

TAXONOMIC IDENTITY OF A RECENTLY NATURALIZED *SENECIO* SPECIES IN CALIFORNIA

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ABSTRACT

A species of the diverse genus *Senecio* (Asteraceae), originally identified as the Australian *S. quadridentatus* Labill. and reported naturalized in Orange and San Diego counties, California, was determined to be correctly identified as the South African *Senecio angustifolius* (Thunb.) Willd. True *Senecio quadridentatus* is confirmed to be naturalized in southern California in Santa Barbara County, both in mainland coastal regions and on Santa Rosa Island. The two species differ in plant habit (perennial herb in *S. quadridentatus*, shrub in *S. angustifolius*), leaf length (60–130 mm in *S. quadridentatus*, 10–35 mm in *S. angustifolius*), head type (disciform in *S. quadridentatus*, discoid in *S. angustifolius*), and head shape and size (involucre narrowly cylindrical and 6.5–10 mm in *S. quadridentatus*, involucre widely cylindrical and 5–6 mm in *S. angustifolius*). Evidence for these determinations, a description for *Senecio angustifolius*, and a revision to the key to *Senecio* in California are presented. The eradication of these exotics in natural habitats of southern California is ongoing, but further monitoring is required.

Key Words: Asteraceae, invasive, naturalized, nomenclature, *Senecio*, taxonomy.

The narrow focus of local floras makes identification of recently introduced species problematic, especially if the taxon is part of a diverse genus. In the case of invasive species that have no clear country of origin, even the search for relevant literature can be arduous, particularly if monographs of the genus are not available. This was the case with a relatively recent discovery of a *Senecio* species in San Diego and Orange counties, California. *Senecio* is one of the more diverse genera of flowering plants, with approximately 900–1000 species, depending on how it is circumscribed (Frodin 2004). The genus is taxonomically challenging, with over 20 segregate genera having been recognized (Mabberley 2017). Species of *Senecio* are distributed worldwide, range in habit from trees, shrubs, vines, to herbs, and occur in a diversity of ecological habitats from xeric to mesic and even aquatic (Mabberley 2017).

A species of *Senecio* apparently new to North America was first vouchered by M. R. Mulligan (*Mulligan 1968*) on 13 May 2007 from Marine Corps Base Camp Pendleton of northern San Diego County, California (see Appendix 1 for details). A subsequent collection from a nearby (ca. 1 kilometer distant) locality (*Mulligan 1991*, 28 May 2007) was identified as *Senecio quadridentatus* Labill. (Fig. 1; see Trock 2012), a species native to Australia, New Zealand, and Timor (Belcher 1956; see AVH 2020).

After those first two vouchers, 19 additional collections were made in San Diego and Orange counties, most initially identified as *Senecio quadridentatus*. All but five of these were found within Marine Corps Base Camp Pendleton, where intensive floristic surveys by the San Diego Natural History Museum have been conducted in the last several years. The other five collections (some from the same populations) were made in the Santa Ana Mountains



FIG. 1. Specimen (Mulligan 1991) identified as *Senecio quadridentatus*, among the first collected in California: Camp Pendleton Marine Corps Base, San Diego County; see Appendix 1 for details.

and foothills of Orange County (see Appendix 1). Plants from both counties were noted to be perennial herbs or shrubs with sessile, narrowly lanceolate to linear, denticulate, revolute leaves, with a tapering or auriculate-dentate base and soft, appressed, whitish trichomes, these sparse adaxially, denser abaxially between the veins. The capitulescences consist of short racemiform arrays of heads, each with a prominent calyculus and a short-cylindric involucre of 12–16 phyllaries (see Fig. 2). When identified using the Jepson eFlora (2021) key to *Senecio*, these plants best fit *Senecio quadridentatus*.

In Santa Barbara County, four collections of *Senecio quadridentatus* were made from 2007 to 2013 (Appendix 2). However, examination of online specimen images on the CCH2 (2021) made it clear that the Santa Barbara County specimens (exemplar at Fig. 3) were distinct from those of San Diego and Orange counties in morphology, particularly in leaf and head morphology. When we confirmed that there were two different species in California that had been identified as *S. quadridentatus*, the challenge became: What are their correct names?

Study of online images, along with experience from some of the authors with *Senecio* taxa overseas, convinced us that the Santa Barbara County collections were a good fit for the Australian *Senecio quadridentatus*, the holotype specimen of which is seen in Fig. 4. From a revision of the complex by Belcher (1956), *Senecio quadridentatus* is described as having leaves that are “linear to lanceolate and as much as 9 cm. long and 0.3 cm. wide or sometimes the lower ones oblong-lanceolate, sessile, attenuated toward the base, sometimes with minute linear and simple auricles, more or less minutely and distantly callose-denticulate, usually revolute, typically densely arachnoid to lanate especially when young, sometimes becoming subglabrous especially on upper side, acute to subacuminate.” The heads of *S. quadridentatus* are described as having “phyllaries of the involucre 11 to 13, 6.5 to 8 mm. long, 0.4 to 0.5 mm. wide, at first arachnoid later glabrate towards the apices.” Measurements of mean involucre lengths of the four known Santa Barbara County collections identified as *Senecio quadridentatus* yielded values comparable to those of the holotype specimen. However, the mean leaf length of all California specimens was greater than that of the type (Fig. 5). Experience by some of us with *Senecio quadridentatus* in Australia and New Zealand confirmed that this species is morphologically variable; it at times appears annual, and shows somewhat broad ranges of leaf shape, hair density, and capitulescence morphology between colonies. While the plants in Santa Barbara County cleanly fit within the expected variation of *S. quadridentatus*, those from Orange and San Diego counties were clearly different. We subsequently observed that the heads of the Orange and San Diego county plants fit the concept of discoid, with no discernible differences between peripheral and central flowers, whereas those of *S.*

quadridentatus are described as disciform, having peripheral pistillate flowers.

For a time, the identity of the Orange and San Diego county specimens of this novel *Senecio* remained a mystery. The relatively intact native habitats that the plants inhabited, outside of the usual weedy spaces typically occupied by exotic species, suggested a possible undiscovered native taxon. However, later discussions with botanists from South Africa, culminating in physical examination (by M. Koekemoer) of two specimens (*Rebman 31331*, *SDSU22272*, and *Vanderhoff 118*, *SDSU22349*) verified their identity as the native South African species *Senecio angustifolius* (Thunb.) Willd., the holotype of which is seen in Fig. 6. It is now clear that what was called *Senecio quadridentatus* in Orange and San Diego counties, California, is actually *Senecio angustifolius*, a species native to South Africa. A comparison of mean leaf lengths and mean involucre lengths of the type of *S. angustifolius* and selected specimen collections in Orange and San Diego counties is seen in Fig. 5, showing a good match in these features, especially when compared to true *Senecio quadridentatus*. (At the time of this publication, all known Orange and San Diego county specimens of this species have been annotated as *S. angustifolius*.) The currently known distributions of the two species (including recently extirpated populations) from herbarium vouchers and verified (“research grade”) observations from iNaturalist (2021) and Calflora (2021) confirmed by us (Appendix 3) are shown in Fig. 7.

Senecio angustifolius is common in the Cape Provinces of South Africa and is known to be weedy in some areas of that country, such as those under cultivation for rooibos tea (Van Wyk et al. 2017). *Senecio angustifolius* was not previously known to be naturalized in other parts of the world (POWO 2021; USDA-NRCS 2021).

There are some nomenclatural issues worth mentioning with regard to *S. angustifolius*. First, there are several other, invalid *S. angustifolius* names (see list in Appendix 4) that are still seen in the general literature and in local species lists. Second, there is another described native species of South African *Senecio*, *S. leptophyllus* DC. [not *S. leptophyllus* Hook. & Arn., illegit.= the Chilean *S. hakeifolius* Bertero ex DC.], which is very similar to *S. angustifolius*. *Senecio leptophyllus* DC. (holotype seen in Fig. 8) differs from *S. angustifolius* primarily in having a greater density of trichomes, and might be viewed as a heterotypic synonym of the latter, perhaps awaiting future studies. However, if the two are treated as one species, *Senecio angustifolius* has priority of publication.

In cooperation with California Native Plant Society-Orange County Chapter, Orange County Parks, and the Cleveland National Forest, the known populations of *Senecio angustifolius* in Orange County have been monitored, with all observed plants in the known and nearby vicinities removed as of 2021. Commitments for ongoing management in Orange County are in place with these organiza-

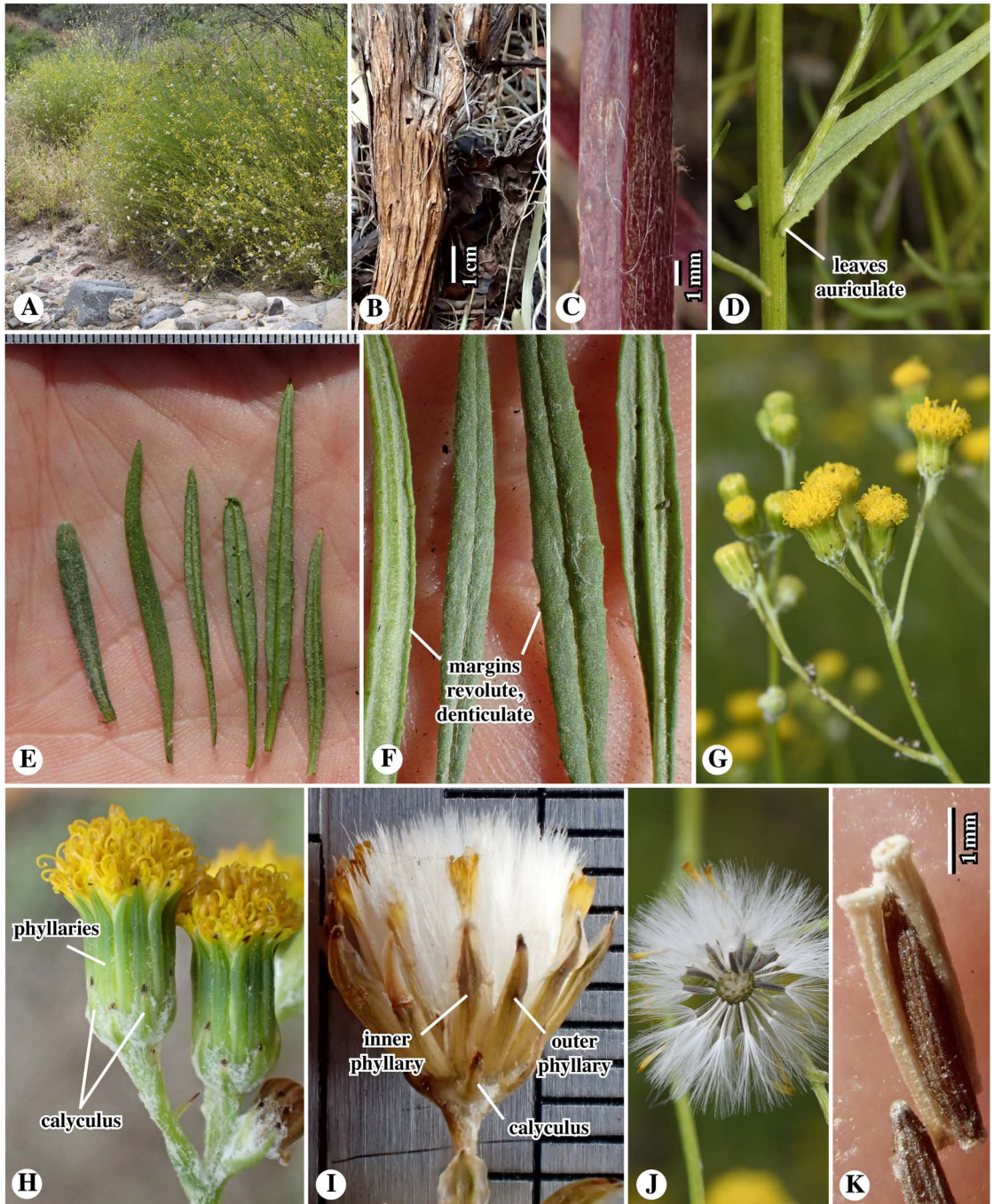


FIG. 2. Field photographs of what was initially identified as *Senecio quadridentatus*, from Orange County. A. Plant habit, a shrub. B. Base of main stem, showing woody growth. C. Distal stem surface; note sparse, appressed, whitish trichomes. D-F. Leaves, showing narrowly lanceolate shape, revolute and denticulate margins, occasionally auriculate and denticulate bases, and appressed, whitish trichomes, denser abaxially. G. Capitulescence, a cluster (corymbiform or short racemiform) of heads. H. Head unit, showing flowers, phyllaries, calyculus and short, appressed, whitish trichomes on peduncle and involucre base. I. Fruiting head, showing narrower outer phyllaries with narrower wings and wider inner phyllaries with wider wings. J. Fruiting head with intermixed fertile (dark) and sterile (whitish) fruits, all with a prominent pappus. K. Detached fertile fruits (dark brown) with two sterile fruits (tan). Images at B, C, E, F, H, I, K by Ron Vanderhoff, associated with *Vanderhoff 118* (IRVC100094, SDSU22349). Images at A, D, G, J by Fred Roberts, associated with *Roberts 8774* (IRVC).



FIG. 3. Exemplar of Santa Barbara County collection of *Senecio quadridentatus*: Ballard s. n., 2013-02-02 (SBBG161829=SBBG125740). A. Herbarium sheet voucher. B. Inset, showing close-up of heads. Note difference in shape and size with heads in Fig. 2.

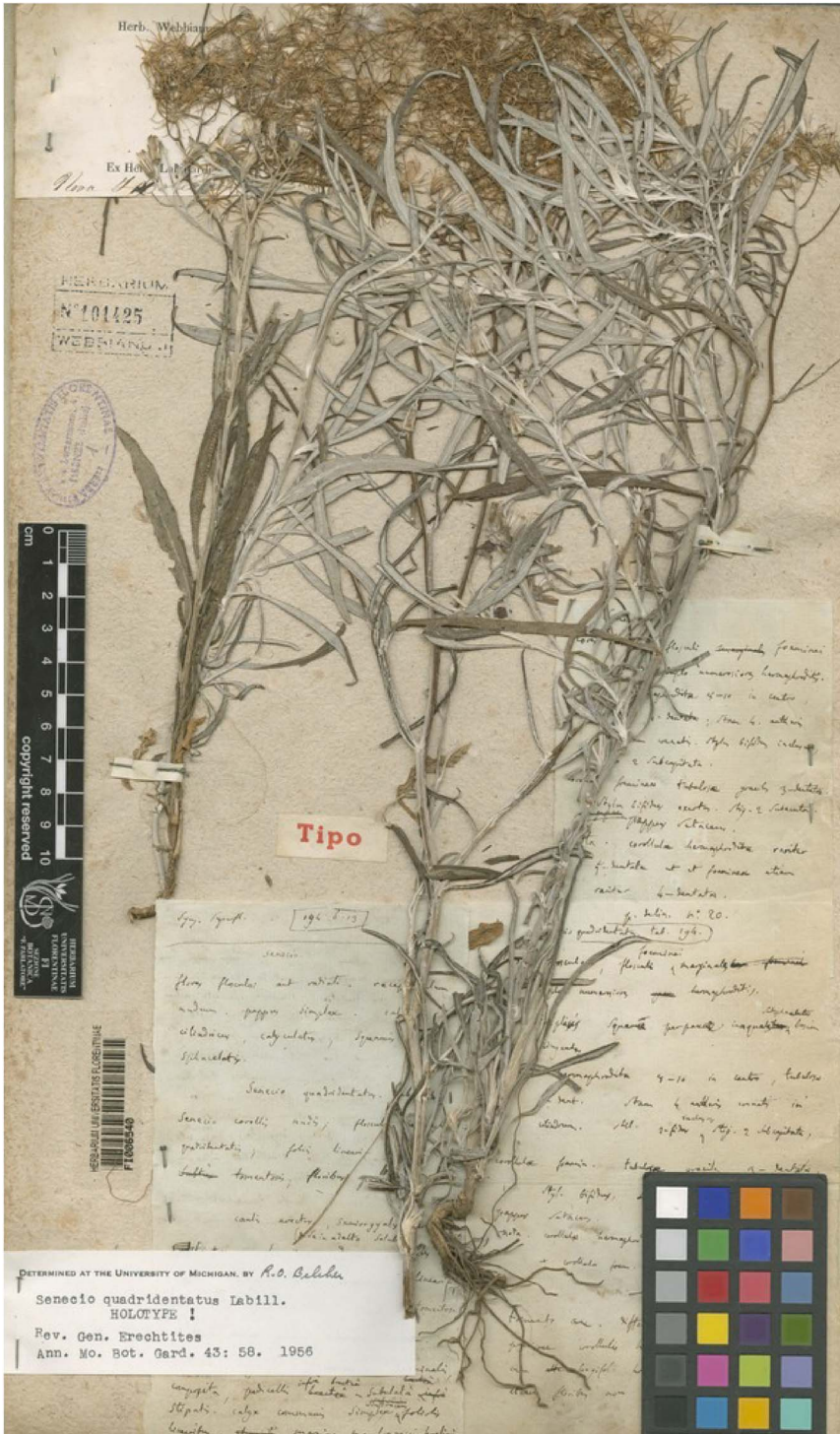


FIG. 4. Holotype specimen of *Senecio quadridentatus*, J. J. H. Labillardière s. n., [date unknown] "In capite Van-Diemen" [Tasmania], Australia, FI006540.

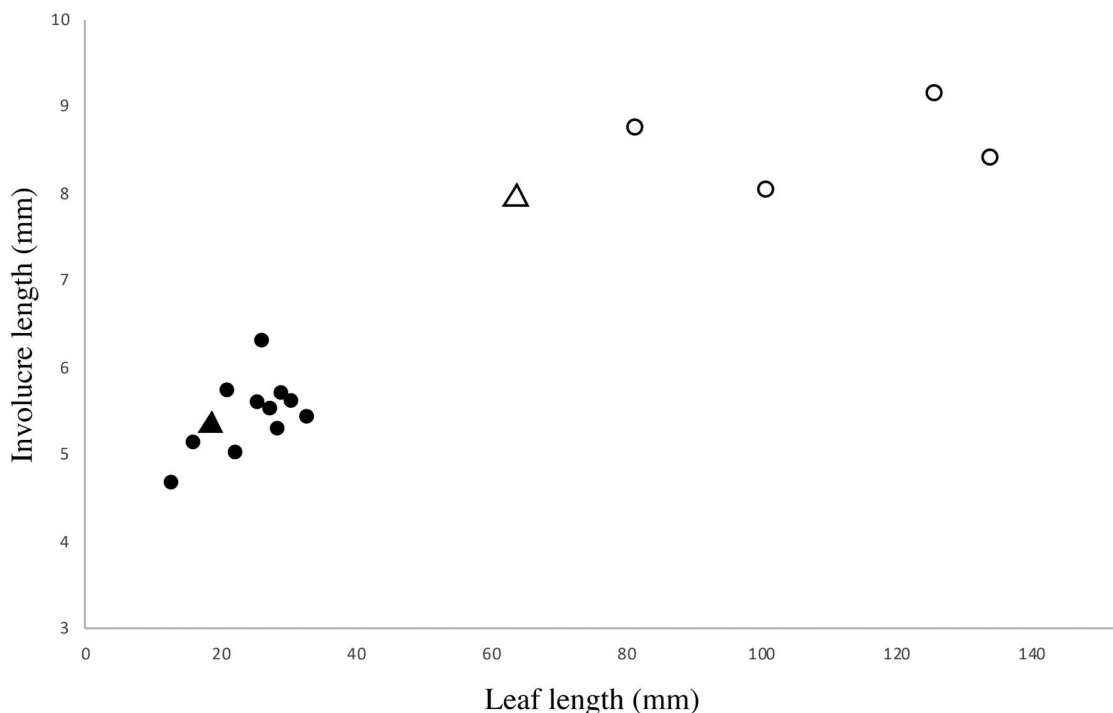


FIG. 5. Graph of mean leaf lengths and mean involucre lengths of specimens ultimately identified as *Senecio quadridentatus* (open symbols, upper right) and *Senecio angustifolius* (closed symbols, lower left). Circle symbols represent California specimens; triangles represent type specimens.

tions and land managers. For example, Orange County Parks completed another removal (ca. 30 plants) at the Red Rock Canyon colony (Appendix 1) on 8 June 2021; a field check of the site on 17 June 2021 (by R. Vanderhoff) revealed no plants (see records on Calflora 2021). In addition, a focused survey on 1 July 2021 of the site of Orange County's first record (Agua Chinon, Lomas de Santiago, *Josie Bennett, Calflora observation 19356*, 16 Feb 2016; see Appendix 3) revealed no plants. Efforts to eradicate *Senecio angustifolius* at Camp Pendleton have been intensive, with newly discovered populations rapidly eliminated.

Monitoring of the species confirms that *S. angustifolius* is persisting in California, but so far it appears to be spreading at a slow rate, likely limited by available habitat. Models of invasiveness generally rely on data from other, similar climatic regions of the world (see California Invasive Plant Council 2021). Given there are no other known naturalized colonies of *Senecio angustifolius* outside of South Africa, the potential impacts of this species in Southern California are to date difficult to evaluate. However, current observations from Orange and San Diego counties show that this *Senecio* species appears to invade intact native plant communities, apparently not associated with anthropogenic disturbance seen with other invasive plants, such as staging areas, trailheads, construction, or restoration projects. If this ecological trend is sustained, the invasiveness of

this species could be problematic, creating a detection challenge. On the Marine Corps Base Camp Pendleton in San Diego County, establishment of *Senecio angustifolius* was observed on naturally disturbed arroyos and in post-fire areas of coastal sage scrub. In addition, *Senecio angustifolius* in Southern California shows perhaps some degree of environmental plasticity, at least relative to ocean influence and elevation. Plants have been detected within 500m of the ocean and as far as 26km inland, at elevations from 4m to 475m (Fig. 7, Appendices 1 and 3). Continued surveys are needed in both Orange and San Diego counties to inform proper management of *S. angustifolius*.

The recognition of *Senecio angustifolius* in California makes a current total in the state of 27 species and 31 minimum-ranked taxa in *Senecio*, with 1/3 (nine) of the species noted as non-native and naturalized. (Some species, such as *Senecio squalidus* L., are reported only as weeds in cultivation and have not been cited as naturalized in California; see Trock 2012.) These naturalized species are native in Australia/Australasia (four, including true *S. quadridentatus*), Europe/Eurasia/northern Africa (3), and South Africa (two, including *S. angustifolius*). Given the great diversity of the genus and the weedy nature of many of the species, more could be expected as naturalizations in California or other parts of the country. We will pursue having *Senecio angustifolius* added to a future revision of the Jepson eFlora (2021).



FIG. 6. Holotype specimen of *Senecio angustifolius* [*Jacobaea angustifolia*]: C. P. Thunberg s. n. (date unknown), Western Cape Province, east Cape, South Africa (UPS:BOT:V-132348=UPS19662).



FIG. 7. Distribution map of *Senecio quadridentatus* in Santa Barbara County and *Senecio angustifolius* in Orange and San Diego counties. Circles represent localities of herbarium vouchers, triangles those of iNaturalist and Calflora observations.

The following can serve as a template for a description of the species, in the format of the Jepson eFlora. We also present a taxonomic key, modified from that in the Jepson eFlora (Trock 2012).

Taxonomic Treatment
***Senecio angustifolius* (Thunb.) Willd.**

NATURALIZED

Habit: Shrub, at maturity up to 1 m tall, 2 m wide, woody at base, bark with rounded to vertically elliptic lenticels. **Stems** several from base, distal stems green, these ridged to narrowly winged, + glabrous proximally, glabrous to white-tomentose distally. **Leaves** distributed mainly in distal stems, sessile, 10–35 mm, 1–2 mm wide, linear to very narrowly lanceolate to oblanceolate, base tapered or not, often auriculate, margins minutely dentate, rolled under, sometimes covering most or all of abaxial surface, thinly hairy of both surfaces, with tufts of white hairs often present in axil and on leaf base. **Inflorescence** heads discoid, in clusters of (1) 2–4; involucre short-cylindrical to cup-shaped, generally overtopping

shoots, typically with small tufts of white hairs at base and on peduncles, phyllaries 12–16, + 5–6 mm, green with 1–2 central, yellowish veins, veins enlarged in central-distal region, outer phyllaries narrower with narrow, tannish wings, inner phyllaries wider with wide, translucent wings, both often minutely brown- to black-tipped; basal bracts of calyculus reduced, 1–2.5 mm. **Flowers** 50–60 per head, disk only; corolla minutely lobed. **Fruit** 2–2.8 mm, upwardly appressed hairy in grooves between ribs, fertile and sterile often intermixed within a head.

Ecology and Distribution

Ecology: Alluvial washes, stragglers in coastal scrub or chaparral; **Elevation:** 5–482 m. **Bioregional Distribution:** SCo; **Distribution Outside California:** Native to South Africa. **Flowering Time:** All months.

Synonyms

Synonyms: *Jacobaea angustifolia* Thunb.

We note that of all *Senecio* taxa listed in the Jepson eFlora (2021) as native or naturalized in



FIG. 8. Holotype specimen of *Senecio leptophyllus* (Holotype: J. F. Drège 787, 13 December 1826, Steekloof bei Uitvlagt, South Africa (P00118907)). This species is currently accepted as conspecific with, and thus a heterotypic synonym of, *S. angustifolius*. Note that *Senecio leptophyllus* differs in having a denser cover of trichomes.

California, Plants of the World Online (POWO 2021) lists *Senecio elegans* Thunb. as a synonym of *Senecio arenarius* Thunb., *Senecio glomeratus* Desf. ex Poir. as a synonym of *Erechtites glomeratus* (Desf. ex Poir.) DC., *Senecio integerrimus* A.Gray as a synonym of *Senecio crassulus* A.Gray, *Senecio jacobaea* L. as a synonym of *Jacobaea vulgaris* Gaertn., *Senecio minimus*

Poir. as a synonym of *Erechtites minimus* (Poir.) DC., and *Senecio quadridentatus* Labill. as a synonym of *Erechtites quadridentatus* (Labill.) DC. These changes reflect ongoing research in the systematics and taxonomy of the diverse genus *Senecio* s.l. Note that POWO (2021) does, however, list *Senecio angustifolius* (Thunb.) Willd. as accepted.

PARTIAL KEY TO *SENECIO*, MODIFIED FROM THE JEPSON eFLORA (2021)

Leads/couplets in **bold** are new changes here.

1. Heads discoid, disciform, or minutely radiate, rays (if present) generally ≤ 2 mm, scarcely, if at all exceeding involucre
2. Heads disciform or minutely radiate, pistillate flowers present
- 2' Heads discoid, pistillate flowers 0 [couplets 3–7 unaltered]
 8. Annual [couplet 9 unaltered]
 - 8' Biennial, perennial herb, **or shrub**
 - 8B. Shrub, woody at base** *S. angustifolius*
 - 8B' Biennial or perennial herb, not woody at base** [couplets 10–14 unaltered]
- 1' Heads radiate, rays 3–20 mm, generally well exceeding involucre [remainder of key unaltered from here]

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APPENDIX I

SPECIMENS OF *SENECIO ANGUSTIFOLIUS*, MOST OF THESE ORIGINALLY IDENTIFIED AS *SENECIO QUADRIDENTATUS*, IN CHRONOLOGICAL ORDER OF COLLECTION DATE

- Margaret R. Mulligan 1968*, 2007-05-13 (SD207402); USA: California, San Diego County, Camp Pendleton Marine Corps Base, on the ridge N of the intersection of Horno Canyon Rd and Basilone Rd., 33.3743 -117.4337, 241 meters elevation.
- Margaret R. Mulligan 1991*, 2007-05-28 (SD207401, UC2027614); USA: California, San Diego County, Camp Pendleton Marine Corps Base, S of Range 217. In wash on west side of entry road to Range 217 just N of Basilone Rd, ca. 1 mile east of Horno (53 Area), 33.38031 -117.44955, 151 meters elevation.
- Margaret R. Mulligan 1992*, 2007-05-28 (SD207400). USA: California, San Diego County, Camp Pendleton Marine Corps Base, on the ridge N of the intersection of Horno Canyon Rd and Basilone Rd., 33.3743 -117.4337, 241 meters elevation.
- Jon P. Rebman 17052*, 2009-04-15 (SD195770); USA: California, San Diego County, Camp Pendleton Marine Corps Base: Papa 3 Training Area in the northwestern portion of base and on the east side of the San Onofre Mountains; along Horno Canyon Road; burned in Horno Fire, 33.37454 -117.43662, 210 meters elevation.
- Meghan Dinkins 39*, 2010-08-17 (SD266207); USA: California, San Diego County, Camp Pendleton; W of Stuart Mesa Road; Papa 3 Training Area; W of Basilone Road; E of San Onofre Peak, 33.3743 -117.4349, 230 meters elevation.
- Jon P. Rebman 20511*, 2010-12-02 (SD210073); USA: California, San Diego County, Camp Pendleton: India Training Area; along De Luz Road south of Camp De Luz; vicinity of the convergence of the Santa Margarita River and De Luz Creek, 33.36277 -117.32164, 40 meters elevation.

- Jon P. Rebman 24670*, 2012-06-05 (SD230472); USA: California, San Diego County, Camp Pendleton: Training Area Finch; east of Camp Horno and just north of Basilone Road; along San Onofre Creek, 33.37879 -117.46107, 135 meters elevation.
- Margaret R. Mulligan 3258*, 2013-04-15 (SD00017498); USA: California, San Diego County, Marine Corps Base Camp Pendleton, Oscar I Training Area, ca. 1.5 mi NE of the junction of MACS Rd and Stuart Mesa, near tower along powerline road., 33.26218 -117.38494, 35 meters elevation.
- Jon P. Rebman 26437*, 2013-05-15 (SD235269); USA: California, San Diego County, Camp Pendleton: west-central portion of Base; Training Area Finch; east of Camp Horno, southwest of Range 216; along the South Fork of San Onofre Creek just north of Basilone Road, 33.37811 -117.46645, 120 meters elevation.
- Jon P. Rebman 28428*, 2014-05-08 (RSA0031589, SD240582, SDSU22292). USA: California, San Diego County, Camp Pendleton: Training Area Hotel: eastern portion of Base; along De Luz Creek just south of the confluence with Roblar Creek. Square: D6., 33.3855 -117.3191, 60 meters elevation.
- Jon P. Rebman 31331* (with W. Schmidtmann, M. Mulligan, G. Kenney), 2016-04-06 (RSA0107872, SBBG161321, SD254247, SDSU22272). USA: California, San Diego County, Camp Pendleton: northwestern portion of Base; Alpha Two Training Area; San Onofre Creek riparian area east of I-5 and just south of Basilone Road., 33.3883 -117.5479, 25 meters elevation.
- Jon P. Rebman 33956*, 2018-04-03 (SD00024155); USA: California, San Diego County, Camp Pendleton: northwestern portion of Base; Training Area Alpha Two: along San Onofre Creek between Basilone Road and Beach Club Road; in the San Onofre Creek riparian area, 33.38455 -117.57496, 5 meters elevation.
- Jon P. Rebman 34121*, 2018-04-25 (SD00016472); USA: California, San Diego County, Camp Pendleton: northeastern portion of Base; Training Area Range 409A: East of Roblar Road at the bottom of the canyon; along Roblar Creek just north of Roblar Canyon Road, 33.40031 -117.34718, 165 meters elevation.
- Jon P. Rebman 34213*, 2018-05-01 (SBBG153981, SD00021382); USA: California, San Diego County, Camp Pendleton: northeastern portion of Base; Training Area Range 409A, E of Roblar Rd along Mojito Rd at bottom of cyn, along Roblar Creek, 33.40641 -117.35517, 206 meters elevation.
- Ron Vanderhoff 117*, 2018-10-24 (IRVC); USA: California, Orange County, Whiting Ranch, Red Rock Trail, 33.70103 -117.64977, 349 meters elevation.
- Ron Vanderhoff 118*, 2018-11-22 (IRVC100094, SDSU22349); USA: California, Orange County, Harding Canyon, Santa Ana Mountains., 33.71656 -117.61253, 475 meters elevation.
- Ron Vanderhoff 135*, 2018-11-25 (IRVC100093, SDSU22348); USA: California, Orange County, Whiting Ranch, Red Rock Trail, 33.70103 -117.64977, 349 meters elevation.
- Fred Roberts 8774*, 2019-04-27 (IRVC); USA: California, Orange County, Whiting [Ranch] Wilderness Park: Lomas de Santiago, Upper Borrego Canyon, along Red Rock Trail, 1.0 km SSE Bolero Lookout. (El Toro 7.5' Quad), 33.701069 -117.649889, 317 meters elevation.
- Jon P. Rebman 35685*, 2019-05-09 (SD00033041); USA: California, San Diego County, Camp Pendleton: west-central portion of Base; eastern foothills of the San Onofre Mountains; Training Area Papa Two; rolling hills northwest of Pulgas Lake, 33.35527, -117.44774, 155 meters elevation.
- Jon P. Rebman 35852*, 2019-05-21 (SD00033040); USA: California, San Diego County, Camp Pendleton: west-central portion of Base; south of San Onofre Peak in Las Pulgas Canyon; Training Area Oscar Two; in riparian area just south of Las Pulgas Canyon Road, 33.31783, -117.43864, 34 meters elevation.
- Ron Vanderhoff 671*, 2020-12-10 (IRVC); USA: California, Orange County, Harding Canyon, 880 air meters NE Harding Cyn. Truck Trailhead, Santiago Canyon, Santa Ana Mts., 33.71656, -117.61253, 475 meters elevation.

APPENDIX 2

SPECIMENS OF *SENECIO QUADRIDENTATUS*, CORRECTLY IDENTIFIED, IN CHRONOLOGICAL ORDER OF COLLECTION DATE

Chapman 10-14 is presumed to represent the same collection. An asterisk (*) indicates that the elevation was estimated from georeference data.

- M. Honer 2617*, 2007-06-11 (SBBG161828, UC1926984); USA: California, Santa Barbara County, Santa Ynez Mtns; Gaviota Pk Trail, ca. 2 mi up trail from parking lot, 34.5033 -120.20405, 566 meters elevation*.
- Wayne Chapman 10*, 2009-04-02 (UCSB032566); USA: California, Santa Barbara County, South side of US-101 at Mariposa Reina. Estimated locality: 34.473018, -120.206708, 28 meters elevation.
- Wayne Chapman 11*, 2009-04-02 (UCSB032567); USA: California, Santa Barbara County, South side of US-101 at Mariposa Reina. Estimated locality: 34.473018, -120.206708, 28 meters elevation.
- Wayne Chapman 12*, 2009-04-02 (UCSB68442); USA: California, Santa Barbara County, South side of US-101 at Mariposa Reina. Estimated locality: 34.473018, -120.206708, 28 meters elevation.
- Wayne Chapman 13*, 2009-04-02 (UCSB032568); USA: California, Santa Barbara County, South side of US-101 at Mariposa Reina. Estimated locality: 34.473018, -120.206708, 28 meters elevation.
- Wayne Chapman 14*, 2009-04-02 (UCSB032569); USA: California, Santa Barbara County, South side of US-101 at Mariposa Reina. Estimated locality: 34.473018, -120.206708, 28 meters elevation.
- Wayne Chapman 9*, 2009-07-11 (UCSB032565); USA: California, Santa Barbara County, South side of US-101 at Mariposa Reina. Estimated locality: 34.473018, -120.206708, 28 meters elevation.
- L. Ballard s. n.*, 2013-02-02 (SBBG161829). USA: California, Santa Barbara County, Santa Ynez Mtns; private ranch S of Hwy 1, ca. 2 mi W of US Hwy 101, 34.51513, -120.27453, 351 meters elevation.

APPENDIX 3

OBSERVATIONS OF *SENECIO ANGUSTIFOLIUS* AND *S. QUADRIDENTATUS* FROM CALIFORNIA AND INATURALIST, LISTED CHRONOLOGICALLY

Note: All elevations estimated from georeference data.

SENECIO ANGUSTIFOLIUS

- Josie Bennett, Calflora observation 19356*, 2016-02-16, USA: California, Orange County, Agua Chinon, Lomas de

- Santiago, 33.7047362, -117.6767571, 253 meters elevation.
- Jon P. Rebman, *iNaturalist observation 10595194*, 2018-04-03, USA: California, San Diego County, Camp Pendleton, 33.38458, -117.574975, 5 meters elevation.
- Gwen Kenney, *iNaturalist observation 12022380*, 2018-05-01, USA: California, San Diego County, Camp Pendleton, 33.406228, -117.355155, 205 meters elevation.
- Gwen Kenney, *iNaturalist observation 12139013*, 2018-05-01, USA: California, San Diego County, Camp Pendleton, 33.400263, -117.344803, 159 meters elevation.
- James P. Bailey, *iNaturalist observation 19848032*, 2019-01-24, USA: California, Orange County, Limestone-Whiting Wilderness Park, 33.70102, -117.64975, 370 meters elevation.
- James P. Bailey, *iNaturalist observation 19848032*, 2019-04-27, USA: California, Orange County, Limestone-Whiting Wilderness Park, 33.70103, -117.64979, 376 meters elevation.
- Margaret R. Mulligan, *iNaturalist observation 33476258*, 2019-09-25, USA: California, San Diego County, Camp Pendleton, 33.40118, -117.347917, 171 meters elevation.
- Margaret R. Mulligan, *iNaturalist observation 33572365*, 2019-09-28, USA: California, San Diego County, Camp Pendleton, 33.410022, -117.38372, 535 meters elevation.
- J. I. Masmus, *iNaturalist observation 66106107*, 2020-12-04, USA: California, San Diego County, Camp Pendleton, 33.38286, -117.570657, 6 meters elevation.
- J. I. Masmus, *iNaturalist observation 66384604*, 2020-12-10, USA: California, San Diego County, Camp Pendleton, 33.384721, -117.575007, 5 meters elevation.
- Ron Vanderhoff, *iNaturalist observation 66398674*, 2020-12-10, USA: California, Orange County, Modjeska Canyon Nature Preserve, Harding Canyon, 33.716503, -117.612428, 474 meters elevation.
- Amy Bulone, *iNaturalist observation 81933519*, 2021-06-06, USA: California, Orange County, Limestone-Whiting Wilderness Park, 33.7031, -117.64851, 374 meters elevation.

SENECIO QUADRIDENTATUS

- Stephanie Calloway, *iNaturalist observation 9267027*, 2017-07-22, USA: California, Santa Barbara County, Santa Rosa Island, 33.965003, -120.110779, 274 meters elevation.

APPENDIX 4

FOUR ILLEGITIMATE USES OF THE NAME *SENECIO ANGUSTIFOLIUS*

Some are still used in the literature: the first is a *nominum invalidum*, the last three are illegitimate later homonyms.

- Senecio angustifolius* G.Forst., Fl. Ins. Austr. 91 (1786), *nom. inval.* (*nomen nudum*, with neither a description nor a reference to a description indicated) [= *Senecio lautus* Sol. ex G.Forst., Fl. Ins. Austr.: 91 (1786)]
- Senecio angustifolius* Wall. ex DC., Prodr. [A. P. de Candolle] 6: 367 (1838), illegit. (later homonym) [= *Senecio wightii* (DC.) Benth. ex C.B. Clarke, Compos. Ind.: 197 (1876); distribution: southeast Asia]
- Senecio angustifolius* Sond., Linnaea 25(5): 526 (1853), illegit. (later homonym) [current identity unknown]
- Senecio angustifolius* Hayata, J. Coll. Sci. Imp. Univ. Tokyo 30(Art. 1): 154 (1911), illegit. (later homonym) [= *Senecio morrisonensis* Hayata var. *dentatus* Kitam., Acta Phytotax. Geobot. 4: 274 (1937); distribution e. Asia]