

CHENOPODIUM LITTOREUM (CHENOPODIACEAE), A NEW GOOSEFOOT FROM DUNES OF SOUTH-CENTRAL COASTAL CALIFORNIA

NURI BENET-PIERCE AND MICHAEL G. SIMPSON

Department of Biology, San Diego State University, San Diego, CA 92182, USA
nuribpierce@gmail.com

ABSTRACT

Chenopodium littoreum is described as new. It had been incorrectly cited in the past as *C. carnosulum* Moq. var. *patagonicum* (Phil.) Wahl, a variety of the South American *C. carnosulum*. However, **C. littoreum** differs from the *C. carnosulum* complex in having narrowly elliptic to lanceolate and mostly unlobed leaves, consistently five stamens per flower, and seeds that are invariably horizontal. **Chenopodium littoreum** is similar to another South American taxon, *C. patagonicum* Phil. (= *C. philippianum* Aellen), but the latter differs in having basally lobed leaves, sepals fused above the middle, and generally one or two (rarely five) stamens. **Chenopodium littoreum** has a range currently known only from coastal dunes of San Luis Obispo Co. and Santa Barbara Co. of the Central Coast of California, plus a single historic collection from Los Angeles Co. of the South Coast of California.

Key Words: *Chenopodium*, *C. carnosulum* var. *patagonicum*, *C. patagonicum*, *C. philippianum*, Chenopodiaceae, dune flora, coastal goosefoot.

Chenopodium (Chenopodiaceae; Amaranthaceae *sensu* APG III 2009) is a large genus of approximately 100 species of mostly temperate plants, with a worldwide distribution. It is segregated from the related genus *Dysphania* (ca. 32 species) in recent treatments (Clemants and Mosyakin 2003a, b). Although many species of *Chenopodium* are weeds, some are economically important, such as the pseudo-grain *C. quinoa* of South America (Mabberley 2008).

The preparation of the *Chenopodium* treatment (Clemants and Benet-Pierce in preparation) for the second edition of *The Jepson Manual* necessitated the resolution of issues left pending by the untimely death of Dr. Steve Clemants of the Brooklyn Botanic Garden. One major issue was the taxon *Chenopodium carnosulum* Moq. var. *patagonicum* (Phil.) Wahl, several specimens of which had been cited as occurring (and presumably naturalized) in San Luis Obispo and Santa Barbara counties, California (Wilken 1993). After reviewing the literature and observing numerous specimens and specimen images, we are convinced that the California taxon in question does not correspond to *Chenopodium carnosulum* Moq., nor to *C. patagonicum* Phil. (*C. philippianum* Aellen; see below), and therefore has been an ongoing case of misidentification.

We propose here that what was previously identified as *Chenopodium carnosulum* var. *patagonicum* is actually an undescribed, new species. We presume it to be native and endemic to California, as specimens of this taxon have not been found elsewhere.

Chenopodium littoreum Benet-Pierce & M. G. Simpson, sp. nov. (Fig. 1).—Type: USA, California, San Luis Obispo Co., road along

Jack Lake, ca. 9 km south of Arroyo Grande, ca. 16 m, 35.03858°N, 120.60378°W, 15 May 1966, R. F. Hoover 9856 (holotype: OBI 17235; isotypes: CAS 473439, 473440, 473441).

Paratypes (see Fig. 1F, G for locality map): USA. CALIFORNIA. Los Angeles Co.: Playa del Rey, 33.96184°N, 118.4468°W, 14 May 1904, G. C. Grant s.n. (DS 91772). San Luis Obispo Co.: Oceano, 35.0946°N, 120.622327°W, 30 April 1910, G. F. Condit s.n. (UC 455220); Oceano Dunes, 35.09456°N, 120.622327°W, 30 May 1931, R. Hoffman 420 (CAS 189558); Oso Flaco Lake, 35.02941°N, 120.62756°W, 13 May 1950, L. S. Rose 50116 (CAS 367246, RSA 63058, UC 942915); Morro Bay, 35.37257°N, 120.863926°W, 9 June 1967, R. F. Hoover 10629 (OBI 17236); Morro Bay, 35.37257°N, 120.863926°W, 29 June 1969, J. R. Potter 51 (OBI 4176); Little Coreopsis Hill, 35.03433°N, 120.615°W, 25 May 1980, A. P. Griffiths s.n. (OBI 56356); Black Lake, Highway 1, 35.05885°N, 120.609709°W, 25 April 1985, D. Keil 18563 (OBI); Los Osos, 35.31548°N, 120.86648°W, 9 June 1985, D. Keil 18790 (OBI). Santa Barbara Co.: SBC Vandenberg Air Force Base, 34.79311°N, 120.621247°W, 23 August 1996, D. Keil 25849 (OBI 67573); North Base, 34.74747°N, 120.62801°W, 23 August 1996, D. Keil 25947 (OBI 67553).

Chenopodium littoreum differt a *C. carnosulum* Moq. foliis integerrimis anguste ellipticis lanceolatis vel late lanceolatis plerumque non-lobis basi cuneatis, apice mucronulatis, 5 stamenibus, et semenibus complanatis; differt a *C. patagonicum* Phil. et *C. philippianum* Aellen foliis integerrimis anguste ellipticis lanceolatis vel late lanceolatis plerumque non-lobis, calycis ulterioribus separatis, et 5 stamenibus.

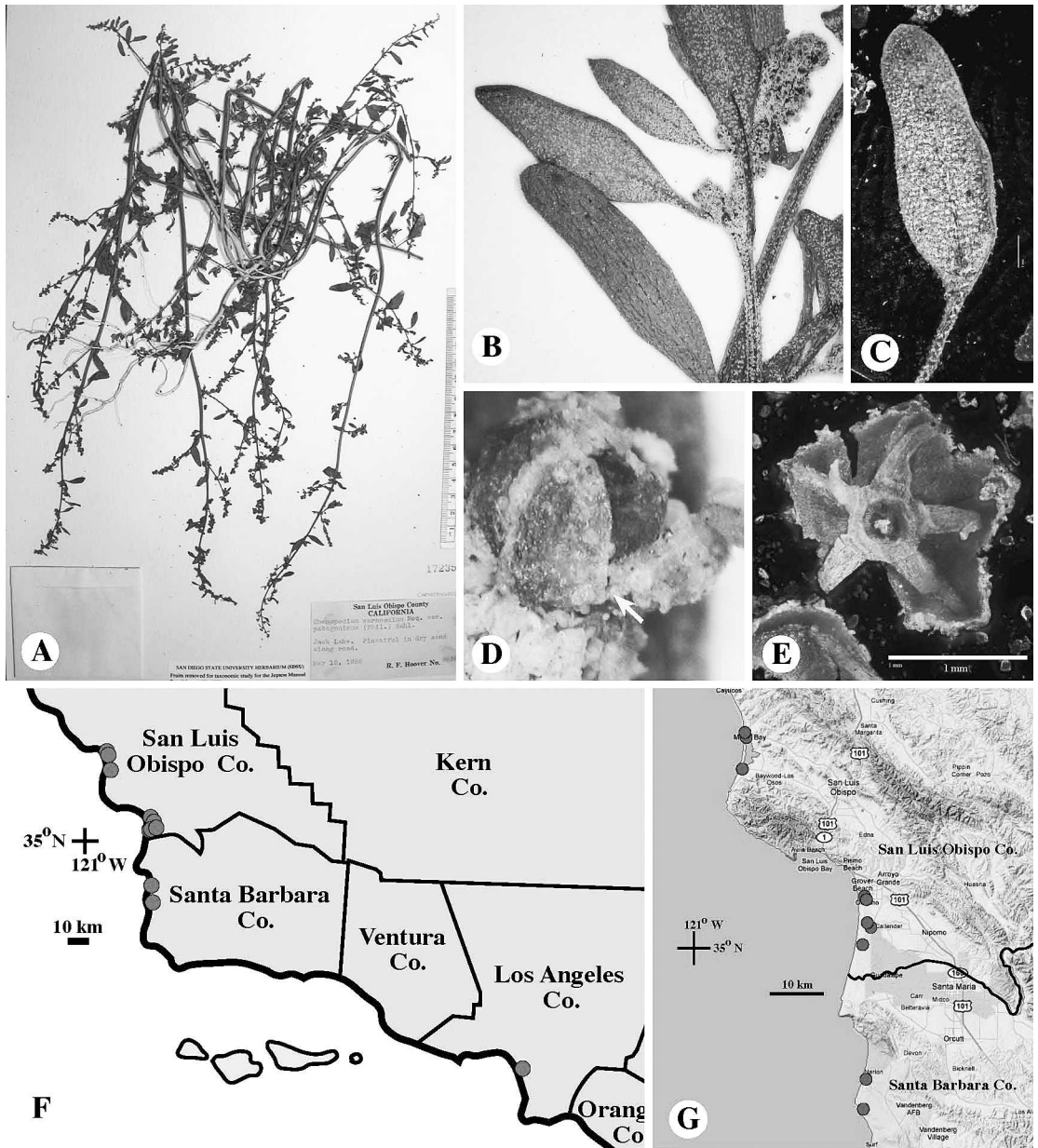


FIG. 1. *Chenopodium littoreum*. A. Herbarium specimen (OBI 17235, holotype). B. Specimen (OBI 67553, paratype). Close-up of leaves, showing narrowly elliptic to lanceolate shape. C. Specimen (CAS 473441, isotype). Single leaf close-up; note farinose surface. Scale bar = 1 mm. D, E. Specimen (OBI 17235, holotype). D. Fruit, showing calyx lobes distinct almost to base (arrow). E. Flower, removed, showing five stamen filaments. Scale bar = 1 mm. F. Distribution map of known collections. G. Close-up of specimen localities in Santa Barbara and San Luis Obispo counties.

Chenopodium littoreum differs from *C. carnosulum* Moq. by having entire, narrowly elliptic, lanceolate, or widely lanceolate, mostly non-lobed, basally cuneate leaves, apex mucronulate, 5 stamens, and horizontal seeds; it differs from *C. patagonicum* Phil. and *C. philippianum* Aellen in having entire, narrowly elliptic, lanceolate, or

widely lanceolate, mostly non-lobed leaves, with calyx lobes distinct to near base, and 5 stamens.

Annual prostrate herb, branched from base, forming mats to ca 4 dm in diameter. **Leaves** alternate; petioles 5–9 mm long; blades narrowly elliptic, lanceolate, or broadly lanceolate, rarely basally lobed, 6–15 (20) mm long, 3–8 mm wide,

light green; base cuneate, apex acute, obtuse, or rounded, often mucronulate, farinose adaxially, densely farinose abaxially. Inflorescence of glomerules up to 7 mm wide, in axillary and terminal spikes and panicles, 1–15 cm long; bracts leaf-like. **Flowers** perfect, radial, approximately 1 mm in diameter; perianth uniseriate; calyx synsepalous, with five lobes, distinct to near base, lobes apically obtuse, densely farinose abaxially. **Stamens** five, distinct, whorled, antisepalous; filaments terete, yellow, with laterally dehiscent, dithecal, subbasifixed anthers. **Gynoecium** syncarpous, hypogynous; ovary superior, with two stigmas. Placentation basal with one curved ovule. **Fruit** an achene, horizontal, dark brown, lenticular, margin rounded, approximately 1 mm in diameter; fruit wall minutely tuberculate to smooth, attached to the seed, but becoming loose at maturity. **Seeds** 0.9–1 mm in diameter, perispermous; seed coat smooth, black-brown to red.

Distribution and habitat: *Chenopodium littoreum* is currently known from dunes of a narrow coastal strip of the Central Coast of California (San Luis Obispo and Santa Barbara counties), and one collection from the South Coast of California (Los Angeles Co.; Fig. 1F, G).

Phenology: *Chenopodium littoreum* appears to flower and fruit from late April to as late as August.

Etymology: The specific epithet, *littoreum*, Latin (pronounced li-TOR-e-um), translates as “of the seashore,” in reference to the coastal distribution of this species.

Suggested common name: Coastal Goosefoot.

DISCUSSION

California collections of *Chenopodium littoreum*, described here, have mostly been identified as *Chenopodium carnosulum* Moq. var. *patagonicum* (Phil.) Wahl (basionym *C. patagonicum* Phil.), purportedly a Californian variety of an otherwise mostly South American species. However, the species *C. carnosulum* is markedly different in a number of features from *C. littoreum*.

Christian Horace Bénédict Alfred Moquin-Tandon described *Chenopodium carnosulum* in 1849. It is mostly found in the southernmost tip of South America, in Chile and Patagonia in Argentina, but specimens have been cited from Peru and Mexico. Examination of an on-line image of the holotype of *C. carnosulum* Moq. (K 583167, Port Gregory, Patagonia, Argentina; Fig. 2A) shows a plant with leaves that are relatively small, rhombic-deltoid, and strongly lobed; this is in contrast to the elliptic or lanceolate, mostly unlobed leaves of *C. littoreum* (Fig. 1A–C). Physical examination of other specimens of *C. carnosulum* (UC 559383; GH 257655, 257651, 257652; and GH (Mexico) 7960, not accessioned; Fig. 2 B–E) and of the infra-

species *C. carnosulum* Moq. var. *scabricaulum* (Speg.) Aellen & Just (GH 257656) all show similar features. The leaves of all of these specimens are small, rhombic-deltoid and strongly lobed (elliptic to lanceolate or widely lanceolate and mostly unlobed in *C. littoreum*); the flower has only one stamen or occasionally 2 (consistently 5 in *C. littoreum*); many of the seeds are vertical or oblique (consistently horizontal in *C. littoreum*); and the fruit wall is often mottled (mottling absent in *C. littoreum*). In addition, the description of *Chenopodium carnosulum* Moq. from the protologue (Moquin-Tandon 1849) states: “Folia 3–4 lin. [=6.3–8.4 mm] longa (incl. petiolo 1/2–1 lin. [=1–2.1 mm]), 1 1/2–2 lin. [=3.2–4.2 mm] lata, subcarnosa; superiora rhombico-deltaidea” This description of the leaves as rhombic-deltoid with a length:width ratio of approximately two substantiates our observations of images and specimens of this taxon. In summary, the significant disparities between *C. carnosulum* Moq. and the taxon described here definitively rules out any possible identity between the two.

Given that the basionym for Wahl’s taxon is *C. patagonicum* Phil., we investigated the features of that taxon in comparison to *C. littoreum*. The original description by Philippi (1895) of *C. patagonicum* reads: “foliis ... integerrimis, ovatis seu oblongo-triangularibus, basi sub truncates vel trapezoideis, interdum basi utrinque unidentatis...,” translated as “the leaf is entire, ovate or oblong-triangular with base subtruncate, or [leaf] trapezoidal, sometimes basally one-toothed from both sides.” These characters are different from the narrowly elliptic to widely lanceolate (base cuneate) leaves of *C. littoreum*, which cannot be described as trapezoidal or subtruncate. The accompanying description in Spanish by Philippi just below the Latin one, says “su lamina 21 milímetros de longitud i [sic] 15 milímetros de anchura, pero la mayor parte de las hojas tienen la mitad de ese tamaño ...” (“its blade 21 mm long by 15 mm wide but the majority of the leaves are closer to half of this size”). The measurements of 21mm by 15 mm are inconsistent with the leaf length of *C. carnosulum* (ca. 6 to 8 mm) and are not those of an elliptic to widely lanceolate leaf either, as in the Californian *C. littoreum*. In the original description, the leaves of *C. patagonicum* (Philippi 1895) resemble those of *C. carnosulum* in shape, but are apparently larger in size.

Additional evidence of the distinctiveness of *C. littoreum* comes from synonymy. Aellen (1929) and Aellen and Just (1943) combined three previously described Argentinian taxa - *C. fuegianum* Speg. (1896), *C. patagonicum* Phil. (1895), and *C. scabricaulum* Speg. (1902) (the last having three varieties) with *C. carnosulum* Moq. (1849), which has nomenclatural priority. Thus, these authors considered *C. patagonicum* Phil. to

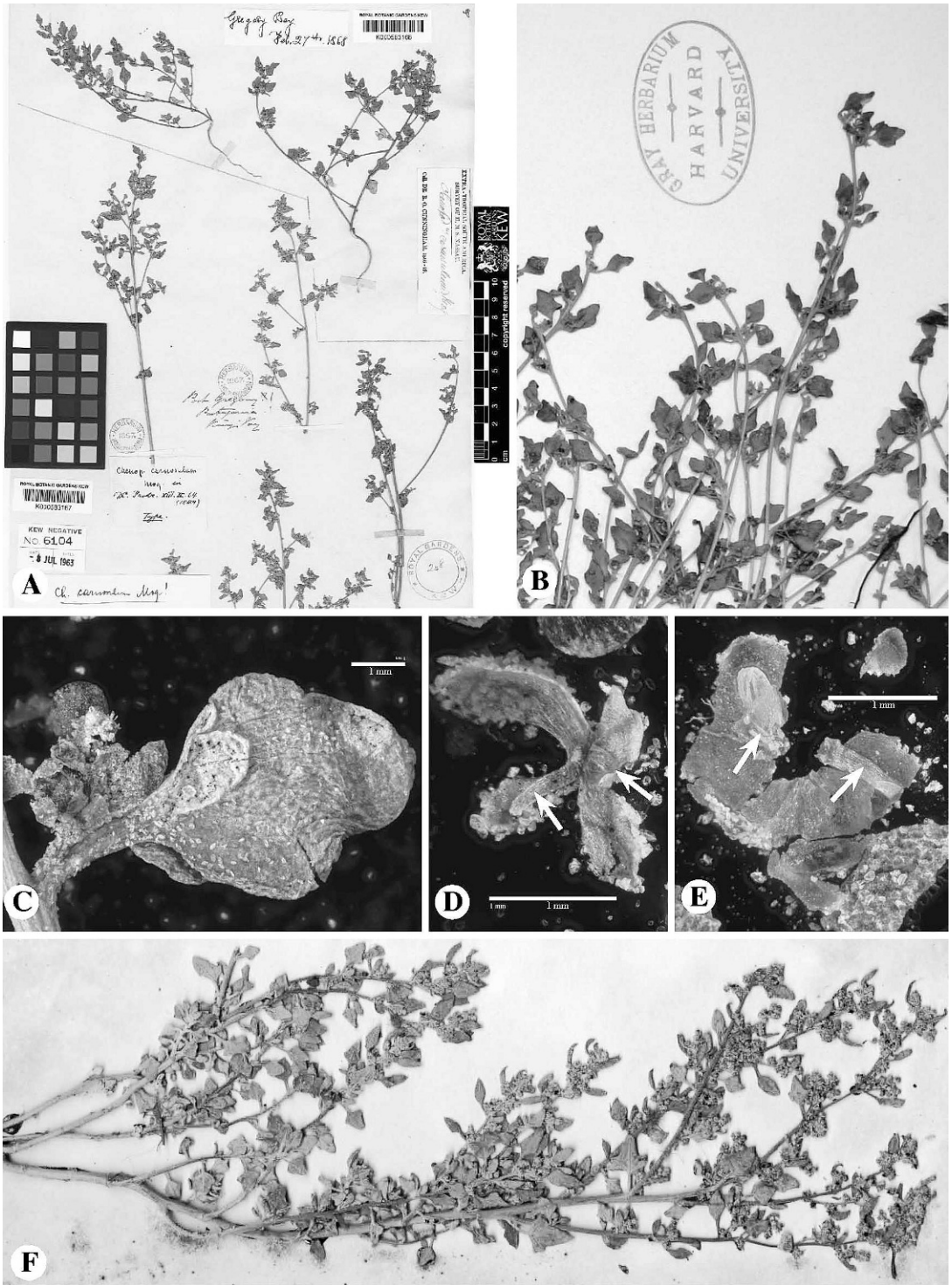


FIG. 2. *Chenopodium carnosulum* Moq. A. Holotype (K 583167). Note relatively short, rhomboid to deltate, basally lobed leaves. B–E. Specimen, Mexia 7960 (GH, *s.n.*). B. Close-up of shoot, showing similar, rhomboid leaves. C. Single leaf, showing rhomboid shape with two lateral lobes. Scale bar = 1 mm. D, E. Close-up of flower remains, showing calyx lobes distinct nearly to base and only two stamens (arrows). Scale bars = 1 mm. F. *C. carnosulum* (*Chenopodium parryi* Standl.) specimen C. Parry 780 (central Mexico, 1878, MO 46467, isotype). Note identical, rhomboid-trapezoid leaves.

be the same taxon as *C. carnosulum*, which, as we already have shown, is quite distinct from *C. littoreum*. These authors presumably thought that any variation between these three species, in a genus well known for its lack of definite and stable leaf characters, was insufficient to warrant separate species status from *C. carnosulum*.

Aellen, having revised the genus in the American continent, pointed out that the original collection of *C. carnosulum* did not come from California, as Moquin-Tandon had noted, but from Port Gregory, Patagonia. Aellen (1929) annotated the type specimen collected by O. Cunningham, the same that Moquin-Tandon had identified as the holotype of *C. carnosulum* Moq. (K 583167). Aellen was clear in his opinion of this: "Moquin made a mistake when he stated, in the 'Prodomus', California as the native country of the original plant. The exemplary originates from Patagonia (Port Gregory). This led to the fate of the species being sealed in the South American literature. North American botanists were certainly mystified by *Ch. carnosulum* Moq., as it couldn't be found in California. S. Watson (l.c.) treated it as a 'doubtful species.' Standley (l.c.) mentioned it from Mount Orizaba, Mexico; yet the identification is not certain." (Aellen 1929, translation by D. Pierce-Knies, personal communication).

In order to ascertain the presence of the South American *C. carnosulum* in North America, we studied other species that have been associated with *C. carnosulum*. One of them, *C. parryi* Standl., was for a time an accepted taxon. The type specimen from Mexico (MO 46467, *C. Parry* 780, central Mexico, 1878; Fig. 2F) shows a species with a trilobed leaf much like *C. carnosulum*, described by Standley as "... leaf-blades triangular or triangular-rhombic in outline, 3–5 mm. long, 3–4 mm. broad, 3-lobed, ..." (Standley 1916). Wahl (1965) also considered this species, stating "The type (no other collection has been referred to it) fits in geographically with the other two Mexican records even if these were difficult to place with any ... *C. Parryi* Standley seems to be the same as *C. carnosulum* Moq. var. *carnosulum*" (Wahl 1965). And we concur, as the type from MO (Fig. 2F) shows the same rhomboid, basally lobed leaf as in *C. carnosulum*, evidently different from that of *C. littoreum*. Thus we confirmed the presence of *C. carnosulum* in North America, but not in the United States.

H. A. Wahl, who revised the genus *Chenopodium* in North America (Wahl 1954, 1965) had recognized the California taxon as puzzling, citing several specimens from CAS that "when I examined them in 1955, could not be placed with any known North American species. These were from sand dunes or similar habitats along or near the coast in San Luis Obispo and Santa Barbara counties, California" (Wahl 1965, p. 137). Wahl

(1965) believed that the California specimens in question were *C. patagonicum*, which he then reduced in rank to *C. carnosulum* var. *patagonicum*. Wahl based his opinion solely on what he described as a photograph of the type of *C. patagonicum*, which he said "is such an exact match for the California plants as to leave no doubt as to their inclusion with this species" (Wahl, 1965, p. 138). As representatives of this taxon, Wahl cites one Chilean specimen (*Bauch-tien s.n.*, in part, Feb. 1903, US; this specimen not listed on the US database); two Mexican specimens (*Seaton 184*, 6 Aug. 1891, GH; this specimen not listed on the Harvard University Herbaria database; *Balis B5503*, 22 Sept. 1938, UC), and several California specimens (*Eastwood 789*, 2 July 1906, CAS; *Hoffmann s.n.*, 29 March 1939, CAS; *Condit s.n.*, 30 April 1910, UC; *Hoffmann 420*, 30 May 1931, CAS; and *L. S. Rose 50116*, 13 May 1950, CAS, UC). However, his conclusions are puzzling, given the disparity in leaf morphology (let alone stamen number) between *C. littoreum* and *C. carnosulum*. We have not seen the specific Chilean specimens he mentioned, but we have examined other specimens of *C. carnosulum*. Having seen all of the same specimens of California collections, we firmly believe they do not correspond to *C. carnosulum*. Wahl, however, treated the California taxon as a variety of *C. carnosulum*, presumably on account of the differences he observed and because *C. patagonicum* had already been treated as a synonym of the former by Aellen (1929) and Aellen and Just (1943).

We have been unable to physically examine specimens of *C. patagonicum* Phil., but we have now seen an image of the type (SGO 38811; Fig. 3). The type specimen does look similar to *C. littoreum* in leaf morphology in that some leaves are narrowly elliptic to widely lanceolate. However, most leaves, in particular the mature ones, are "trullate" in appearance, i.e., rhombic with a more elongate upper half, with two, small lobes near the base, and a mostly rounded apex (Fig. 3B). Thus, leaf morphology of *C. patagonicum* is somewhat different from that of *C. littoreum*, and intermediate to that of a typical *C. carnosulum* (Fig. 2). It is plausible that it was the picture of this plant, identified as *C. patagonicum* Phil., that convinced Wahl that the Californian plants were equivalent, introduced from South America.

From the SGO 38811 image of the *C. patagonicum* type, we noted that this specimen had been annotated as *C. philippianum* (A. Marticorena, annotated 2000; Fig. 3C). In addition, *C. patagonicum* has been treated as a synonym of *C. philippianum* in at least one recent treatment (Marticorena 2008). If indeed these two taxa are equivalent, we do not understand why *C. patagonicum* Phil. (1895) would not have



FIG. 3. *Chenopodium patagonicum* Phil. Type specimen (SGO 38811). A. Whole herbarium sheet, B. Close up of larger plant (at left on sheet). Note leaves varying from narrowly elliptic to widely trullate, with two, small lobes near base. Scale bar = 1 cm. C. Close-up of herbarium labels. Note original designation as *C. patagonicum* Phil., annotated as *Chenopodium philippianum* Aellen by A. Marticorena (2000).

nomenclatural priority over *C. philippianum* Aellen (1929). This discrepancy we hope to address in a later study in conjunction with our Chilean colleagues at SGO.

Because *C. philippianum* looks superficially similar to *C. littoreum*, and indications are it may be equivalent to *C. patagonicum*, it was particularly important to thoroughly investigate

the former from specimens. We have physically examined *C. philippianum* (GH 257649; Fig. 4A–C), the same specimen Wahl had also examined and which he had determined to be different from the California collections. We found the leaves to resemble *C. patagonicum*, being generally rhomboid and lobed, although they are much larger and with lobes much less pronounced than *C.*

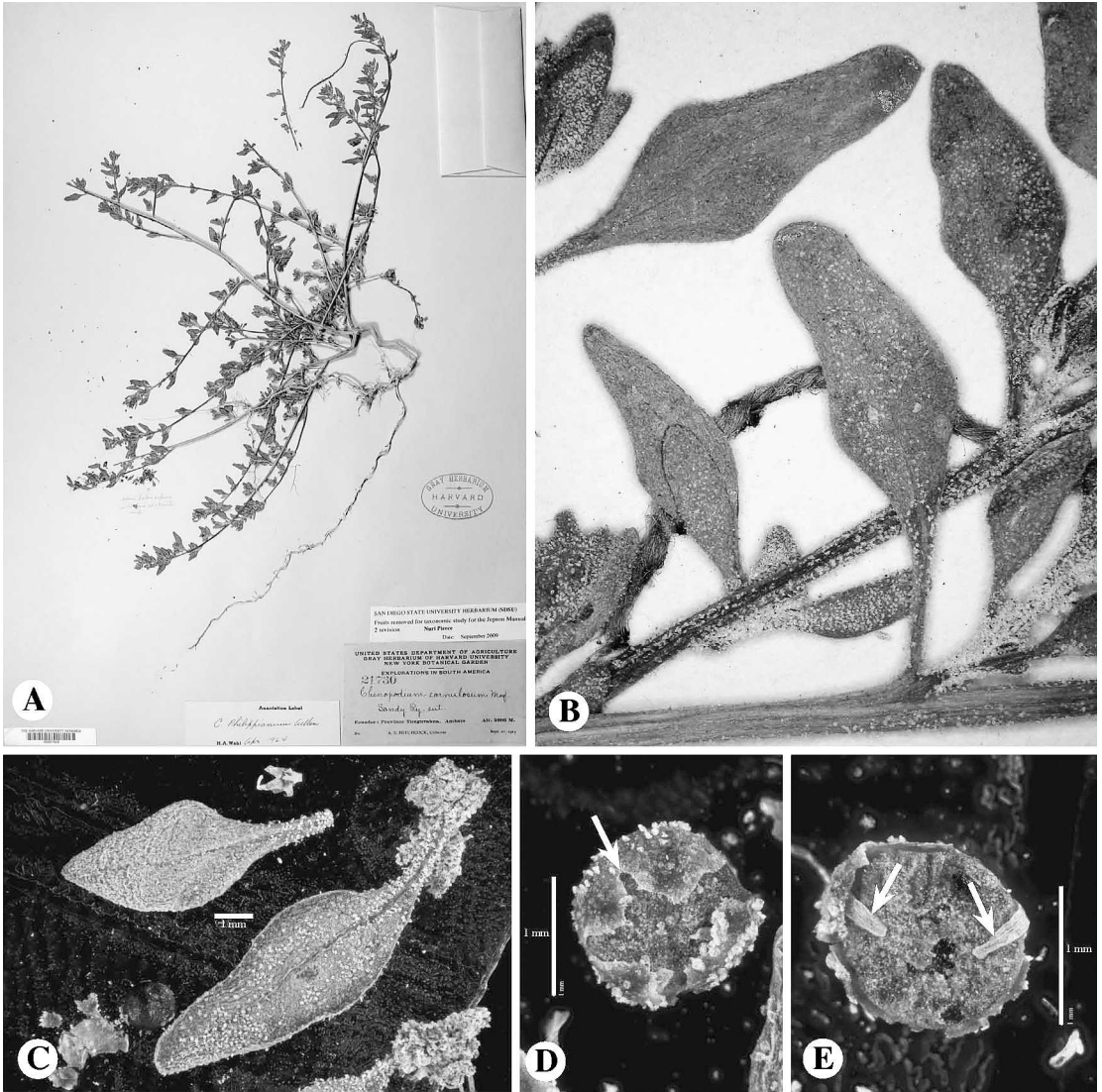


FIG. 4. *Chenopodium philippianum* Aellen. A–C. Specimen GH 257649. A. Herbarium sheet. B, C. Leaves, showing somewhat trullate to widely lanceolate shape, with slight lobbing near base. Scale bar = 1 mm. D, E. Specimen GH 21730. Scale bars = 1 mm. D. Fruit, showing calyx fused (arrow) more than halfway to apex. E. Fruit, showing remains of two stamens (arrows).

carnosulum. We have been able to ascertain that the leaf apices are rounded to obtuse and generally not mucronulate, which is often the case in *C. littoreum*. In the two type specimens of *C. philippianum* (K 583181 and K 58382, both images available on line), the leaves are even more strongly lobed than the specimen we physically examined, but they probably represent more mature plants. *C. philippianum* also has a variable number of stamens (mostly 2–3, occasionally 5) (GH 21730; Fig. 4E). In addition and perhaps more significantly, the sepals of *C. philippianum* are fused to half or more than half of their length (Fig. 4D), whereas in *C. littoreum*

the calyx is fused well less than half its length (Fig. 1D), calyx fusion being somewhat useful diagnostically in *Chenopodium*. Thus, we can rule out this species being the same as the Californian taxon on the basis of the leaf shape and apex, calyx fusion, and stamen number (Fig. 4). In general, though, this species does show stronger similarities with *C. littoreum* than do any taxa of the *C. carnosulum* complex, and future molecular work could better elucidate their relationship. To further explore the *C. patagonicum* type, we asked the curator of SGO in Santiago, Chile, to examine the type of *C. patagonicum* (SGO 38811; Fig. 3). Dr. M. Muñoz reported the

specimen having 2 and 5 stamens and a calyx fused to around the middle (personal communication). These findings would support the consideration that *C. patagonicum* Phil. and *C. philippianum* Aellen are the same species. We also reviewed the diagnosis of *C. philippianum* by Aellen (1929). Aellen had problems identifying the material from which he diagnosed this species: "The labeling of the Philippianum material is extremely difficult. To approximate the species is only indirectly possible. The Washington original material of Cordillera de Talca is a very incomplete, small specimen, which can't be accurately identified; the one from Berlin is a little more complete, but does not feature any fully developed seeds ... Philippi, seemingly, never published his *Ch. Andinum* ..." (translation by D. Pierce-Knies, personal communication).

It is plausible that Aellen (1929) described *C. philippianum* as a new species (even given the poor material he had seen), unaware that it was equivalent to *C. patagonicum*. In the past, he had incorrectly accepted *C. patagonicum* to be a synonym of *C. carnosulum* even if he had done this while issuing a warning that the synonymy of *C. carnosulum* could be in doubt: "Assumedly, it [*C. carnosulum*] was newly characterized by Philippi or Spegazzini; it still needs to be established with certainty whether it is the same as *Ch. patagonicum* Phil. or *Ch. fuegianum* Speg. or *Ch. Scabricaule* Speg." (Aellen 1929, translation by D. Pierce-Knies, personal communication). We have recently seen an image of *C. fuegianum* (SGO 59002), which is now identified as *C. carnosulum* var. *carnosulum*, *C. carnosulum* having priority over *C. fuegianum*. Aellen's concerns also give further credence that these two species, *C. philippianum* and *C. patagonicum*, could be the same.

On the other hand, when Wahl examined the California collections, specimens that had been sent to Wahl by R.F. Hoover from San Luis Obispo, the notion that *C. littoreum* could be a new species did occur to him. He wrote (Wahl 1965): "The possibility of these representing an undescribed species was considered but the known occurrence on the west coast of varieties of species native in the drier and colder parts of southern and western South America [*C. macrospermum* Hook. f. var. *farinosum* (Wats.) J. T. Howell, *C. chenopodioides* (L.) Aellen var. *Degenianum* (Aellen) Aellen and var. *Lengyelianum* (Aellen) Aellen] suggested a possible similar relationship for these relatively restricted plants." Wahl never confirmed this relationship. We have been able to determine that the above naturalized *Chenopodium* species for the most part have vertical seeds, and probably are not comparable at all to *C. littoreum*; they were presumably cited as an analogy, indicating that because other South American species have become established

in California, what we are calling *C. littoreum* could have been as well.

Thus, although it was presumably a picture of the type of *C. patagonicum* that convinced Wahl of its equivalence to what we are describing as *C. littoreum*, we can only rely on the facts: 1) that *C. patagonicum* is described as having "ovate or oblong-triangular with base subtruncate, or [leaf] trapezoidal, sometimes basally one-toothed from both sides, 21 mm long by 15 mm wide" in the protologue (Philippi 1895), agreeing more with the leaf shape of *C. carnosulum* and *C. philippianum* but not with *C. littoreum*; 2) that the type of *C. patagonicum* shows differences in leaf morphology from *C. littoreum* in the former being trullate in shape with basal lobes; 3) that *C. patagonicum* has been considered a synonym of *C. carnosulum* by some authors (Aellen 1929; Aellen and Just 1943), a taxon quite different from *C. littoreum*; and 4) that *C. patagonicum* is apparently equivalent to *C. philippianum*, a taxon that we have been able to show differs from *C. littoreum* in having stamen number 2–3 or occasionally 5, a more extensive sepal fusion, and differences in leaf morphology. Therefore, we do not believe that *C. patagonicum* Phil., nor by extension *C. carnosulum* Moq. var. *patagonicum* (Phil.) Wahl, nor *C. philippianum* Aellen are the same taxon as *C. littoreum*. No other South American taxa that we know have been associated at any point with these species' characteristics. We have thoroughly reviewed every species at one time associated with *C. carnosulum* and *C. patagonicum*. We have reviewed Chilean (Marticorena, 2008; Reiche, 1911) and Argentinean (Toloaba, 2006) keys to *Chenopodium* and have found no other species that would fit the description of *C. littoreum*. In particular, it is the highly restricted range of *C. littoreum*, in the absence of any other likely candidate in *Chenopodium* keys for South America, Baja California (Wiggins, 1980), or neighboring North American states (Clemants and Mosyakin 2003a), plus its differences with the above-mentioned species, that supports the conclusion that it is endemic, particularly in a region well known for dune endemic vegetation (D. Keil California Polytechnic State Univ., personal communication).

In conclusion, the Californian *Chenopodium littoreum* described here does not conform to any of the South American taxa that have been associated with it nor to any other we have separately considered, and its narrow range makes it unlikely that it should be. *Chenopodium littoreum* is also unlike any other North American species in the genus. Although it shares some characters with other *Chenopodium* species found here, with the usual horizontal seed and five perianth parts, none of these taxa is prostrate. Other *Chenopodium* species in North America that are either prostrate or somewhat decumbent

have vertical or vertical and horizontal seeds and have usually one or two stamens, or other differing vegetative or floral characters.

We end with this quote from Wahl (1954): “No group of plants of comparable size and wide distribution known to the writer has suffered the lack of understanding of the taxa involved as has the genus *Chenopodium* ... The reasons for this lie in (1) the ecological variability characteristic of weedy annuals, (2) the fact that important diagnostic characters are present in the seeds, which are of small size and often lacking from collected material, (3) the repetition of similar variations in habit and leaf shape in distinct species and (4) the lack of pubescence characters in most species.” The convergence of these factors probably contributed to the confusion that has surrounded *C. littoreum*, this new Californian species, to this day. We are hopeful that future molecular work will clarify some of the confusion in this complex and lead to further elucidation of the relationships among South and North American taxa.

ACKNOWLEDGMENTS

Our sincere thanks to Drs. D. Keil, A. Marticorena, M. Muñoz for their expert advice, to Drs. D. Trock and E. Zacharias for their generous assistance with locating needed specimens, and the following herbaria for allowing us to examine material or images CAS-DS, GH, JEPS, OBI, RSA-POM, SGO, and UC. Thanks to E. N. Genovese, Professor Emeritus of Classics and Humanities at SDSU, for his help on the name of the name of this new species and to Lee M. Simpson for his help with the images. We specially want to thank our reviewers for their help and willingness to work under a very tight deadline.

LITERATURE CITED

- AELLEN, P. 1929. Beitrag zur Systematik der *Chenopodium*-Arten-Amerikas, vorwiegend auf Grund der Sammlung des United States National Museums in Washington, D.C. I, II. Feddes Repertorium Specierum Novarum Regni Vegetabilis 26:31–64, 119–160.
- AND T. JUST. 1943. Key and synopsis of the American species of the genus *Chenopodium* L. American Midland Naturalist 30:47–76.
- APG III. 2009. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III. Botanical Journal of the Linnean Society 161:105–121.
- CLEMANTS, S. E. AND S. L. MOSYAKIN. 2003a. *Chenopodium*. Pp. 273–299 in Flora of North America Editorial Committee (eds.), Flora of North America north of Mexico, Vol. 4. Oxford University Press, NY.
- AND —. 2003b. *Dysphania*. Pp. 267–273 in Flora of North America Editorial Committee (eds.), Flora of North America North of Mexico, Vol. 4. Oxford University Press, New York, NY.
- MABBERLEY, D. J. 2008. Mabblerley's plant-book: a portable dictionary of the higher plants, their classification and uses, 3rd ed. Cambridge University Press, Cambridge, U.K.
- MARTICORENA, A. 2008. Clave Para la Identificación de las Especies de *Chenopodium* en Chile. Website <http://www.chlorischile.cl/chenopodium/chenopodium.htm> [accessed 10 June 2010].
- MOQUIN-TANDON, C. H. B. A. 1849. *Chenopodium carnosulum*. In Augustin Pyramus de Candolle. Prodrromus Systematis Naturalis Regni Vegetabilis 13(2):64.
- PHILIPPI, R. A. 1895. Plantas Nuevas Chilenas. Anales de la Universidad de Chile 91:419.
- REICHE, K. 1911. Estudios críticos de la Flora de Chile. Anales de Universidad de Chile 6:148–159. Available at: <http://www.biodiversitylibrary.org/item/10736#1> [accessed 15 June 2010].
- STANDLEY, P. C. 1916. *Chenopodium*. Pp. 1–93 in North American Flora, Vol. 21. The New York Botanical Garden, NY.
- TOLOABA, J. A. 2006. Chenopodiaceae Vent. Aportes Botánicos de Salta 7:18, Herbario del Museo de Ciencias Naturales de Salta (MCNS), Buenos Aires, Argentina.
- THE FLORA OF BAJA CALIFORNIA. 2009, onwards. San Diego Natural History Museum, San Diego, CA. Website <http://bajafloora.org> [accessed 10 June 2010].
- WAHL, H. A. 1954. A preliminary study of the genus *Chenopodium* in North America. Bartoniana 27: 1–46.
- . 1965. *Chenopodium carnosulum* and some related taxa in North and South America. Leaflets of Western Botany 10:137–156.
- WIGGINS, I. L. 1980. Flora of Baja California. Stanford University Press, Stanford, CA.
- WILKEN, D. H. 1993. *Chenopodium*. Pp. 506–511, 513 in J. C. Hickman (ed.), The Jepson manual: higher plants of California. University of California Press, Berkeley, CA.