Encinos, 1 Mar. 1939, *H. S. Gentry 4292* (GH, MO); Ridge northwest of main peak, Cerro de La Giganta, 23 Nov. 1947, *A. Carter 2038* (LL, MEXU, US); North slope of Cerro San Juan, 4 Feb. 1964, *R. Moran 11584* (SD); Summit of Volcán las Tres Vírgenes, 12 Feb. 1964, *R. Moran 11691* (SD, US); North slope, summit of Cerro de la Higuera, Sierra San Francisco, 21 Feb. 1964, *R. Moran 11723* (SD); Summit, Cerro Natividad, Sierra San Francisco, 24 Feb. 1964, *R. Moran 11751* (SD); At pass ca. 3 miles west of ex-mission Guadalupe on trail to San Pedro, 11 Mar. 1964, *R. Moran 11790* (CAS, SD); North slope at summit of Cerro Azufre, 20 Oct. 1971, *R. Moran 18736* (SD, US); North slope of Cerro Barranco, Sierra de Guadalupe, 23 Oct. 1971, *R. Moran 18822* (SD); Sierra de La Giganta, Cerro Mechudo, the southernmost peak of the Sierra, 2 Nov. 1971, *R. Moran 18892* (BM, MEXU, SD); N slopes of NE side of Volcán Tres Vírgenes, 12 Apr. 1973, *J. Henrickson 8993* (SD); Sierra de Las Palmas, W de San Bruno (31 miles), 20 Jun. 1973, *H. S. Gentry 23319* (AZ, DES, CAS, MEXU, US); Rancho La Laguna, the southernmost peak of the Sierra, 2 Nov. 1971, *R. Moran 23824* (SD); Sierra San Francisco, Mesa San Jorge, ca. 7–7.5 km W of San Francisco & 16 km MW of Santa Marta, 9 Jun. 1984, *J. Dice 512, 515, 516* (CAS, MEXU, SD); Sierra de San Francisco, Mesa de San Jorge, ca. 4.21 km (by road) WSW of the Village of San Francisco de la Sierra, 23 Jun. 1986, *C. Dice, 675* (GH, SD); Sierra de San Francisco, west of the town of San Francisco de La Sierra, along road to Rancho Sorpresa, 24 Apr. 1994, *W. Hodgson 8185A* (DES, SD); Sierra de San Francisco, west of the town of San Francisco de La Sierra, on the road to Rancho Sorpresa, 24 Apr. 1994, *J. Rebman 2627* (BCMEX, SD); Sierra San Francisco, Cerro Bola, 3 Sept. 1995, *W. Hodgson 9582, 9589a* (DES, SD); San Francisco de la Sierra, 23 Oct 1997, *J. Rebman s/n* (HCIB, SD); West of Mulegé; cumbre de San Pedro; between the Ex-mision Guadalupe and San Juan de las Pílas, 29 Oct. 1997, *J. León de la Luz s/n* (BCMEX); Sierra de Guadalupe: West of Mulegé; cumbre de San Pedro between ex-mission Guadalupe and San Juan de las Pílas, 29 Oct. 1997, *J. Rebman 4716* (HCIB, SD); Sierra de San Francisco, 1.5 km al NW de Santa Ana, Nov. 2004, *O. Baltasar s/n*, (QMEX); Sierra de la Giganta, Campamento de la Sabanilla del Mechudo, 11 Nov. 2007, *J. L. León de la Luz 10539* (HCIB, SD); Hernández 2007 (QMEX).

NOLINA INTERRATA H. S. Gentry Madroño 8:181. 1946. TYPE: USA: California, San Diego Co. Slope west of Dehesa School, 5 Aug. 1945, *H.S. Gentry 7330* (Holotype SD, isotypes: AZ, CAL, MICH).

Plant rhizomatous, subterranean stems growing in a horseshoe shape by branching always to the same side; bark reticulate forming pentagonal pyramids 0.5 cm deep, 1 cm wide. Leaf rosettes subsessile, 40 to 90 cm diam, 15 to 25 leaves per rosette. Leaves linear, 48 to 109 cm long, 0.7–1 cm wide, helicoidal, glaucous green, scabrid; leaf margins with two sizes of denticles, the larger ones separated ca. 0.5 mm; leaf bases triangular to long deltate, 6–7 cm long, 3–3.5 cm wide in the inferior part, 1.2–1.5 cm wide in the superior part, yellow straw to dark brown with age, persistent, recurved; leaf apex entire.

Inflorescences paniculate, largely ovoid to largely ellipsoid, 0.8 to 2 m long, 40 to 42 cm wide; scapes 35 to 45 long, 0.8 to 1.3 cm diam at the base; scape bracts linear, 15 to 30 cm long, separated among them by 10 to 15 cm; inflorescence branches compound, 37 cm long, decreasing apically in size to 9 cm, pedunculated, with 2 branchlets at the base, all subtended by papery linear-lanceolate bracts, 14 cm long, decreasing apically in size to 1 cm; branchlets 3 to 8 cm long, the apical ones 8 to 15 cm long, all subtended by amplexicaule papery bracts, 7 to 10 mm long. Staminate flowers 2 to 3(–4) per node, 3 to 3.5 mm diam, on pedicels 4 to 5 mm long, wider in the apex, articulate above the middle, surrounded by membranaceous bracteoles, 2 to 3 mm long, margins dentate; tepals lanceolate, 2 to 3 mm long, 1.5 mm wide, reflexed from the middle at maturity, white to creamy, the midvein yellow green; filament 1 to 1.2 mm long, anthers 0.8 to 1 mm long; ovary undeveloped, on a small stipe. Pistillate flowers 2 per node, 2 mm in diam, on pedicels 1.8 to 2 mm long, articulate around the middle, surrounded by membranaceous bracteoles 2 to 4 mm long, margins dentate; tepals lanceolate, 2 to 2.5 mm long, 1 to 1.5 mm wide, white to creamy with purple dots or blotches around the midvein; staminoids 1 mm long; ovary 1.5 to 2 mm diam, stigmas sessile, 3-lobulate. Fruits slightly depressed, 0.8 to 1 cm long, 1 to 1.2 cm wide, on peduncles 6 to 7 mm long, articulate below the middle; fruit lobes papery, brown with purple reddish spots at the middle, with weak margins; apical notch 2.5 to 3 mm deep; tepals persistent, the external ones reflexed. Seeds ovoid, asymmetrical, 4 to 4.5 mm long, 2 to 2.5 cm wide, grayish green to brown at maturity, microreticulate, punctate, and sometimes with papillate trichomes, hilum suprabasal with a conic caruncle. Figure 8.

Ecology and Distribution—This species grows in sandy to deep soils on slopes with gabbro outcrops, 340 to 460 m in elevation, in chaparral vegetation with *Adenostoma fasciculatum* Hook. & Arn., *Arctostaphylos* sp., *Rhus ovata* S. Watson and *Ceanothus* sp. The individuals of *N. interrata* can withstand periodic wildfires.

It is an endemic and endangered species of San Diego County, California and the northwestern part of Baja California, Mexico (Fig. 2). The plants flower from April to August, and set fruits from August to October.

Representative Specimens Examined—Mexico.—BAJA CALIFORNIA: Rancho de la Cruz, 6 Km ENE of San Antonio de Las Minas, 12 Aug. 1981 *R. Moran 29794* (CAS, MO, TEX); Rancho de la Cruz, 6 Km ENE of San Antonio de Las Minas, 12 Aug. 1981 *R. Moran 29795* (MEXU, MO, SD, UC); 1 km NW of ranch house, Rancho de la Cruz, 6 Sept. 1981, *R. Moran 29836*

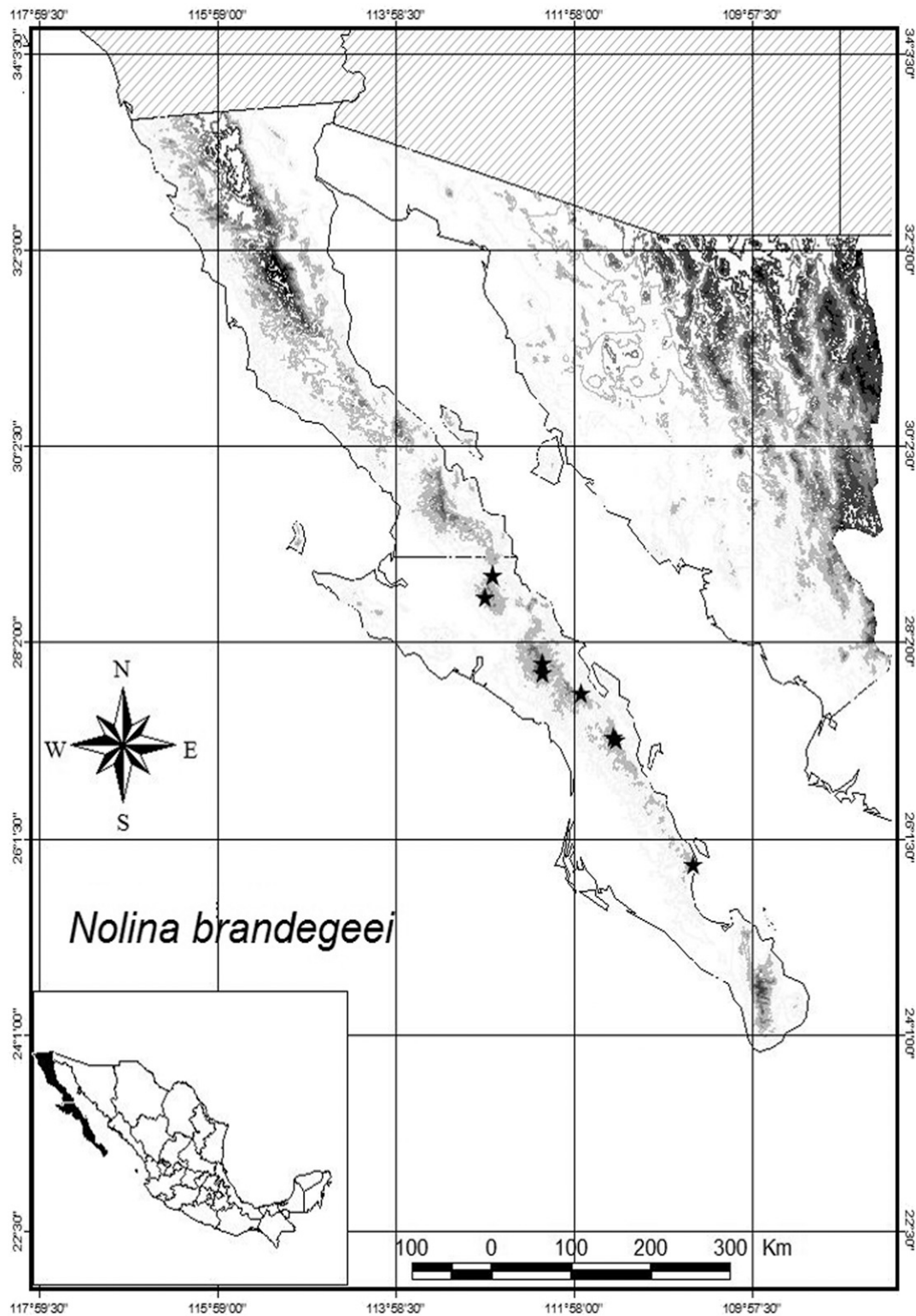


FIG. 7. Distribution of *Nolina brandegeei* in the Baja California Peninsula.

(SD); Upper Canyon Arce, 2 km SW of Rancho de la Cruz, 6 Sept. 1981, R. Moran 29841 (SD); 3 km SSW of Rancho La Cruz, 6 Sept. 1981, R. Moran 29845 (SD); Upper portion of Cañón Arce, ca. 2.1 km of Rancho de la Cruz, ca. 10 km N of Ensenada, J. Dice 621 (CAS); ca. 1 km of Rancho La Cruz, 13 km N of Ensenada, J. Dice 700 (SD).

NOLINA PALMERI S. Watson Proc. Amer. Acad. Arts 14:248. 1879.

TYPE: MEXICO. Baja California, Tantillas (Cantillas) Mountains, 5 Aug. 1875, E. Palmer s/n (Holotype US).

Beaucarnea palmeri (S. Watson) Baker, Journ. Linn. Soc. Bot. 18: 235. 1880.

Nolina palmeri var. *palmeri* Trelease Proceedings of the American Philosophical Society 50:420. 1911.

Plants caespitose forming clumps 3.5 m wide, acaulescent or with trunks 10 to 60(–100) cm high, 10 cm diam; bark forming polygonal pyramids 1 to 1.5 cm deep, 1 to 2(–2.5) cm wide.

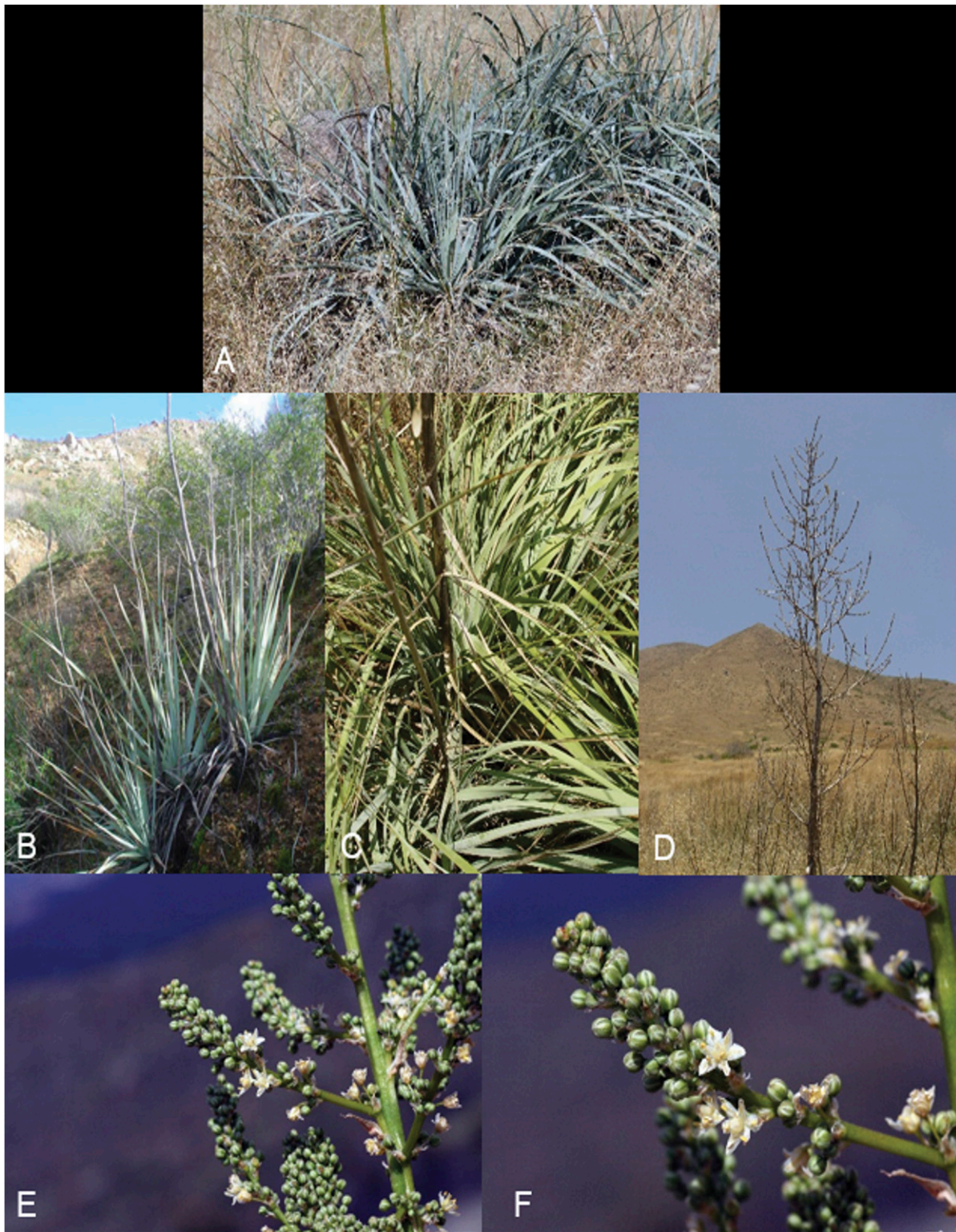


FIG. 8. *Nolina interrata*. A. Habit. B. Plants with inflorescences. C. Inflorescence bracts. D. Inflorescence architecture. E. Staminate inflorescence branch. F. Staminate flowers. Photos A, E, F: Jon Rebman; B–D: Luis Hernández-Sandoval.

Rosettes 12. Leaves linear, 90 to 116 cm long, 4 to 8 mm wide at the middle, concave in cross section; leaf base triangular, (5–)9 to 11 cm long, (2–)4 to 7.5 cm wide below, (0.8–)1 to 1.6 cm wide above; leaf margin with translucent to brown denticles with the epidermis up growing in the middle; leaf tips coiled, becoming dry with a yellow straw color. Inflorescence 0.96 to

3 m high, 8 cm wide; scape 10 to 0.35 to 1 m long, 1 to 4 cm diam at the base with linear bracts, 8 to 50 cm long; the first 15 to 30 cm of the inflorescence bear the loose and thin branches 5 to 8 cm long; the rest of the branches stiff, erect to curved, ascending, 24 to 17 cm long, decreasing in size to 6 to 4 cm at the apex branch, subtended by linear to long triangular bracts,

shorter than the branches, from 16 cm long, decreasing to the apex to 2 cm, papery, the larger ones with tips coiled; branchlets 1–8 cm long, last part of branches beyond the last branching (4–)6 to 11 cm long. Staminate flowers 1(–2) per node, campanulate, 2.5 to 3.5 mm long, 4 to 5 mm wide, on pedicels to 1 mm long, articulated at the very base, surrounded by 2 widely lanceolate bracteoles, the external one 2 to 3 mm long, the internal one 1.5 to 2 mm long, white, membranaceous, margins lacinate to denticulate; tepals oblong to oblong-lanceolate, 2.5–3 mm long, 1–1.5 mm wide, white, reflexed from the middle at maturity; filaments 1 to 1.2 mm long, anthers 1–1.1 mm long. Pistillate flowers 1 to 2(–3) per node, campanulate, 2–3.5 mm long, 3–4 mm wide, on pedicels up to 2 mm long, articulated above the middle, surrounded by lanceolate bracteoles, the external ones 2–4 mm long, the internal ones 1.5–2 mm long, white, membranaceous, margins long lacinate to denticulate; tepals lanceolate, 2.2–2.5 mm long, 1–1.5 mm wide, white with the base thick, greenish, midvein reddish to brown; ovary round, 3 mm diameter, 3-lobed; ovules basal, subtended by a small, round or shelf-like protruding structure, which is flattened by the fertilized ovule growth; stigmas sessile, 3 branched. Fruit depressed to orbicular, 4–5 mm long, 5–7 mm wide, on peduncles 3 to 4 mm long, articulated at or below the middle, green to brown; lobes with margins. Seeds 1 to 2 per fruit, rounded, 3.5–4 mm in diam, exposed at maturity, testa microreticulate, light to dark brown. Figure 9.

Ecology and Distribution—*Nolina palmeri* grows in canyons, on east and west slopes, crevices, boulders, and dry hills, on volcanic and granitic rocks, and granitic alluvium soils, 1250 to 2830 m in elevation (Fig. 10). It is part of the chaparral, and the pine, juniper, and oak forests, along with *Adenostoma* spp., *Arctostaphylos pungens* Kunth; *Artemisia* sp., *Brahea armata* S. Watson, *Ceanothus* sp., *Celtis ehrenbergiana* (Klotzsch) Liebm., *Condalia brandegeei* I. M. Johnston., *Cylindropuntia cholla* (F. A. C. Weber) F. M. Knuth, *Cylindropuntia alcahes* (F. A. C. Weber) F. M. Knuth, *Dodonaea viscosa* Jacq., *Juniperus californica* Carrière, *Pinus jeffreyi* Grev. & Balf., *P. contorta* Loudon subsp. *murrayana* (Grev. & Balf.) Critchf., *Populus tremuloides* Michx., *Prosopis articulata* S. Watson, *Quercus* spp., *Salvia pachyphylla* Munz, and *Yucca schidigera* Ortega. The flowers are visited by Hemiptera to lay eggs that hatch in June. The species flowers from April to June, and produces fruits from July to November.

Nolina palmeri is an endemic species to Baja California, and occurs sympatrically with *N. bigelovii* in the Sierra de San Pedro Mártir and Sierra de Juárez in the northern portion of the state, and is distributed to the Sierra de La Libertad at its southern limit.

Representative Specimens Examined—Mexico.—BAJA CALIFORNIA: Cantillas Canyon, s/d, C. R. Orcutt s/n (US); Piñon District, Oct. 1882, C. R. Orcutt 713 (GH, MO); Piñon forest, 26 Jul. 1883, C. R. Orcutt s/n (US); N Lower California, 3 Jul. 1885, C. R. Orcutt 530 (MEXU -photo-, US); Paraíso, 1890, Brandegee s/n (UC); San Pedro Mártir, 16 May. 1893 Brandegee s/n (UC); San Matías pass, N end of San Pedro Mártir Mountains, 28 June 1905, Goldman E. A 1183 (US); Lower California, 1 Jan 1907, Orcutt C. R. s/n (US); Between Neji Rancho and town Alaska, 16 Sept. 1929, Wiggins I. R. 4167 (CAS, GH, SD, US); La Encantada, Sierra San Pedro Mártir, 20 Sept. 1930, Wiggins I. R. 4962 (CAS, GH, SD, US); Rancho Neji, Sept. 1930, H. Bravo 21–665 (MEXU); Summit of rim just N of Picacho de La Encantada, Sierra San Pedro Mártir, 18 Oct. 1946, Wiggins I. R. 11278 (CAS); Head of Cantillas Canyon 22 Apr. 4 1951, Harbison C. F. s/n (SD); Head of Cantillas Canyon, 1 Sept. 1951, Harbison C. F. s/n (CAS, SD); Head of the trail into Tajo (Cantillas) Canyon, 1 June 1952, Harbison C. F. s/n (CAS, SD); Canyon del Diablo, to the North and West of Picacho del Diablo (Cerro La Encantada), eastern flank of Sierra San Pedro Mártir, 17

June 1954, Chambers K. L. 630 (CAS, UC); Sierra San Borja, San Juan Mine, 24 Mar. 1960, R. Moran R. Moran 8017 (CAS, SD); 3 mi W of Santa Catarina, 64 miles SE of Ensenada, 21 Aug. 1961, Broder R. E. 599 (BM, MEXU, US); Sierra San Pedro Mártir, along trail on way to La Encantada to Rimrock, 5 Sept. 1961, Wiggins I. R. 16647 (CAS); Mouth of Valley of San Juan, 25 Nov. 1961, R. Moran 8497 (CAS, SD); El Topo, Sierra Juárez, 29 June 1962, R. Moran 9811 (CAS, SD, UC); 3 mi north of El Topo, Sierra Juárez, 29 June 1962, R. Moran 9806 (CAS, SD, UC, US); Portezuelo de Jamau, 9 May 1963, R. Moran 10978 (SD, UC, US); Cerro Chato, 3 June 1963, R. Moran 11120 (CAS, SD, UC); Summit Cerro La Sandía, 21 Jan 1964, R. Moran 11536 (CAS, SD); Sierra San Borja, summit of Cerro La Chona, 19 Mar. 1966, R. Moran 12792 (CAS, SD); Sierra Juárez, 1.5 miles NW of Rancho Marcos, 4 Sept. 1966, R. Moran 13481 (SD); Cerro La Encantada, 19 Aug. 1967, R. Moran 14358 (BCMEX, MEXU, SD, UC); Santa Rosa. San Pedro Mártir, 20 Aug. 1967, R. Moran & Thorne R. F. 14426 (BCMEX, LL, UC); Sierra San Pedro Mártir, rocky ridge north of Vallecitos, 6 Jul. 1968, R. Moran 15279 (SD); East slope above Arroyo Copal, 25 Aug. 1968, R. Moran 15515 (BCMEX, MEXU SD); Sierra San Pedro Mártir, near the settlement of Vallecitos, 21 Sept. 1968, Breedlove D. E. 16365 (CAS); On slope above meadow at Vallecitos, Sierra San Pedro Mártir, 9 Aug. 1969, Witham H. V. 420 (BCMEX, SD); West slope of Cerro Piñón, 3 km north of el Alamo, 30 May. 1970, R. Moran 17672 (MEXU, SD); Sierra Juárez, 3 miles SW of San Pedro, 19 Sept. 1971, R. Moran 18517 (SD); Sierra Juárez, 3 Oct. 1971, R. Moran 18665 (SD); North slope at summit of Cerro Matomí, 3 May 1973, R. Moran 20742 (CAS, SD, UC); North slope of Cerro Tarasizo, southernmost peak of range. Also on summit, 2 May 1976, R. Moran 23008 (SD); Los Manzanos, 20 Aug. 1977, R. Moran s/n (BCMEX); Sierra San Pedro Mártir, 20 Aug. 1977, R. Moran 24543 (SD); Steep rocky hillside, 1 km NW of Tres Pozos, 26 May 1979, R. Moran 23008 (CAS, SD); Tres Pozos, Sierra de Juárez, 26 May 1979, R. Moran 27402 (CAS); On rocky slope 3.5 km SE of El Compadre, 14 Nov. 1981, R. Moran 29888 (SD); Arroyo 3 km west of Cerro el Toro, 31 May 1982, R. Moran 30894 (SD); Vallecitos 3 June 1982, Dice J. s/n (BCMEX); Vallecitos Open, road to Observatory and campground, 18 June 1985, Thorne R. F. s/n (BCMEX); Area del observatorio, San Pedro Mártir. 13 Oct. 1985, Delgadillo J. s/n (BCMEX); Observatorio San Pedro Mártir, 29 Jul. 1986, Salazar M. s/n (BCMEX); San Pedro Mártir, 29 Jul. 1986, Passini & Salazar s/n (BCMEX); San Pedro Mártir, 8 Aug. 1986, Passini & Salazar s/n (HCIB); Northern Sierra San Pedro Mártir, SW corner of a small plateau on the western escarpment, 17 June 1988, Sanders A. C. 7940 (BCMEX, SD, UC); Sierra Juárez, 3 miles East of Laguna Hanson, 26 Jul. 1994, Rebman J. 2840 (BCMEX, SD, UC); Sierra San Pedro Mártir, ridgetop above and east of Vallecitos area, 25 June 1996, Rebman J. 3263 (BCMEX, SD); Sierra San Pedro Mártir: Rancho Picacho, norte de SPM, 5 May. 1998, Delgadillo J. s/n (BCMEX); 10 km al W de la Reserva de la Biósfera San Pedro Mártir, 11 Apr. 2004, Hernández L. 5274 (QMEX); 11 km al W de la Reserva de la Biósfera San Pedro Mártir, 11 Apr. 2004, Hernández L. 5275 (QMEX); Carreteras entre Ensenada y San Felipe, 13 Apr. 2004, Hernández L. 5278 (QMEX); Sierra La Libertad: vicinity of el Rodeo; along the trail between Rancho Hierba Buena and Las Cuevitas, 25 Oct. 2009, Rebman J. 18666 (SD).

Species Possibly Present on the Baja California Peninsula—Two species, *Nolina cismontana* and *N. parryi* have not yet been discovered on the Baja California peninsula, but grow at a distance less than 50 miles north of it in San Diego County, California, USA (Hess 2002). It is very likely that either one of these species could occur in the Baja California region. We consider it important to include a small diagnosis of each as well as photographs for both species so that accurate identification can be made if encountered in the region.

NOLINA CISMONTANA DICE

Plants caulescent; rosettes 3 to 7; stems 30–150 cm. Leaves 30 to 90 per rosette; blade wiry, 50–140 cm long, 12–30 mm wide, occasionally glaucous, margins denticulate, not filiferous; bases spoon-shaped, 30–85 mm long. Scape 40–150 cm, 14–35 mm diam at base. Inflorescences paniculate, 90–180 cm long, 10–40 cm wide; bracts persistent, conspicuous. Pistillate

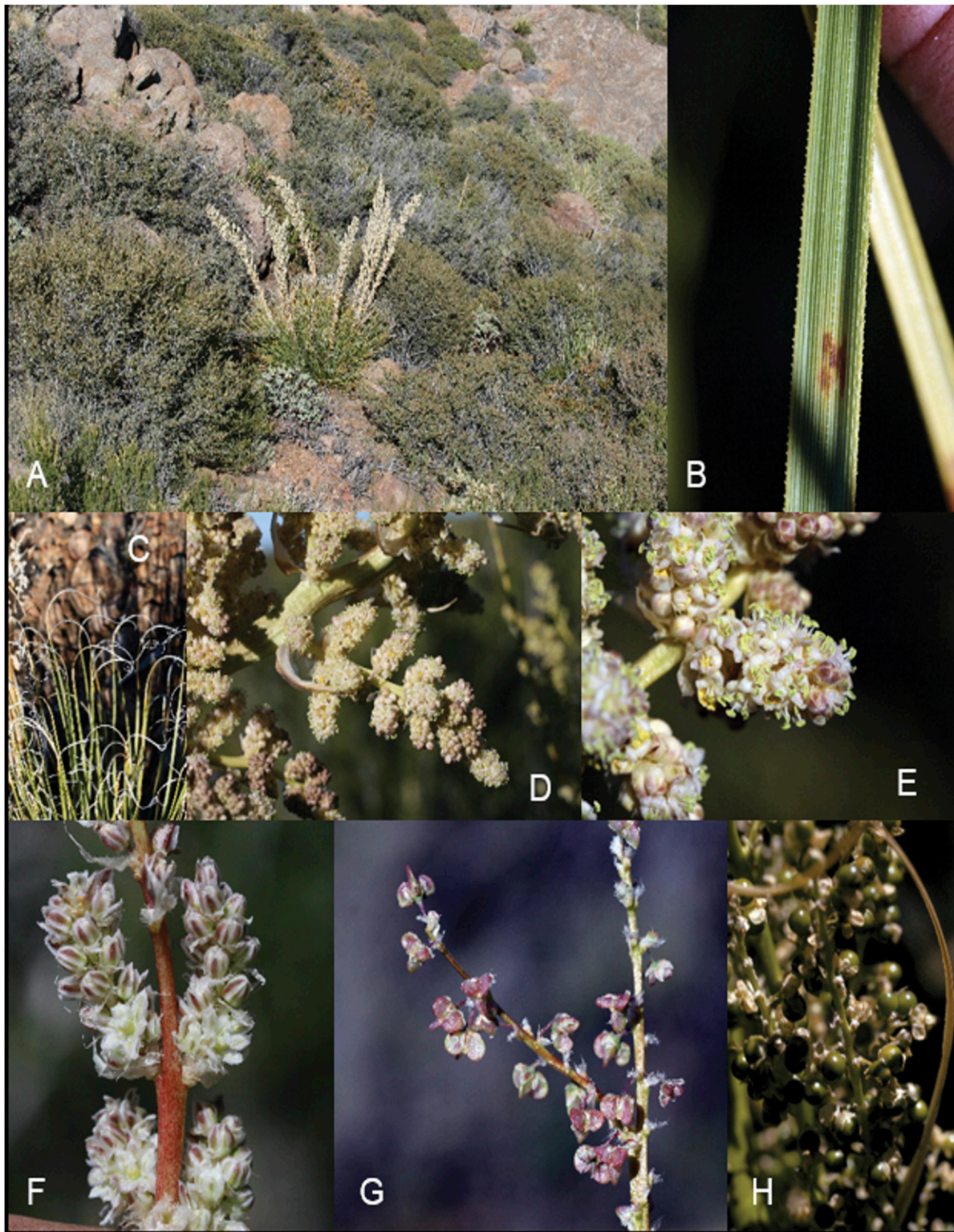


FIG. 9. *Nolina palmeri*. A. Habit. B. Leaf lamina and margin. C. Leaf apices. D. Staminate inflorescence branch. E. Staminate flowers. F. Pistillate flowers. G. Infructescence branch. H. Fruits. Photos: Jon Rebman.

flowers 3 to 5 mm diam on pedicels erect, 3 to 5 mm long, articulate at or above the middle, surrounded by lacinate bractlets; tepals 2.5 to 5 mm long, staminoids 1–1.2 mm, anthers 0.4–0.6 mm; Staminate flowers 3 to 5 mm diam; filaments 2 to 4 mm long, anthers to 1.2 mm; Fruit 8.2–11.2 mm long, 9–12 mm wide, notched basally and apically. Seeds

ovoid, 4 to 5 mm long, 3 to 4 mm wide, reddish brown, exposed at fruit maturity. Figure 11.

According to Hess (2002), *N. cismontana* flowers in early to mid-spring, and grows on rocky hillsides in dry chaparral of coastal mountains from 200 to 1300 m in elevation.

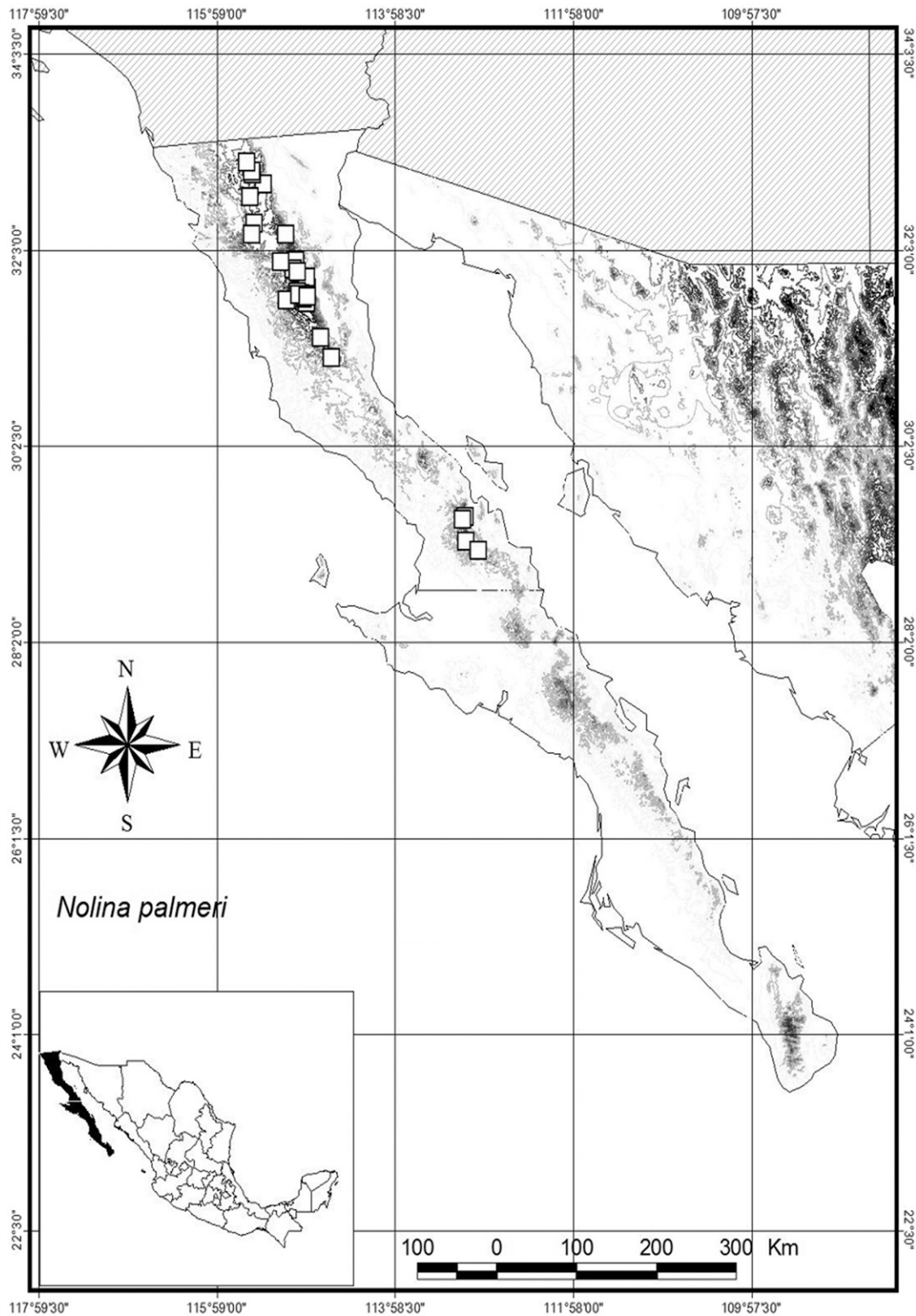


FIG. 10. Distribution of *Nolina palmeri* in the Baja California Peninsula.

NOLINA PARRYI S. WATSON

Plants caulescent; rosettes from woody, branched caudices and forming small colonies. Stems 0.5 to 2.1 m. Leaves 65 to 220 per rosette; blade helicoidal, 50 to 140 cm long, 20 to 40 mm wide, rarely glaucous; bases spoon-shaped, 5–16.5 cm wide; margins denticulate. Scape 40–170 cm, 26–90 mm diam at base.

Inflorescences 20 to 130 cm long, 9–18 cm wide; bracts persistent, 15 to 36 cm long, papery. Pistillate flowers 3 to 5.5 mm diam on pedicel erect, 3 to 4 mm long, articulated at or above the middle, surrounded by lacinate bractlets, to 10 mm, fragile; tepals 2.5 to 5 mm; staminoids 1–2.5 mm long, anthers 0.4 to 0.5 mm long. Staminate flowers 3–5.5 mm diam, stamens 3–4 mm, anthers 1.3–1.8 mm. Fruits 9 to 13 mm long,



FIG. 11. A–E. *Nolina cismontana*. A. *N. cismontana* growing on Camp Pendleton in northwestern San Diego County, California. B. Habit with inflorescence. C. Leaf bases. D. Leaf lamina. E. Fruits. F–H. *Nolina parryi*. F. *N. parryi* on Whale Peak in Eastern San Diego County, California. G. Rosette. H. Inflorescence. Photos by Jon Rebman.

8 to 11 mm wide, notched basally and apically. Seeds ovoid to oblong, 3–4 mm long, 2–3 mm wide, reddish brown, exposed at fruit maturity. Figure 11.

According to Hess (2002), *N. parryi* flowers in early spring and grows on rocky slopes of desert and pinyon-juniper woodlands from 900 to 2100 m in elevation.

ACKNOWLEDGMENTS

The authors would like to thank Mahinda Martínez for her constant herbarium and field support, Yolanda Pantoja for the map illustrations, and Olga Gómez-Nucamendi for the leaf margin photos. Thanks as well to all the herbarium curators and their staff members for their help and kindness while visiting the collections. CONACYT (37081-V) and CONABIO (KT011) funded parts of the project.

AUTHOR CONTRIBUTIONS

Luis Hernández-Sandoval authored most of the taxonomic treatment as well as the *Nolina* historical context, and provided some field collections. Jon Rebman contributed to the species taxonomic descriptions, plant collections, and distribution decisions. He also contributed most of the plant photographs.

LITERATURE CITED

- Brandege, T. S. 1889. A collection of plants from Baja California, 1889. *Proceedings of the California Academy of Sciences* 2: 117–216.
- Brandege, T. S. 1890. A new *Nolina*. *Zoe* 1: 305–306.
- Gentry, H. S. 1972. *The Agave Family in Sonora*. Pp. 180–181. Handbook 399. Washington D. C.: U.S. Department of Agriculture.
- Hess, J. 2002. *Nolina*. Pp. 413–419 in *Flora of North America North of Mexico*, vol. 26, eds. Flora of North America Editorial Committee. New York and Oxford: Oxford University Press.
- Hochstätter, F. 2010. Il genere / the genus *Nolina* (Nolinaceae). *Piante Grasse* 30 (Suppl. al n I): 1–50.
- Martín Barajas, A. 2000. Volcanismo y extensión en la Provincia Extensional del Golfo de California. *Boletín de la Sociedad Geológica Mexicana* V. 53: 72–83.
- Moran, R. 1952. The Mexican itineraries of T. S. Brandege. *Madroño* 11: 221–252.
- Rebman, J. and N. C. Roberts. 2012. *Baja California Plant Field Guide*. Ed. 3. Pp. 88–89. San Diego, California: San Diego Natural History Museum.
- Thiede, J. 2012. Nomenclatural status of unranked names published by Trelease (1911) in *Beaucarnea*, *Dasyllirion*, and *Nolina* (Asparagaceae-Nolinoideae). *Phytoneuron* 77: 1–4.
- Trelease, W. 1911. The desert group *Nolineae*. *Proceedings of the American Philosophical Society* 50: 404–442.
- Wiggins, I. L. 1980. *Flora of Baja California*. Palo Alto: Stanford University Press.