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HELIANTHUS WINTERI (ASTERACEAE), A NEW PERENNIAL SPECIES FROM THE SOUTHERN SIERRA NEVADA FOOTHILLS, CALIFORNIA

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ABSTRACT

Helianthus winteri is described from Fresno and Tulare Counties in the southern Sierra Nevada foothills of California. It is distinguished from *H. annuus* by its woody trunk, year-round blooming, and morphological characteristics. It occurs in open, ungrazed foothill woodlands and annual grasslands on well-drained, granitic soils, generally on lower-elevation, south-facing foothill slopes east of the San Joaquin Valley.

Key words: Asteraceae, California, *Helianthus winteri*, *Helianthus annuus*, new species, North America, Sierra Nevada foothills, sunflower.

TAXONOMIC TREATMENT

Helianthus winteri J.C.Stebbins, sp. nov. “Winter’s sunflower” (Fig. 1–10).—TYPE: USA. California, Fresno County: on steep south-facing slopes in annual grassland, north side of Highway 180, 0.6 km east of Cove Road, 36.7211701N, 119.3118021W, 335 m elevation, 01 Aug 2008, *J. C. Stebbins & C. J. Winchell 0423* (holotype RSA; isotypes CAS, FSC, JEPS, UC).

Helianthus winteri occurrit praecipue in clivis spectantibus ad meridianam coeli partem in collibus australibus Sierrae Nevadaee et a specie communi pervagataque *H. annuo* in forma distinguitur statura grandi (usque 4 m altitudine); caulibus persistentibus perennibus lignosisque; et florescentia per totum annum. Differentiae additiciae includunt achenia valde minora; colorem purpurascens saturatum caulium juvenium, palearum phyllariorumque; et praesentiam exsudatorum resinorum in caulibus lignosis.

Subshrub to 4 m tall. Trunk generally solitary, erect or ascending, to 8 cm in diameter at base, proximally unbranched, bark gray-brown; branches ascending; young stems purplish-maroon, hirsute, hairs stout, spreading, pustulate-based, 2–4 mm, and strigose hairs finer, 0.2–1 mm, and minutely glandular-puberulent, hairs \pm 0.1 mm. Leaves mostly alternate; petioles of principal leaves 6–12 cm, blades 3-veined, 12–14 cm, widely ovate, base widely cuneate to truncate or cordate, apex acute to acuminate, margins serrate; distal leaves: petioles shorter, blades lance-ovate to lanceolate, smaller; abaxial surfaces of blades hispid along veins, hairs 0.5–2 mm, densely hirtellous between veins, hairs finer, \pm 0.2 mm, and dotted with minute sessile resin glands, adaxial surfaces hispid and hirtellous, hairs 0.1–1 mm, and dotted with minute resin glands. Heads radiate, in openly branched, paniculiform capitulescences; peduncles ascending 4–24 cm; involucre cupuliform, 3–4 cm diameter; phyllaries ovate to acuminate, 12–20 mm, abaxially hispid, hirtellous, glandular-puberulent, purplish and resin-dotted, adaxially glandular-puberulent, margins ciliate, hairs stiff, straight or curved, 0.5–1.5 mm; paleae 9–10 mm, 3-lobed, middle lobe long-acuminate, darkly pigmented, hirtellous. Ray florets 12–34;

laminae bright yellow, \pm 20 mm long, 5–8 mm wide. Disc florets many; corollas yellow, 6–6.5 mm, tube 1 mm, throat 3.5–4 mm, proximally swollen, distally cylindric, lobes ovate \pm 1.5 mm, acute, tube and proximal bulge of throat puberulent, hairs stiff, ascending, acuminate, distal throat and lobes glabrous; anthers \pm 4 mm, reddish brown; shaft of style 4.5 mm, branches 2.5 mm, glabrous in proximal 1 mm, distally densely hirtellous, reddish brown. Achenes \pm 3.5 mm, weakly compressed, gray-brown, densely covered with ascending hairs 0.2–1.0 mm; pappus scales lanceolate, 2.5–3 mm, $2n = 34$.

Stem morphology varies with plant age and environmental and edaphic conditions. Young herbaceous stems of first-year plants appear indistinguishable from those of *H. annuus* L.; stems of older plants are woody and have abundant resinous secretions.

Distribution and habitat.—The nine known *H. winteri* sites (Fig. 11) are found in relatively steep, open areas (ungrazed, south-facing, grassy slopes, rock outcrops, roadcuts; Fig. 12–13) on well-drained granitic soils in the northern portion of southern Sierra Nevada foothills at elevations of 180–460 m. Associated species include *Avena barbata* Link., *A. fatua* L., *Carduus pycnocephalus* L., *Quercus douglasii* Hook. & Arn., *Q. wislizeni* A. DC., *Frangula californica* (Eschsch.) A.Gray, *Bromus diandrus* Roth., *B. hordeaceus* L., *B. madritensis* L. subsp. *rubens* (L.) Husn., *B. tectorum* L., *Caulanthus coulteri* S.Watson, *Phacelia cicutaria* Greene, *Chaenactis glabriuscula* DC. var. *glabriuscula*, *Eschscholzia caespitosa* Benth., *Poa bulbosa* L., *P. secunda* J.Presl., *Plagiobothrys nothofulvus* (A.Gray) A.Gray, *P. tenellus* (Hook.) A.Gray, *Erodium botrys* (Cav.) Bertol., *E. cicutarium* (L.) Aiton, *Amsinckia eastwoodiae* J.F.Macbr., *A. intermedia* Fisch. & C.A.Mey., *Pholistoma auritum* (Lindl.) Lilja var. *auritum*, *Lupinus albifrons* Benth. var. *albifrons*, *L. bicolor* Lindl., *L. benthamii* A.Heller, *Scrophularia californica* Cham. & Schltld., *Thysanocarpus curvipes* Hook., *Dichelostemma capitatum* (Benth.) Alph. Wood subsp. *capitatum*, and *Datura wrightii* Regel.

Paratypes (CAS, FSC, JEPS, RSA, UC).—USA. California, Fresno County: 36.7201911N, 119.3143022W, 345 m eleva-

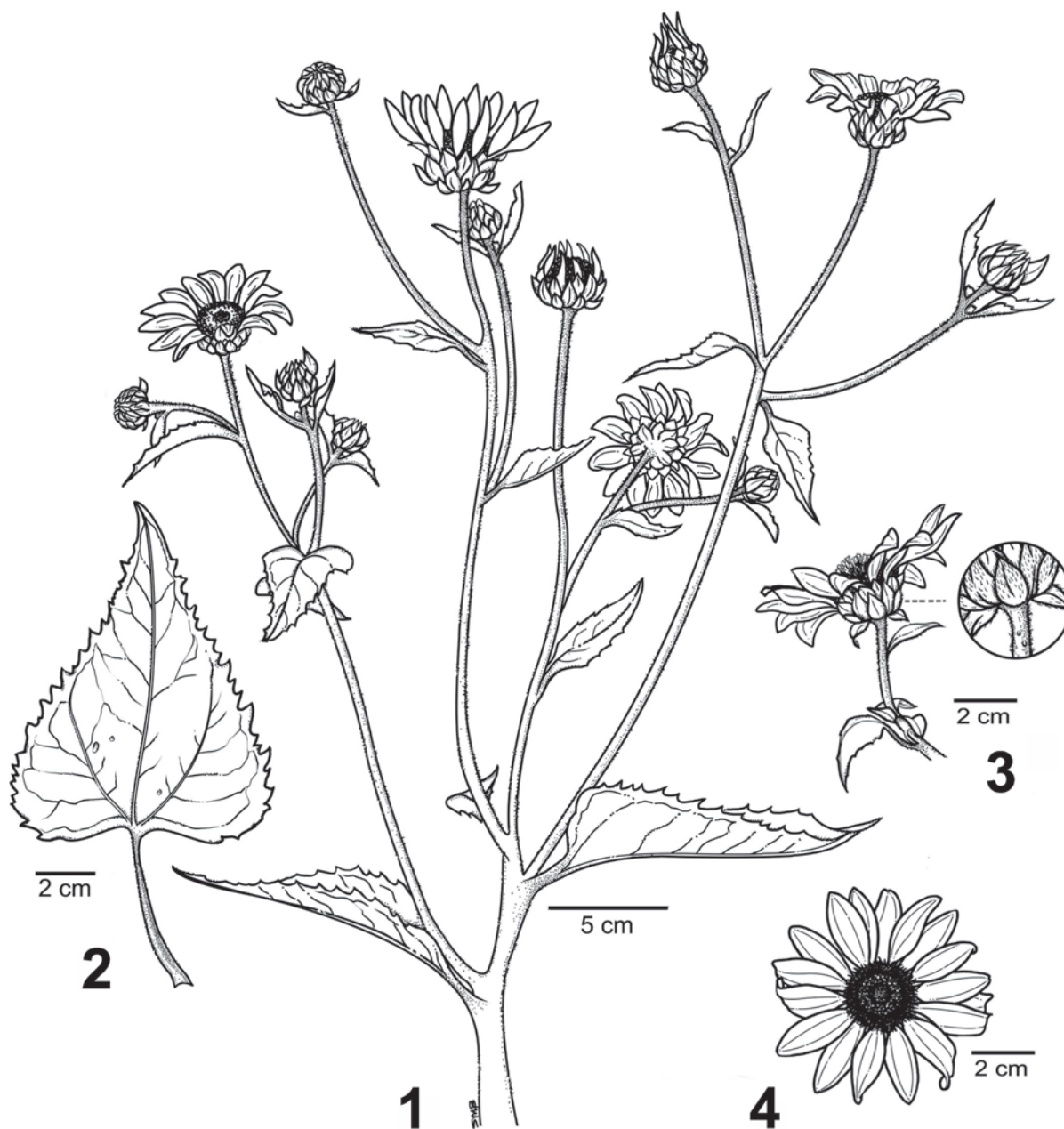


Fig. 1–4. *Helianthus winteri* J.C.Stebbins (Winter's sunflower).—1. Shoot structure.—2. Leaf.—3. Inflorescence with detail of phyllaries.—4. Inflorescence from above. Line drawings by Shannon Bickford.

tion, 1 Aug 2008, *J. C. Stebbins & C. J. Winchell* 0426; 36.7201011N, 119.3169033W, 330 m elevation, 4 Dec 2010, *J. C. Stebbins & C. J. Winchell* 3348; 36.7201920N, 119.3137220W, 335 m elevation, 4 Dec 2010, *J. C. Stebbins & C. J. Winchell* 3349; 2.3 km N of American Avenue, E of Friant-Kern Canal and W of Avenue 32, 36.671516N, 119.330467W, 330 m elevation, 12 Oct 2012, *J. C. Stebbins & J. V. H. Constable* 12940; 2.6 km N of American Avenue and 0.2 km NW of Avenue 32 adjacent to Southern California Edison Company transmission lines, 36.681000N, 119.332900W, 335 m elevation, 12 Oct 2012, *J. C. Stebbins & J. V. H. Constable* 12941. Tulare County: N side of Avenue 448, 0.2 km S of Highway 63, 36.603300N, 119.292383W, 320 m elevation, 12 Oct 2012, *J. C. Stebbins & J. V. H.*

Constable 12942; E side of Friant-Kern Canal and SW of Curtis Mountain adjacent to Southern California Edison Company transmission lines, 36.593016N, 119.284050W, 325 m elevation, 12 Oct 2012, *J. C. Stebbins & J. V. H. Constable* 12943; N side of Boyd Drive, 2.3 km NE of Avenue 416 on south-facing slope, 36.559150N, 119.192433W, 340 m elevation, 12 Oct 2012, *J. C. Stebbins & J. V. H. Constable* 12944; 0.5 km NE of Friant-Kern Canal on S slope of Curtis Mountain, 36.589617N, 119.257733W, 335 m elevation, 7 Jan 2013, *J. C. Stebbins & J. V. H. Constable* 12945.

Etymology.—*Helianthus winteri* is named in honor of Robert F. (Bob) Winter, emeritus Fresno City College instructor who has influenced the development of many California biologists,

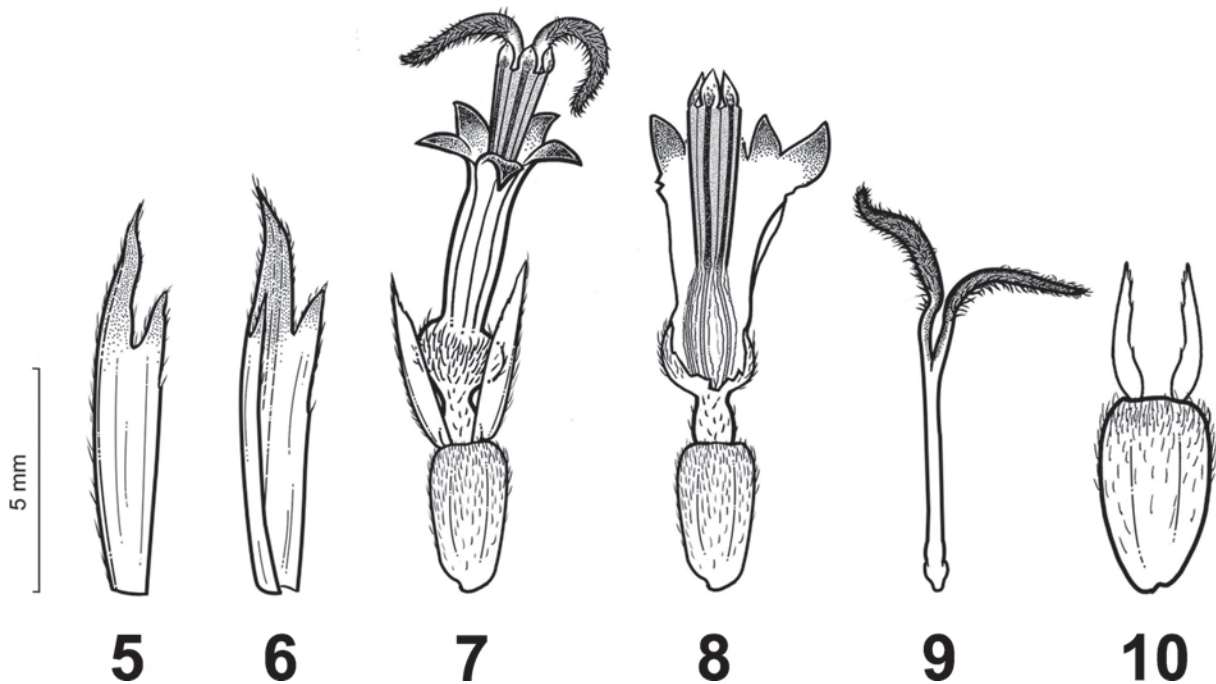


Fig. 5–10. Floral structure of *Helianthus winteri* J.C.Stebbins (Winter's sunflower).—5. Palea dorsal view.—6. Palea ventral view.—7. Disc floret.—8. Disc floret with part of corolla removed.—9. Disc floret style.—10. Achene with pappus. Line drawings by Shannon Bickford.

and natural historians within and beyond the range of this newly described species. His comment to “look at that big sunflower (blooming in January) up there” eventually prompted this closer analysis of a plant that superficially appeared to be *H. annuus*. The fact that the plants routinely flower year-round, including the winter months, lends further justification to the specific epithet.

NOTES AND DISCUSSION

Helianthus winteri is known from a relatively limited geographic and elevation range in southern Fresno County and northern Tulare County (Fig. 11). The type locality for the species is directly adjacent to Highway 180 east of Fresno, which represents a major access route to Sequoia and Kings Canyon National Parks. Many plants of this species grown in cultivation readily succumbed to frost, suggesting frost as a major determinant in the distribution of the species. Plants with woody stems tolerate severe frosts and the occasional low elevation snowfall at some sites. Localization of the plants on steep, rocky, south-facing slopes may benefit survival due to increased temperatures (enhanced insolation of southern exposures), enhanced water availability (rocky terrain creates surface runoff), and protection from domestic livestock grazing in these microhabitats. Presence of *H. winteri* only on slopes with little apparent livestock grazing suggests intolerance of herbivory similar to that of some other California native species (e.g., species of *Clarkia* Pursh, *Aristida* L., *Stipa* L.) that remain physiologically active during the late spring and summer (Ornduff 1974). Young plants of *H. annuus* are not tolerant of intensive grazing and occur primarily on roadsides and fallow and ruderal “waste” areas where domestic grazing does not occur (Abrams and Ferris 1960; Munz 1973). *Helianthus annuus* also occurs at some of the *H. winteri* sites, where it flowers only between April and

October. Accessible foothill habitat within the known range of *H. winteri* that is not developed or farmed is subject to grazing on a year-round basis, although livestock is sometimes excluded from steep rocky slopes due to safety concerns or the low forage value of these locations. Identification of sites that may support *H. winteri* is aided by observations of fence lines that may indicate sites with lower grazing intensity. The details of the causal relationship between the distribution of *H. winteri* and site characteristics (e.g., slope, aspect, grazing intensity and timing, and presence of invasive plant species) require further examination. It is likely that *H. winteri* historically occurred at lower elevations and on less rocky sites on the east side of the southern San Joaquin Valley. However, these lands are now intensively managed for agriculture or support highly developed infrastructure, and the species is now likely eliminated from these sites. *Helianthus winteri* may occur in similar habitats northwards in the central Sierra Nevada Foothills and southwards in the southern Sierra Nevada Foothills. Based upon ecological and geographic restrictions, *H. winteri* should be evaluated as a potential rare plant by the California Native Plant Society and the state and federal agencies with jurisdiction over rare species.

Phenological and morphological features that distinguish *H. winteri* from *H. annuus* are its year-round flowering and woody stem (Fig. 12–15). Individuals of *H. winteri* flower throughout the year, even after significant freezes. Stems that persist for years become woody (Fig. 14), and damaged stems display regrowth patterns similar to those of other woody plants. Stems increase in diameter through what appear to be more or less distinct growth rings (Fig. 15; S. Leavitt, pers. comm., 11 Apr 2013). Evolution of woody taxa from herbaceous progenitors is well established (e.g., Böhle et al. 1996; Ballard and Sytsma 2000), and such a transformation may occur relatively rapidly with minimal genetic change (Thomas et al.



Fig. 11. Distribution of known populations of *Helianthus winteri* J.C.Stebbins (Winter’s sunflower).

2000; Groover 2005), such that the genetic distinction between *H. winteri* and *H. annuus* may be subtle. Molecular studies suggest that the development of woody characteristics may be linked to the timing of flowering (Melzer et al. 2008; Lens et al. 2012). Field observations of first-year plants of *H. winteri* and *H. annuus* reveal relatively few clear morphological differences; however, differences in vascular differentiation has been observed as early as three weeks post-germination (Moyers and Rieseberg 2013). Ongoing studies of the genetic differences between *H. winteri* and *H. annuus* indicate equivalent genome size between the two species, and identical ploidy levels ($2n = 34$). Nonetheless, genetic differentiation between the two species has been observed (B. Moyers, pers. comm., 6 May 2013). Examination of phylogenetic relationships between *H. winteri* and other *Helianthus* species (e.g., *H. annuus*, *H. bolanderi* A.Gray, *H. exilis* A.Gray, and others) demonstrates that *H. winteri* consistently clusters more closely with *H. annuus* than with other annual *Helianthus* species (B. Moyers, pers. comm., 6 May 2013). *Helianthus inexpectatus* D.J.Keil & Elvin was recently recognized as a rare sunflower from Southern California based on a combination of geographic isolation and ploidy level, but it displays inconsistent morphological differences (Keil and Elvin 2010; Keil 2012). As described here, *H. winteri* is recognized as a separate species by the combination of morphological and phenological attributes

coupled with its presence in sites with specific ecological and geographical features.

A PARTIAL KEY TO PERENNIAL CALIFORNIA HELIANTHUS SPECIES SIMILAR TO *H. WINTERI*

1. Plant from taproot, subshrub, mature stems woody; immature stems with bark at base; buds and phyllaries generally purplish; blooms year-round; southern Sierra Nevada Foothills (Fresno and Tulare Counties)..... ***H. winteri***
- 1' Plant from rhizome, stems not woody at base, buds not purplish
2. Phyllaries generally 3–5 mm wide, tips of outer generally reflexed at maturity *H. californicus*
 - 2' Phyllaries generally < 3 mm wide, tips ± erect to reflexed at maturity
3. Phyllaries generally 2–3 mm wide, tips generally spreading to reflexed *H. inexpectatus*
 - 3' Phyllaries generally 1–1.5 mm wide, tips of outer ± spreading to erect *H. nuttallii*

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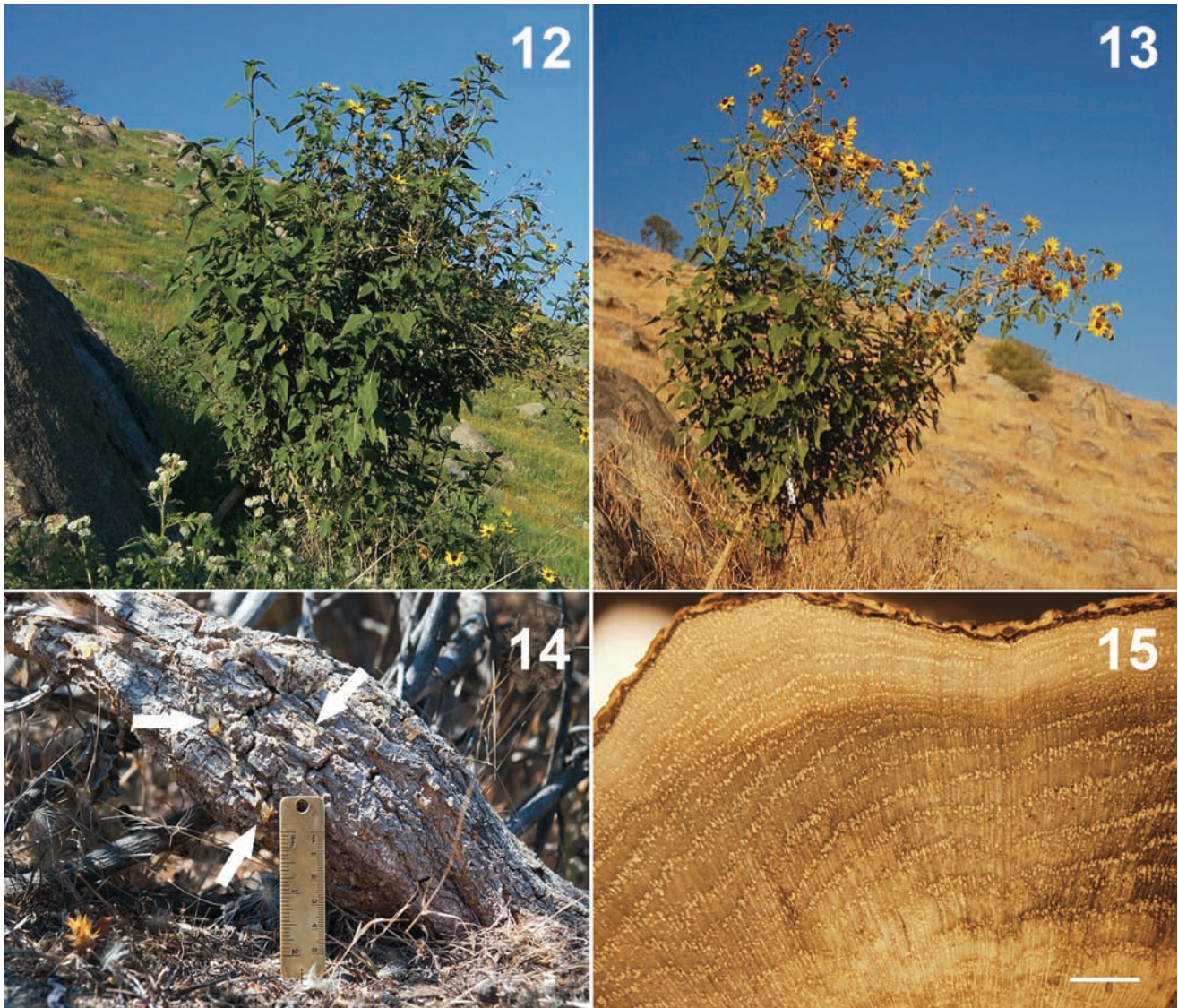


Fig. 12–15. *Helianthus winteri* J.C.Stebbins (Winter’s sunflower).—12. Growth habit, March 2008 at type locality.—13. The same individual as in Fig. 12, October 2010.—14. Stem illustrating woody characteristics and resinous secretions (arrows), scale bar 5 cm.—15. Stem transverse section at 10 \times magnification, scale bar 200 μ m.

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