

**LECTOTYPIFICATION AND SYNONYMY OF *CASTILLEJA ARVENSIS*  
(OROBANCHACEAE),  
WITH NOTES ON ITS STATUS, IDENTIFICATION, AND RELATIONSHIPS**

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**ABSTRACT**

A lectotype is designated for *Castilleja arvensis* Schltld. & Cham. and a full synonymy is provided. A lectotype is also designated for the synonymous name, *Castilleja haitiensis* Urb. & Ekm. The annual *C. arvensis* is also distinguished from the designated lectotype of the perennial species *C. lithospermoides* Kunth (a nomenclatural synonym of *C. scorzonifolia* Kunth) and from other species with which *C. arvensis* is often confused. A simplified key and vouchered field photograph are provided for distinguishing *C. arvensis* from its morphologically similar congeners.

*Castilleja arvensis* Schltld. & Cham. is an annual found throughout much of Mexico, Central America, and South America, from near sea level to above timberline, largely in ruderal habitats such as roadsides, grazed and agricultural lands, and forest edges and also in lower paramos, volcanic debris fields, and other moderately natural habitats. It has spread to island groups, including the Galapagos and the Hawaiian and Caribbean archipelagos; it has yet to be documented north of the Mexican border in North America.

In the protologue (Schlechtendal & Chamisso, 1830) for *Castilleja arvensis* two herbarium sheets collected by C.J.W. Schiede and F. Deppe in the vicinity of the city now known as Xalapa, Veracruz, Mexico, were cited. The protologue lists the locations as “Parce prope Jalapam, inter segetes inter San Andres et Serro colorado.” The two collections are of the same species and bear the same Schiede number and date (August 1828), and are labeled as “Typus.” Locations recorded on the two sheets are different, indicating that they were perhaps collected in different localities and necessitating the designation of a lectotype. Holmgren (1978), in his treatment of the *Castilleja* species of Costa Rica and Panama, cited both collections as “Type.” He also mentioned “Type not seen,” and he may have not realized two syntype sheets were involved. One syntype sheet, HAL 096090, is labeled “inter segetes inter San Andres et Serro Colorado;” the other is selected as the lectotype designated below.

**CASTILLEJA ARVENSIS** Schltld. & Cham., *Linnaea* 5: 103. 1830. **LECTOTYPE** (designated here): **MÉXICO**. [**Veracruz**]: Parce prope Jalapam [= Xalapa] (prope Jalapam parce provenit), Aug 1828, *C.J.W. Schiede 542 and F. Deppe* (HAL 096089!). Figure 1. [Note: The collections cited by Schlechtendal and Chamisso in the *Linnaea* paper are assumed to be collected by both Schiede and Deppe; the latter’s name does not appear on either of the syntype sheets at HAL. The lectotype sheet was selected due to the more ample material thereon.]

*Bartsia trinervis* Ruíz & Páv. ex A. Lopéz, *Anal. Inst. Bot. Cavanilles* 17: 445. 1959. **TYPE: SOUTH AMERICA**. Ic. 496, fig. b. [no collection data provided] (holotype: MA?).

*Castilleja agrestis* Pennell, *Fieldiana Bot.* 28: 519. 1953. **TYPE: MEXICO. Michoacan**. Cornfields near Patzcuaro, 18 Nov 1890, *C.G. Pringle 3349* (holotype: PH!; isotypes: BR!, E!, S!).

*Castilleja communis* Benth., in DC., Prodr. Syst. Nat. Regn. Veg. 10: 529, 1846. **LECTOTYPE** (Holmgren, Brittonia 30: 185, 1978): México. Veracruz. Jalapa [= Xalapa], (Apr 1838) *J.J. Linden 212* (lectotype: K!; isolectotypes: BR-GENT!, G!, MICH!). [Note: Holmgren (1979) stated that F.W. Pennell made the original lectotypification for this taxon, using *Linden 212* but made no mention of the published source of Pennell's lectotypification. I have been unable to find any such reference by Pennell for this study, and I believe Holmgren's citation was based on Pennell's unsigned annotation of *Linden 212* as "Type specimen" on the type sheet at K. This sheet contains two other collections besides *Linden 212*. A year earlier, Holmgren (1978) cited *Linden 212* as the "Type" for *C. communis*, and I am taking this to be the effective lectotypification, pending discovery of an earlier publication by Pennell. Some unpublished sources cite the location of Pennell's putative lectotypification as his paper on the Scrophulariaceae of Panama (Pennell 1940); I find no such lectotypification in that publication.]

*Castilleja communis* Benth. f. *johnstoniae* Standl., Field. Mus. Pub. Bot. 23: 86. 1944. **TYPE: Guatemala.** Dept. Escuintla: between Río Jute and Río Pantaleón, on road between Escuintla and Santa Lucía Cotz. [= Santa Lucía Cotzumalguapa], in moist (damp) field, (alt. 540-720 m), 24 Jan 1939, *P.C. Standley 63500* (holotype: F!). [Note: This was described as a pale color form. Such rare color forms occur rarely and sporadically throughout the range of this normally reddish-bracted species.]

*Castilleja haitiensis* Urb. & Ekm., Arkiv. Bot. 23A, 11: 46. 1931. **LECTOTYPE** (designated here): **Haiti.** Massif de la Hotte, in parte occidentali prope Torbec inter Les Platons et Farmon in campis, 1000 m alt., 26 Dec 1926, *E.L. Ekman 7421* (lectotype: S 04-3441!; isolectotypes: A!, C!, F!, G! GH[2]!, K!, NY!, S 04-3440!, TEX-LL!, US!). [Note: two sheets with identical labels and both annotated as "Typus" are found at S. The sheet selected as lectotype contains Ekman's field notes, perhaps indicating that this was his intended holotype.]

*Castilleja hyssopifolia* G. Don, Gen. Syst. Gard. Bot. 4: 615. 1838. **TYPE: Ecuador.** "*Willd. Herb #11697*", [*Humboldt 2294*, from vicinity of Quito, 1802] (holotype: B-WILLD!). [Note: Don's intention in listing this name is not entirely clear. It is included in a numbered paragraph under the species *Castilleja lithospermoides* Kunth, listed as "*C. hyssopifolia*, Willd. Herb. No. 11697," and was likely intended as a nomen subnudum to be included within the synonymy of *C. lithospermoides*. Don provided a partial description of the plant, possibly contrasting it with *C. lithospermoides*, though there is no clear designation of the collection as a "typus." This collection is conspecific with the type of *C. arvensis* and not with lectotype of *C. lithospermoides* from Mexico.]

*Castilleja lithospermoides* Kunth var. *pastorei* Hicken, Physis. Revista de la Sociedad Argentina de Ciencias Naturales 1: 30. 1912. **TYPE: Argentina.** En el Cerro del Ruidito (San Luis), 20 Jan 1911, *F. Pastore s.n.* (holotype: SI!).

*Castilleja pulcherrima* Sessé & Moç., Icones Fl. Mex., plate 104. 1889; Pl. Nov. Hisp., Ed. 1: 95. 1889 (La Naturaleza, Ser. II.i., App. 95). **LECTOTYPE** (Nelson, Anales Jard. Bot. Madrid 55: 375-418. 1997): **México. [probably Distrito Federal].** In agris Sancti Augustini [= San Agustin de las Cuevas, = Tlalpan] oppido prope Mexicum, Sep [1787 or 1788], *M. Sessé 2523* (lectotype: MA!; photograph: F!, negative #30810. [Note: The lectotype cited by Nelson (1997) bears the annotation, "*Castilleja pulcherrima* N." (= Nova). A discussion of this name was provided by McVaugh (2000).]

## Discussion

*Castilleja arvensis* is at times confused with several related species of *Castilleja* sect. *Euchroma* (Nutt.) Benth. This is true on herbarium sheets as well as in some publications (e.g. Xifreda 1999; Páez et al. 2015). This is true because of morphological similarities and misinterpretations of the identity of *C. lithospermoides* Kunth. This misinterpretation has led some authors (e.g., Xifreda 1999) to synonymize *C. arvensis* under the earlier-described *C.*

*lithospermoides*. My studies of the type material involved and the literature concerning the *Castilleja* species of Mexico and my own field studies of *Castilleja* in Mexico, Central America, and South America lead to a different conclusion.

The first relevant consideration is the identity of *Castilleja lithospermoides* Kunth. In his protologue (Nov. Gen et Spec. 2 [folio]: 266, 1818; 2 [quarto]: 331, tab. 164, 1920), Kunth listed two collections: “Crescit in temperatis Novae Hispaniae prope Real del Monte et Moran, et in Regno Quitensi prope Chillo.” The former is a historically famous mining district (including Real del Monte and Real del Moran) in the mountains northeast of Pachuca, Hidalgo, Mexico; the latter is near Quito, Ecuador. In her comprehensive revision of the *Castilleja* species of Mexico, Eastwood (1909) not only treated *C. lithospermoides* as distinct from *C. arvensis* but also provided an effective lectotypification of the former, based on the collection from Mexico: “The type was collected probably in the state of Hidalgo near Real del Monte.” This is surely synonymous with the “Novae Hispaniae prope Real del Monte et Moran” of the protologue, and no other type material applying to *C. lithospermoides* is known to me. Of the type material associated with the name *C. lithospermoides* at P, there are two sheets — one usually is regarded as the type (Nesom 1992) and as Eastwood’s lectotype (Figure 2, P00670473), and the other is labeled as isotype, though it is best regarded as an isolectotype (Figure 3, P00136105, perhaps an addition from Bonpland’s personal herbarium, based on the annotations). Both sheets are labeled with the collection location as “Moran,” though it is not clear if all stems were collected at that location. Both sheets contain three stems. Of these, only one stem on the type sheet but all three on the isotype sheet contain complete inflorescences, and all of these four stems have corollas partially exerted from the calyces. Only the stem on the right side of the type sheet contains roots to indicate duration. That stem lacks an inflorescence. The central stem on the type sheet has neither root nor a complete inflorescence, the latter apparently due to past insect damage, and is of little determinative value, though the linear-lanceolate leaves are consistent with those of the left stem and not with *C. arvensis*. The stem with the root is divergent from the others in its nodulose proximal portion and may actually represent the specimen from near Quito cited in the protologue. It belongs to what is here interpreted as *C. arvensis*, though its collection location is conjectural, and *C. arvensis* is found both in Mexico and in Ecuador. What is certain is the left stem on the type sheet (the only one with an inflorescence), likely the middle stem, and all the stems on the isolectotype sheet are distinct from the type of *C. arvensis*. In addition, both the tab. 164 illustration (Figure 4) and the written description of *C. lithospermoides* show features not found in *C. arvensis*, including a reddish band on the distal portion of the calyces and the clearly exerted distal portion of the corolla. Eastwood’s key also correctly identifies *C. arvensis* as an annual, contrasting it with the perennial *C. lithospermoides*. Finally, on the type sheet of the *C. arvensis* synonym, *C. communis* Benth., Bentham in an undated annotation observed that “All these (the three collections on the sheet) belong to a species common in South America, which I took for *C. lithospermoides* Kunth, but now I think it is an undescribed one.” Evidently, Bentham was not aware at the time of the publication of *C. arvensis*.

Another important point to consider in relation to these plants is the close similarity between *Castilleja lithospermoides* and *C. scorzonerifolia* Kunth, both in their type specimens and in the illustrations accompanying the protologues. This was noted by Nesom (1992a) when he reduced *C. lithospermoides* to synonymy under *C. scorzonerifolia*. This conclusion was evidently also supported by *Castilleja* researcher T.I. Chuang, who annotated the isolectotype sheet of *C. lithospermoides* as *C. scorzonerifolia*. Finally, the perennial *C. scorzonerifolia*, including *C. lithospermoides*, is limited to the eastern and southern portions of Mexico, where it is endemic; the annual *C. arvensis* has a much wider range, including much of Mexico, Central America, and South America. Most, if not all, material in herbaria identified as *C. lithospermoides* and collected outside of Mexico is likely referable to *C. arvensis*.

Yet another species to consider in this discussion is *Castilleja nervata* Eastw. It is found primarily in the Sierra Madre Occidental and Sierra Madre del Sur of Mexico and scarcely enters the USA in the Chiricahua and possibly the Santa Rita Mountains of Cochise Co., Arizona. Like *C. arvensis*, *C. nervata* has a corolla mostly included within the calyx and lacks the brightly-colored distal portion of the calyces; unlike that species, *C. nervata* is perennial and also differs from *C. arvensis* in leaf morphology and seed characteristics. Despite these differences, the identification of these two species is often confused in herbarium specimens collected from the western and southern mountains of Mexico.

The following key can be used to distinguish the species discussed here and should help with the proper identification of these plants both in the field and herbarium. Several other species of sect. *Euchroma* occur in Mexico (see Nesom 1992b); they are all rare to uncommon and highly range-restricted endemics, most of which would separate out with *Castilleja scorzonerifolia* in the first couplet. Vouchered field photographs of all three species treated in the key are also provided below (Figures 5-14). Additional photographs of the genus *Castilleja* from throughout its range, including all species of sect. *Euchroma*, can be found at my Flickr site (Egger 2017).

1. Calyces proximally greenish, distally brightly and contrastingly colored red to orange or red-orange (yellow, rich purple); distal portion of corolla shortly, conspicuously exserted from calyces ..... **Castilleja scorzonerifolia** and other species of sect. *Euchroma* in Mexico
1. Calyces usually greenish throughout, distally greenish to dark greenish to sometimes dull, dark purplish in *C. nervata*; corollas usually wholly included within the calyces or sometimes slightly, inconspicuously exserted.
  2. Plants annual; seeds linear, 400–500 per capsule, 0.8–1.0 mm long, 0.1–0.2 mm wide; leaves usually oblanceolate to lanceolate, often broadly so; stems usually proximally nodulose ..... **Castilleja arvensis**
  2. Plants perennial; seeds narrowly ovate, 50–150 per capsule, 1.3–3.0 mm long, 0.5–1.1 mm wide; leaves usually linear-lanceolate; stems proximally more or less smooth ..... **Castilleja nervata**

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Figure 1. Lectotype of *Castilleja arvensis* Schtdl. & Cham., HAL.



Figure 2. Eastwood's lectotype of *Castilleja lithospermoides* Kunth, P.



Figure 3. Isolectotype of *Castilleja lithospermoides* Kunth, P.



Figure 4. Painted version of Tab. 164, *Castilleja lithospermoides* Kunth.



Figure 5. *Castilleja arvensis*, Pasachoa Forest Reserve, Pichincha Prov., Ecuador, 13 Jul 1987. Two stems from same population showing variation in leaf morphology in this species.



Figure 6. *Castilleja arvensis* as an adventive on the Island of Hawaii. (L) Kipuka P'u'u O'o, Jul 1999. (R) Color variations, near Hilo Airport, 1 Aug 1997.



Figure 7. *Castilleja arvensis*, variation in size and habitat. (L) Plant about 25 cm tall on volcanic cinders, Kipuka P'uu O'o, Island of Hawaii, 14 Jul 1999. (R) Plant nearly 1.5 m tall supported by fence, cloud forest margins, Lower Chiriboga Rd., Pichincha Prov., Ecuador, 9 Jul 1987.



Figure 8. *Castilleja arvensis* variation. (L) Above Santa Inez del Monte, Sierra Clavellinas, Oaxaca, Mexico, 22 Aug 2001. (R) East of Agallpampa, Depto. La Libertad, Peru, 16 Apr 2005.



Figure 9. *Castilleja scorzonerifolia* (syn: *C. lithospermoides*), typical plants. (L) NE slopes of Cerro Potosí, Nuevo León, Mexico, 1 Aug 1999. (R) Near Tlachichuca, Puebla, Mexico, 19 Aug 2000.



Figure 10. *Castilleja scorzonerifolia*, high elevation forms, upper slopes of Cerro Zempoalteptl, Oaxaca, Mexico, 24 Aug 2001.



Figure 11. *Castilleja scorzonerifolia*, unusual color forms. (R) Near Tlachichuca, Puebla, Mexico, 19 Aug 2000. (L) NE slopes of Cerro Potosí, Nuevo León, Mexico, 1 Aug 1999.



Figure 12. *Castilleja nervata*, N of Turkey Cr., Chiricahua Mts., Cochise Co., Arizona, 20 Aug 1992.



Figure 13. *Castilleja nervata*. (L) N of Turkey Cr., Chiricahua Mts., Cochise Co., Arizona, 20 Aug 1992. (R) near Laguna Zempoala, Estado de Mexico, Mexico, 22 Aug 2000.



Figure 14. *Castilleja nervata*, form with unusually colored calyces, near El Palmito, Sierra Madre Occidental, Sinaloa, Mexico, 13 Apr 1999.

All field photographs are by the author and most are vouchered with the following collections deposited at WTU, with some duplicates deposited at MEXU, CAS, NY, and elsewhere.

***Castilleja arvensis***

Fig. 5: no collection obtained.

Fig. 6: (L): Egger 1076  
(R): Egger 895

Fig. 7: (L): Egger 1076  
(R): no collection

Fig. 8: (L): Egger 1185  
(R): Egger 1330

***Castilleja scorzonerifolia***

Fig. 9: (L): Egger 1087  
(R): Egger 1126

Fig. 10: (L): Egger 1196  
(R): Egger 1197

Fig. 11: (L): Egger 1126b  
(R): Egger 1087

***Castilleja nervata***

Fig. 12: Egger 529

Fig. 13: (L): Egger 529  
(R): Egger 1138

Fig. 14: Egger 1059