

**FIELD OBSERVATIONS AND A NEW COLLECTION
OF THE RARE MEXICAN ENDEMIC
CASTILLEJA RACEMOSA (OROBANCHACEAE)**

J. MARK EGGER

Herbarium, Burke Museum of Natural History and Culture
University of Washington
Seattle, Washington 98195-5325
m.egger@comcast.net

OSCAR ABEL SÁNCHEZ VELÁZQUEZ

Faculty of Chemical-Biological Sciences
Universidad Autónoma de Sinaloa
Ciudad Universitaria AP. 1354, Universitarios
Culiacán Rosales, Sinaloa 80030 México
oscar.asv.fcqb@uas.edu.mx

ABSTRACT

A recent collection of the distinctive, rare, and highly localized west Mexico endemic species *Castilleja racemosa* (Breedlove & Heckard) Chuang & Heckard is documented. Field observations from the collection site are provided, including the first published photos of live plants in their natural habitat.

Castilleja racemosa (Breedlove & Heckard) Chuang & Heckard is a little-known species endemic to the Sierra Surutato, a portion of the Sierra Madre Occidental in northeastern Sinaloa, Mexico. The vegetation and ecology of this region was first described by H.S. Gentry (1946). During one of his several collection forays into these mountains, Gentry made the first collection of *C. racemosa*, though he made no mention of it in his paper. While the duplicates were widely distributed, the specimens remained unidentified for 24 years. The ecology of this historically remote region was also characterized by McDiarmid et al. (1976).

The species was first described by Breedlove and Heckard (1970) and was originally placed in its own monotypic genus, as *Gentrya racemosa* Breedlove & Heckard. Later, Chuang and Heckard (1991) placed this entity within an expanded *Castilleja*, based on its chromosome number of $n = 12$, the base number for the genus (Chuang & Heckard 1982), and its seed coat morphology. This placement was confirmed by subsequent phylogenetic studies (Tank & Olmstead 2008; Tank et al. 2009).

The authors of the present paper came into contact through the iNaturalist/Naturalista website. Previously, during 20-23 February 1999, Egger visited the Los Hornos-Ocuragui area in the northern part of the Sierra Surutato, where Breedlove obtained two of his collections, including the type, but he was unsuccessful in locating any populations of *Castilleja racemosa*, at least partly due to human population increases and development in the area. Learning that there was a student in the Ph.D. program in Food Biotechnology at the Universidad Autónoma de Sinaloa who might be interested in attempting to locate extant populations, in early 2018 Egger contacted Sánchez-Velázquez, who offered to search for such populations. Sánchez-Velázquez visited the region on 3 March 2018 and successfully located a population of *C. racemosa* near the pueblo of Surutato. Documentation of his collection and an enumeration of the other collections of this species known to us are presented below. Images of many of these herbarium collections were assembled by Egger and can be viewed on the internet (Egger 2018). We believe that the photos of the live plants of *C.*

racemosa presented below (Figs. 2-11) are the first to be published in any medium. It is significant that all known collections were obtained within a limited portion of northeastern Sinaloa, an indication of the very local endemism of this remarkably distinctive species.

CASTILLEJA RACEMOSA (Breedlove & Heckard) Chuang & Heckard, Syst. Bot. 16: 660. 1991. *Gentrya racemosa* Breedlove & Heckard, Brittonia 22: 21. 1970. **TYPE: MEXICO. Sinaloa.** Mpio. Sinaloa de Leyva: Near the settlement of Ocuragui, NE of [San José de] Los Hornos, Sierra Surutato, broad cultivated valley with forests of *Pinus* and *Quercus* around the margins, 6000 ft, 22 Feb 1969, D.E. Breedlove 16456 (holotype: UC!; isotypes: CAS!, ENCB!, K!, LE, MEXU!, MICH!, NY!, UWM, US!).

Verified collections with associated notes. MÉXICO. Sinaloa. Mpio. Badiraguato: Surutato, 600 m al E del centro del pueblo, 25°48'26.6" N, 107°33'14.5" W, bosque de pino-encino con *Pinus engelmannii*, *Pinus oocarpa*, *Quercus* sp., crece en lugares sombreados, 1453 m, 3 Mar 2018, Sánchez-Velázquez 1 (HJBC!, WTU!, Fig. 1); a 11 km al N de Surutato por la Brecha Surutato-Santa Rita, llano entre claro de bosque, suelo delgado, dominado por gramíneas, rara, +/- 2000 m, 9 Mar 1985, Aviña y Torres 1501 (MEXU [2]!, UAS?); 5 mi NE of La Cienega along road to Santa Rita, steep moist slope with *Cornus*, *Abies*, oak, pine, etc., 7000 ft, 8 Mar 1971, Breedlove 19262 (CAS! [accidentally destroyed], JEPS!); Sierra Monterey [central portion of Sierra Surutato], moist, grassy northern slope, pine forest, 5000 ft, 10 Mar 1940, Gentry 5890 (ARIZ!, CAS!, DES!, GH!, MEXU!, MO!, NA!, NY!, OSC!, WTU!). **Mpio. Sinaloa de Leyva:** 3 mi N of Los Ornos [= San José de Los Hornos] along road to Ocuragui, steep moist slope with *Alnus*, *Styrax*, *Mahonia*, *Molinadendron*, *Clethra*, *Pinus*, *Quercus*, and *Juglans*, 6500 ft, 7 Mar 1971, Breedlove 19,200 (CAS! [accidentally destroyed], DAO!, JEPS!, MEXU!, MO!, OSC!, WTU!); specimens grown from seeds from Breedlove 19,200 on *Helianthus annuus* in greenhouse at Univ. of Calif. Berkeley, 29 Sep 1975, Heckard s.n. (NY!, UC!).

Breedlove 19,200 (JEPS) and *Breedlove 19262* (JEPS) were used for the chromosome counts by Chuang and Heckard (1982), and the former was the source of the genetic analysis reported by Tank and Olmstead (2008).

While the description and illustration of *Castilleja racemosa* in the protologue are thorough and generally correspond with the characters of the new collection, there are a few details visible in the collection that amend the original description. These features are particularly evident in the photographs by Sánchez-Velázquez presented below (Figs. 2-11). One is the fact that at least some of the corollas turn from the usual lemon yellow to a rich orange to red-orange with age, presumably following pollination. Also, the conspicuously exerted stigma and distal portion of the style is not mentioned in the description nor apparent in the illustration accompanying the protologue. Breedlove and Heckard also mentioned that the plants of the type collection have entire floral bracts, while those of Gentry's collection often have bracts with one pair of lateral lobes. The plants of the new collection have bracts of both types, suggesting that this is a fluid trait. While the precise location of the Gentry collection is unknown, the "Sierra Monterey" is a little-used name apparently applied to the southeastern portion of the Sierra Surutato, according to the map in his paper, while the type collection by Breedlove is in the northwestern portion. The new collection location is between those of Gentry and Breedlove and contains plants with both morphologies. Whether the clinal variation suggested is significant or not remains to be tested.

In addition to confirming much of the general habitat information recorded in the protologue paper and on the labels of previous collections, such as gentle slope in predominantly pine-oak zone, the new collection of *Castilleja racemosa* was closely associated with and perhaps parasitic on a small, low-growing *Hosackia* species (Figs. 2-3), perhaps *H. alamosanus* (Rose) Gentry (fide T.R.

Van Devender, Sky Island Institute, pers. comm., 2018). Aside from the *Hosackia* species, the habitat in the immediate vicinity of the *Castilleja* plants was otherwise only sparsely populated with an unknown grass species (Poaceae) and one or two other unidentified small herbaceous species, though the area was covered with a rather deep layer of pine needles, dead grasses, and dried plant material (see Figs. 2-6). Sánchez-Velázquez located three small subpopulations, ranging in size from 160 m² to 450 m² and contained estimated plant densities ranging from 5-10 plants to 15-30 plants per m².

Global conservation status

Castilleja racemosa is rare species of extremely limited distribution in a western front range of the Sierra Madre Occidental and is entirely endemic to two municipalities in northeastern Sinaloa. It should be considered globally threatened, if not endangered, at least until its complete distribution and ecology are better understood. It is a unique species in several respects, and its conservation should be a matter of concern, both in an evolutionary sense and in terms of the conservation of plant species in Mexico. It should be looked for in the adjacent portions of the Sierra Madre Occidental in extreme southwestern Chihuahua and extreme northwestern Durango, where seemingly suitable habitat will likely be found. The region west of Guadalupe y Calvo, Chihuahua, might be especially productive in this regard.

ACKNOWLEDGEMENTS

We thank the personnel of the following herbaria for timely assistance with correspondence and/or loans of specimens and for hospitality during visits to their institutions: CAS, HJBC, MEXU, MO, NY, UC and WTU. We also thank the botanists Érika Pagaza, Guillermo Millán, Eva Rivera, and Fernando Colín of the Jardín Botánico Culiacán for technical support and Jorge Vega and Cruz López for field logistics. Finally, we thank Guy Nesom for editorial guidance and suggestions. This paper is dedicated to the memory of Dennis Breedlove, who graciously provided Egger with important information regarding his collections and travels in the Sierra Surutato.

LITERATURE CITED

- Breedlove, D.E. and L.R. Heckard. 1970. *Gentrya*, a new genus of Scrophulariaceae from Mexico. *Brittonia* 22: 20–24.
- Chuang, T.I. and L.R. Heckard. 1982. Chromosome numbers of *Orthocarpus* and related monotypic genera (Scrophulariaceae: Subtribe Castillejinae). *Brittonia* 34: 89–101.
- Chuang, T.I. and L.R. Heckard. 1991. Generic realignment and synopsis of subtribe Castillejinae (Scrophulariaceae – Tribe Pedicularae). *Syst. Bot.* 16: 644–666.
- Egger, J.M. 2018. *Castilleja racemosa* on Flickr. <https://www.flickr.com/photos/mark_egger_castilleja/albums/72157633292351640>
- Gentry, H.S. 1946. Notes on the vegetation of Sierra Surotato (sic) in northern Sinaloa. *Bull. Torrey Bot. Club* 73: 451–462.
- McDiarmid, R.W., J.F. Copp, and D.E. Breedlove. 1976. Notes on the herpetofauna of western México: New records from Sinaloa and the Tres Márias Islands. *Nat. Hist. Mus. Los Angeles Co. Contrib. Sci.* 275: 1–17.
- Tank, D.C., J.M. Egger, and R.G. Olmstead. 2009. Phylogenetic classification of subtribe Castillejinae (Orobanchaceae). *Syst. Bot.* 34: 182–197.
- Tank, D.C., and R.G. Olmstead. 2008. From annuals to perennials: Phylogeny of subtribe Castillejinae (Orobanchaceae). *Amer. J. Bot.* 95: 608–625.



Figure 1. *Castilleja racemosa*. Sánchez-Velázquez 1 (WTU). Photo by J.M. Egger



Figure 2. *Castilleja racemosa* in its natural habitat. Note small *Hosackia* species and the thick mulch of pine needles and other plant debris. This and all photos of live plants below by O.A. Sánchez-Velázquez.



Figure 3. *Castilleja racemosa* in its natural habitat. Note small *Hosackia* species and the thick mulch of pine needles and other plant debris.



Figure 4. *Castilleja racemosa* in its natural habitat. Note small *Hosackia* species and the thick mulch of pine needles and other plant debris.



Figure 5. *Castilleja racemosa* in its natural habitat. Note the color change from lemon-yellow to deep orange as the corollas age.



Figure 6. *Castilleja racemosa* in its natural habitat. Full plant (above) and crop (below) to show pubescence of stems and floral details.



Figure 7. *Castilleja racemosa* inflorescence in its natural habitat. Note the color change from lemon-yellow to deep orange as the corollas age.



Figure 8. *Castilleja racemosa* inflorescence in its natural habitat. Note the abundant stipitate-glandular pubescence.



Figure 9. *Castilleja racemosa* in cultivation at Jardín Botánico Culiacán.



Figure 10. *Castilleja racemosa*, dried flower with dissected calyx but undissected capsule (L) and with dissected capsule revealing seeds in late stage approaching maturity. From O.A. Sánchez-Velázquez 1 (HJBC). Photo by O.A. Sánchez-Velázquez.



Figure 11. *Castilleja racemosa*, fresh bracts (above and center), showing lobes and variation in size, and fresh leaf (below). From O.A. Sánchez-Velázquez 1 (HJBC). Photo by O.A. Sánchez-Velázquez.