

VARIATION IN *ERYTHRANTHE CORDATA* (PHRYMACEAE) IN ARIZONA

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ABSTRACT

Plants of *Erythranthe cordata* vary greatly in size but are consistently distinguished from *E. guttata* sensu stricto in their small corollas, autogamous breeding, and lack of rhizomes. Aspects of size variability and vegetative and floral morphology in *E. cordata* are shown in photos of collections from the state of Arizona.

Erythranthe cordata (Greene) Nesom of the southwestern USA and adjacent Mexico (Fig. 1) has often been misidentified as *E. guttata* (Fischer ex DC.) Nesom within an inclusive, polymorphic concept of the latter, but *E. cordata* is distinct in its lack of rhizomes and its autogamous flowers. A difference in chromosome number ($x = 15$ in *E. cordata* vs. $x = 14$ in *E. guttata*) points to their evolutionary distinction. Recent study in the ASU herbarium has occasioned this overview of *E. cordata* as it occurs in Arizona, with the aim of clarifying its identity and its distinction from *E. guttata*.

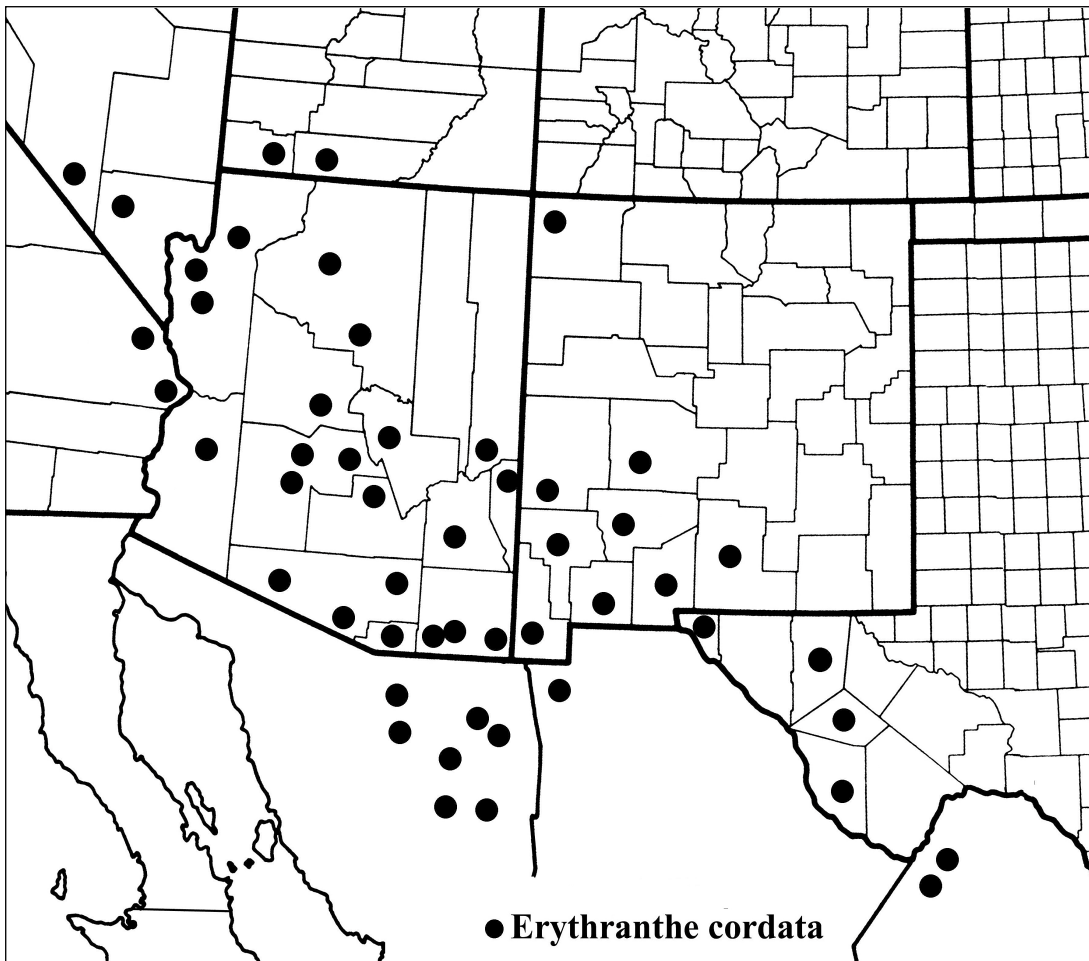


Figure 1. Geographic distribution of *Erythranthe cordata*. From Nesom (2012a) with one additional record for Arizona.

Within *Erythranthe* sect. *Simiola*, *E. cordata* has been regarded as a member of the "*E. arvensis* group" — *E. cordata* plus the *E. arvensis* complex, including *E. brachystylis* and *E. charlestonensis* — each of which is annual (without rhizomes but sometimes with adventitious roots at lower nodes) and produces autogamous flowers (often with small, obviously cleistogamous corollas) mostly produced from distal nodes (Nesom 2012a, 2014a and b). Whether the similar reduced floral features and associated biology in *E. cordata* and *E. arvensis* are strictly homologous or independently evolved probably will be determined by molecular comparisons.

Erythranthe cordata and *E. arvensis* are essentially allopatric, the latter occurring mostly in more northern regions and not documented as a member of the Arizona flora. Typical *E. guttata*, however, occurs widely in Arizona and is distinguished from *E. cordata* by the following contrasts.

- 1. Rhizomatous; corolla tubes (10–)12–20(–26) mm, exserted 3–5 beyond calyx margin, limb expanded 12–24(–25) mm (pressed); styles 15–20 mm, exserted 6–9 mm beyond fruiting calyx margin; stigma above level of anthers (herkogamous), reproduction allogamous; chromosome numbers $2n = 28, 56$ ($x = 14$) ***Erythranthe guttata***
- 1. Without rhizomes, fibrous-rooted; corolla tubes 5–14 mm, exserted 1–3 mm beyond calyx margin, limb expanded 9–14 mm (pressed); styles 7–10 mm, exserted 1–3 beyond fruiting calyx margin; stigma at same level as anthers (plesiogamous), reproduction autogamous; chromosome number $2n = 60$ ($x = 15$) ***Erythranthe cordata***

Even if basal parts are not available and corollas have been shed, contrasts in style length provide an effective distinction. In *E. cordata*, the persistent style is short-exserted from the calyx, reflecting the short corolla tube and plesiogamous arrangement of stigma and anthers (Nesom 2012b). In *E. guttata*, the persistent style is longer, reflecting the longer corolla tube and herkogamous arrangement of stigma and anthers.



Figure 1. *Erythranthe cordata*. Relatively large corolla of autogamous flower, short-tubed with throat closed and stigma and anthers within the tube. Cochise Co., Arizona, San Pedro Riparian National Conservation Area, 13 Apr 2002, *Makings* 943, ASU. Photo by Liz Makings. See Figure 2.



Figure 2. *Erythranthe cordata*. Cochise Co., Arizona, San Pedro Riparian National Conservation Area, 13 Apr 2002, *Makings 943*, ASU. Arrows point to small corollas and short styles. Photo mounted on sheet and in Figure 1 is from the same population.

Plants of *Erythranthe cordata* are highly variable in size — from tiny fibrous-rooted plants with nearly filiform stems to much larger individuals with fistulose stems adventitiously rooting at proximal nodes. Label comments for a collection of *E. cordata* from Kane Co., Utah (*Reveal 819*), are representative of this variation: "This population is exceedingly variable as the plants range from less than 1 cm high to over 8 dm high; growing both in seeps where the plants are large to sandy flats along the stream where the plants are 1-4 dm high, to grassy flats where the same plants were as small as 1 cm."



Figure 3. *Erythranthe cordata*. Maricopa Co., Arizona, Lake Pleasant Regional Park, 12 Mar 1967, Lehto 7750, ASU. Corollas are 8–15 mm long, the tubes 5–8 mm.

The collections *Erythranthe cordata* shown below are arranged generally by increasing size of plants. Figures 4-6 show strictly fibrous-rooted plants; Figures 7-9 show increasingly larger plants with adventitiously rooting lower stems.

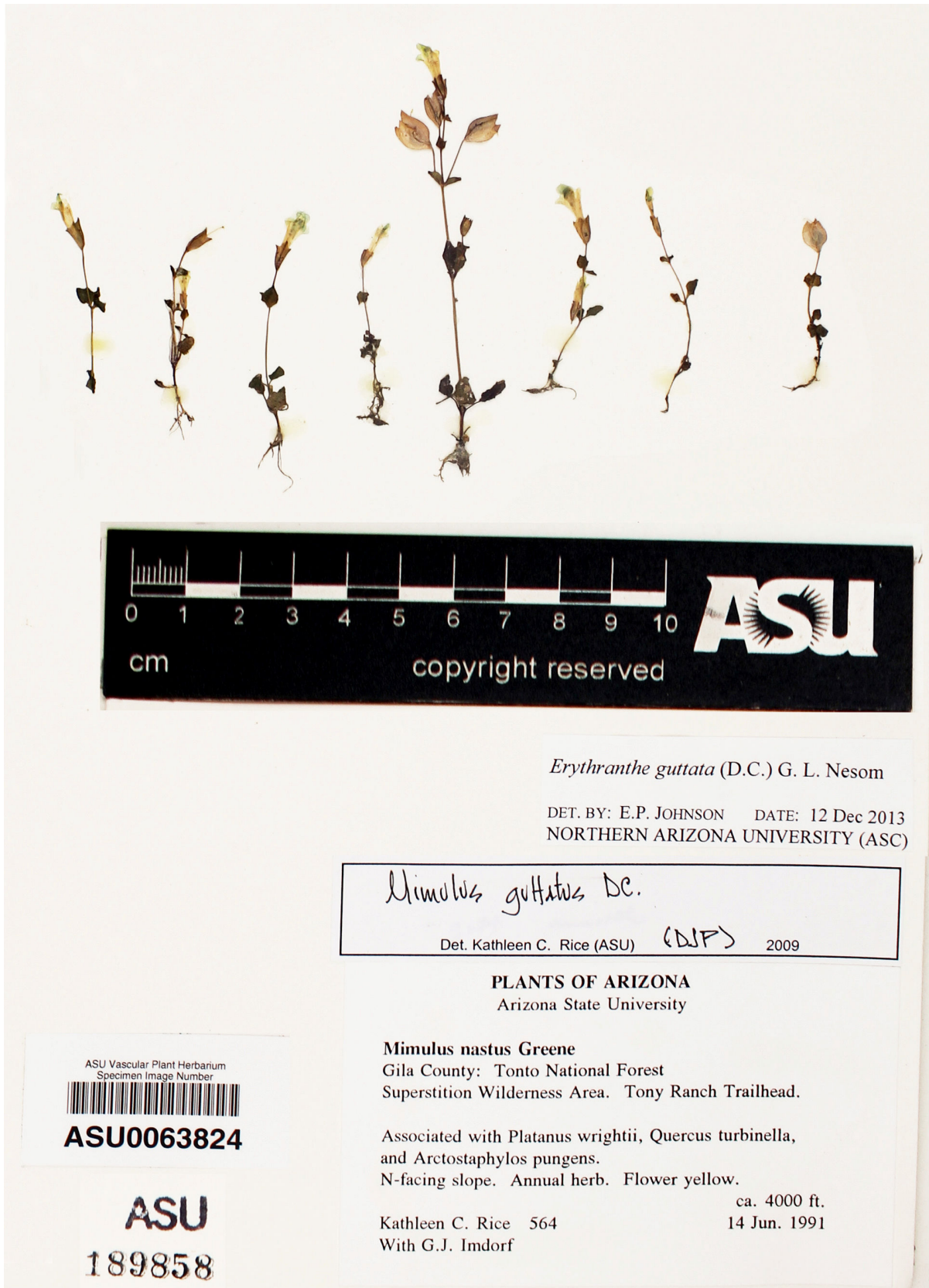


Figure 4. *Erythranthe cordata*. Gila Co., Arizona, 14 Jun 1991, Rice 564, ASU. Smallest plants are ca. 3 cm tall.



Figure 5. *Erythranthe cordata*. Gila Co., Arizona, 3 May 1993, Christy 1443, ASU. Plants range from 4 to 20 cm tall.



Figure 6. *Erythranthe cordata*. Gila Co., Arizona, 21 Apr 2007, Price 806, ASU. Larger plant ca. 25 cm tall.



Figure 7. *Erythranthe cordata*. Cochise Co., Arizona, 19 Mar 1975, Reeves R2418, ASU. Upper plants decumbent at base and producing adventitious roots.



Figure 8. *Erythranthe cordata*. Graham Co., Arizona, 10 Apr 1999, *Buegge 714*, ASU. Plants apparently with rhizome-like bases but, with reference to the autogamous flowers, these inferred to have begun as above-ground stems. Also see collector's label notes: "Annual (?) often in large clumps. Stolons but no rhizomes."



Figure 9. *Erythranthe cordata*. Maricopa Co., Arizona, 14 Mar 1965, *Lehto* 4552, ASU. Fistulose stems with adventitious roots at nodes.



Figure 10. *Erythranthe cordata*. Maricopa Co., Arizona, 16 Feb 2000, Landrum 9640, ASU. Without basal parts but label notes say "Annual herbs." Flowers autogamous.

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