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# A STUDY OF MORPHOLOGICAL VARIABILITY IN *CHENOPODIUM INCANUM* (CHENOPODIACEAE) AND THE RECOGNITION OF TWO NEW VARIETIES

DANIEL J. CRAWFORD

Crawford, Daniel J. (Department of Botany, University of Wyoming, Laramie, WY 82071). A study of morphological variability in *Chenopodium incanum* (Chenopodiaceae) and the recognition of two new varieties. *Brittonia* **29**: 291–296. 1977.—Study of *Chenopodium incanum* has revealed considerable variability in what has been viewed previously as a uniform species. Variation is correlated with geographic distribution, and thus two new varieties are described. Variety *elatum* Crawford occurs in western Texas, southern New Mexico and southern Arizona, whereas var. *occidentale* Crawford is restricted to the Great Basin and Mohave Desert. The var. *incanum* grows primarily on the western Great Plains and eastern slopes of the Rocky Mountains. Morphological features serving to distinguish the varieties are presented and discussed. Also considered are the characters that allow the separation of *C. incanum* and *C. fremontii*.

*Chenopodium incanum* (S. Wats.) A. A. Heller is a widespread species occurring throughout much of the southwestern United States, and reaching as far north as Nebraska and South Dakota. It is a plant of lower elevations, and normally is found in rather arid habitats. Morphologically, *C. incanum* is closest to *C. fremontii* S. Wats., and has been treated as a variety of the latter by some workers (Hitchcock, 1964) whereas others (Aellen & Just, 1943; Wahl, 1952–53) considered it a distinct species. In an abstract (Crawford, 1972), I presented some features that serve to separate the two taxa, and suggested that they are worthy of specific recognition. The morphological distinctions between them will be discussed in greater detail below.

The late H. A. Wahl, who understood *Chenopodium* in North America to a remarkable degree despite limited field work, commented that *C. incanum* is a “relatively easily recognizable and fairly uniform taxon” (Wahl, 1952–53). While the species is usually recognizable, it is not uniform morphologically. The purpose of this report is to discuss morphological variability in *C. incanum* and to erect two new varieties.

## METHODS AND MATERIALS

Specimens were borrowed from most of the major herbaria in the United States. In addition, collections made by the author were studied. In all, more than 115 collections of *C. incanum* were examined, including specimens from throughout the known distribution range of the species. In addition, type specimens for *C. fremontii*, *C. fremontii* forma *farinosum*, and *C. incanum* were studied. Seeds from several collections of each variety were germinated and the plants grown in the greenhouse. This was done to distinguish between genotypic and phenotypic variation. Somatic chromosomes were counted using procedures described in an earlier paper (Crawford, 1975).

## RESULTS AND DISCUSSION

As a consequence of studying the morphological features of *C. incanum* throughout its geographic range, it seems advisable to accommodate the variability in two new varieties in addition to the nomenclaturally typical variety.

**CHENOPODIUM INCANUM** (S. Watson) A. A. Heller var. **INCANUM**.

*Chenopodium fremontii* var. *incanum* S. Watson, Proc. Amer. Acad. Arts **9**: 94. 1874. *C. incanum* A. A. Heller, Pl. World **1**: 23. 1897, sens. str. TYPE: UNITED STATES. NEW MEXICO: in 1847, A. Fendler 722 (GH!).

Representative Specimens. UNITED STATES: COLORADO: Larimer Co., Fort Collins, *Cowen s.n.* (UC). Las Animas Co., Tecolote Mesa, *Rogers 4562* (US). Prowers Co., 23 mi S of Lamar, *Weber 5083* (RSA, UC, US). Washington Co., Akron, *Shantz 1300* (US). KANSAS: Ellis Co., near Hays, *Bondy s.n.* (GH, US). Meade Co., 3 mi E and 14 mi S of Meade, *Horr & McGregor 3878* (GH). NEBRASKA: Buffalo Co., Kearney, *Holms s.n.* (US). Cherry Co., Valentine, *Crawford 390* (RM). Howard Co., Kenyon's Siding, *Bates 4273* (GH). Lincoln Co., North Platte, *Shear 4453* (US). NEW MEXICO: Lincoln Co., Gray, *Earle & Earle 472* (US). San Miguel Co., near Pecos, *Standley 5151* (GH, US). Santa Fe Co., vicinity of Santa Fe, *Standley 6492* (US). Socorro Co., 13 mi E of Bernardo, *Crawford 458* (RM). SOUTH DAKOTA: Jackson Co., 3 mi E of Interior, *Over 6065* (US). Washington Co., White River flood plain, *Over 2352* (US). TEXAS: Bailey Co., 20 mi S of Muleshoe, *Rosson 613* (UC). Hutchinson Co., 9 mi E of Stinnett, *Thornton 52-441* (TEX).

**Chenopodium incanum** var. **elatum** Crawford, var. nov. (Fig. 3)

Differt a var. *incano* statura elata (saepissime 25–75 cm), caulibus erecti et ramis erectiusculis.

TYPE: UNITED STATES. TEXAS: Jeff Davis Co., widespread along hwy in red, rocky igneous soil, 10 mi N of Alpine, 9 Jun 1947, *B. H. Warnock 6203* (HOLOTYPE: TEX).

Representative Specimens. UNITED STATES: ARIZONA: Cochise Co., Chiricahua Mtns., *M. E. Jones 28609* (POM, UC). Pima Co., between Pablos and San Fernando, *Harrison & Kearney 8953* (US); near Continental, *Harrison & Kearney 9072* (POM, US); Univ. of Arizona campus, Tucson, *Thornber 305* (POM, UC, US). NEW MEXICO: Doña Ana Co., western base of Organ Mtns., *Dunn 8549* (RSA); vicinity of Las Cruces, *Gillespie 5274*. Grant Co., Silver City draw, *Wootton s.n.* (US). Luna Co., Nutt, *Eggleston 16270* (US). Eddy Co., 1 mi SW of Whites City, *Melchert 231* (TEX). TEXAS: Brewster Co., Sul Ross campus, Alpine, *Warnock 21414* (GH); Chisos Mtns., near Love Mtn., *Warnock 1208* (GH, TEX). Culberson Co., 2 mi S of Tex-line, *Warnock 6249* (TEX). Jeff Davis Co., Davis Mtns., near Limpia post office, *Hanson 739* (GH, US).

**Chenopodium incanum** var. **occidentale** Crawford, var. nov. (Fig. 4, c-f)

Differt a var. *incano* foliorum lobis rotundatis et apice obtusato.

TYPE: UNITED STATES: CALIFORNIA: San Bernardino Co.: Mohave Desert, Clark Mtns., Pachalka Spring, 27 May 1935, *C. B. Wolf 7044* (HOLOTYPE: UC; ISOTYPES: GH, RSA).

Representative Specimens. CALIFORNIA: Nevada Co., Baca, *K. Brandegee s.n.* (UC). San Bernardino Co., 26 mi NE of Baker, *Munz & Everett 17416* (NY, RSA); Mohave, *Jones 4080* (POM, US); Coliseum Mine, Clark Mtns, *Roos 4960* (US). NEVADA: Clark Co., road to Harris Springs, 9 mi SW of jct with Hwy 39, *Balls & Straw 19249* (RSA); 4½ mi SE of Las Vegas, *Gullion 321* (UC). Mineral Co., mouth of Cory Creek, Wassuk Range, *Archer 6820* (UC). Nye Co., SW of Forty-Mile Canyon, *Beatley & Bamberg 12974* (RSA); Beatty Wash, 5 mi SE of Rt. 95, *Beatley & Reveal 10213* (GH). White Pine Co., along Highline Rd, 5 mi E of US 93 jct, *N. Holmgren & Reveal 1115* (GH, UC).

The distribution of *Chenopodium incanum* is given in Fig. 1, and within this range three morphological phases can be recognized with reasonable certainty. The var. *incanum* occurs primarily in the western Great Plains and the eastern slope of the southern Rocky Mountains with several collections known from lower elevations in central New Mexico, eastern Arizona, western Colorado and extreme southeastern Utah (areas enclosed by solid lines in Fig. 1). As indicated in Table I, plants of var. *incanum* characteristically exhibit a low dense branching habit, very compact

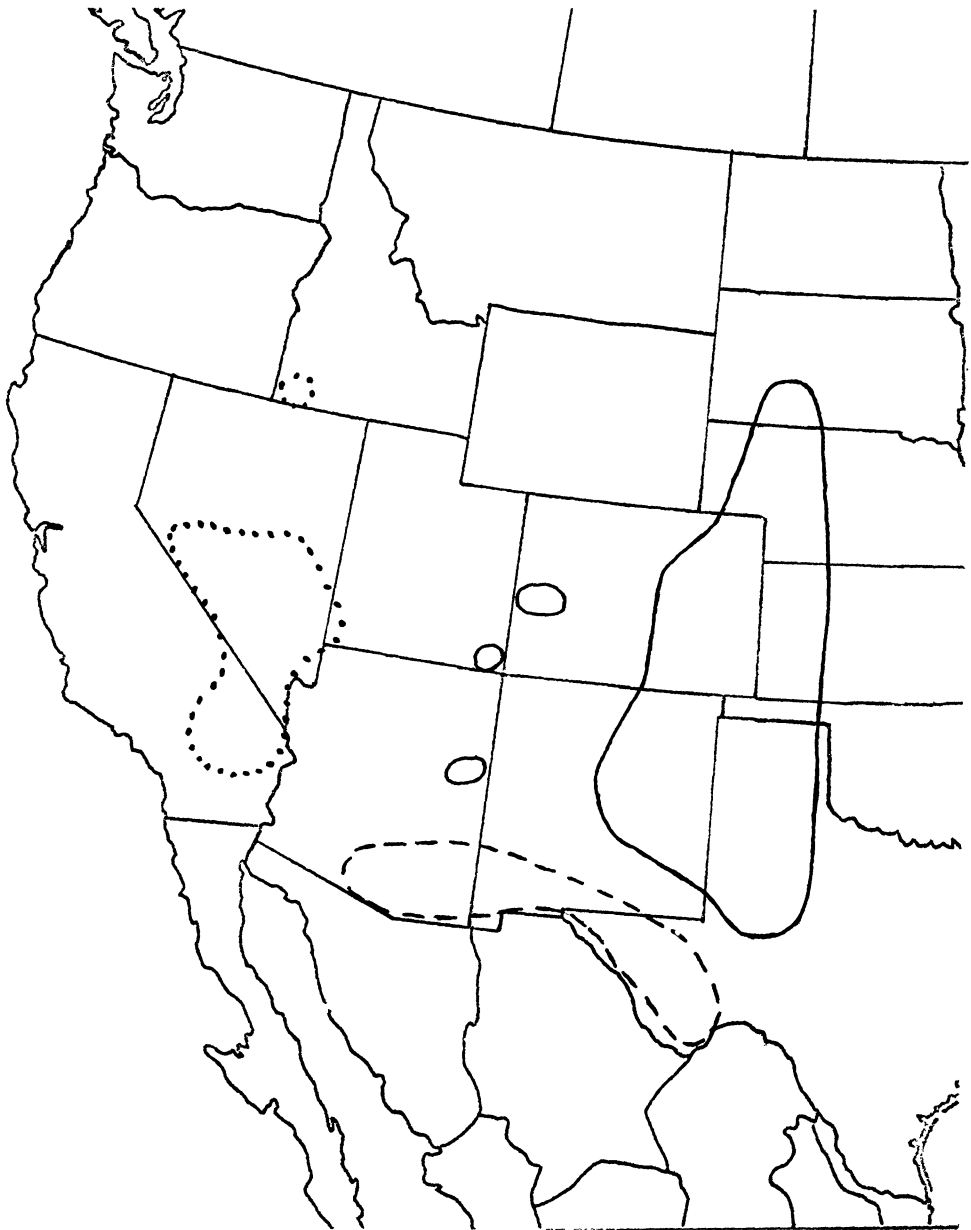


FIG. 1. Distribution of *Chenopodium incanum*: solid lines circumscribe range of var. *incanum*; dashed line that of var. *elatum*; dotted lines that of var. *occidentale*.

inflorescences, i.e., glomerules crowded (Fig. 2), and leaf blades with acute apices and sharp teeth or lobes at one or both margins near the base (Fig. 4 a,b).

Plants referable to var. *elatum* occur in west Texas, across southern New Mexico, and into southern Arizona (Fig. 1, dashed lines). The salient features of this variety are given in Table I, the most striking one being the tall, upright nature of most

TABLE I  
MORPHOLOGICAL FEATURES USEFUL FOR DISTINGUISHING THE THREE VARIETIES OF  
*Chenopodium incanum*

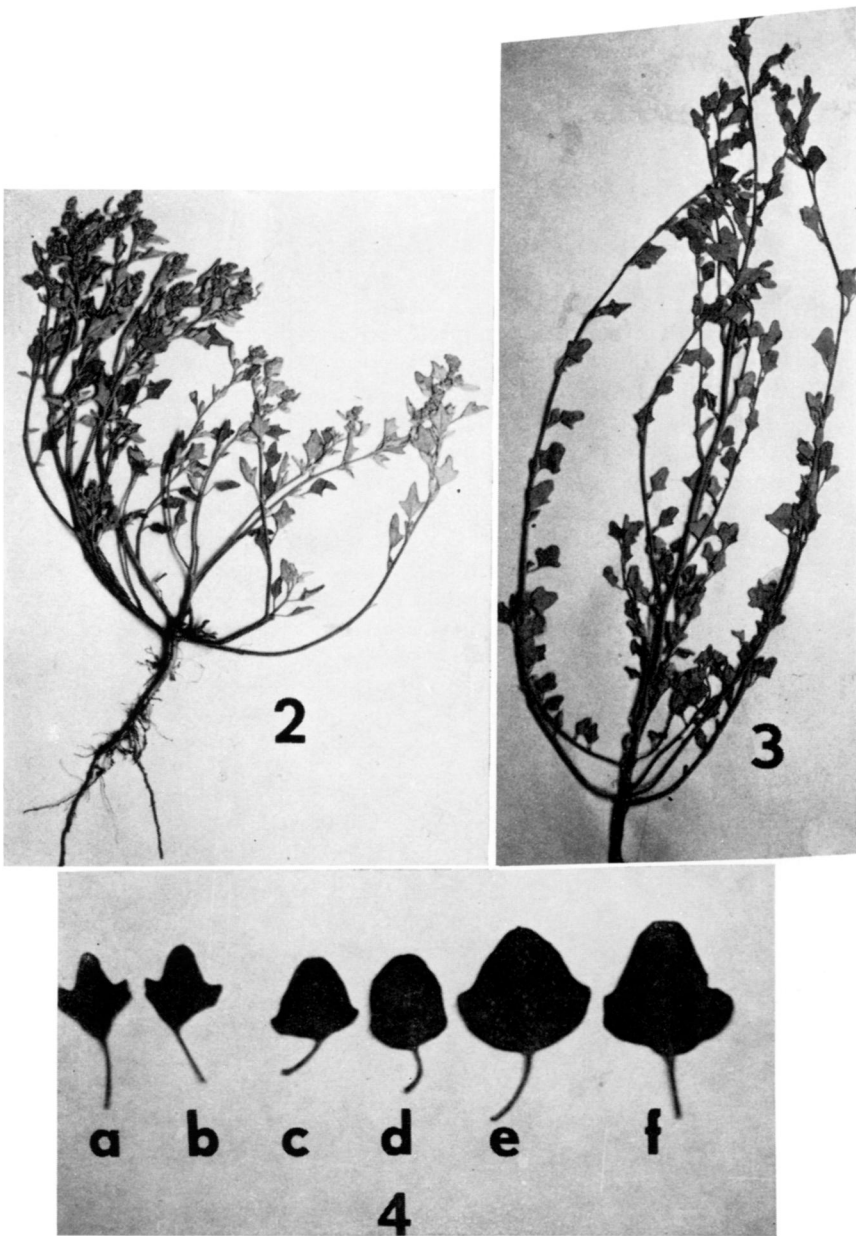
Characters	var. <i>incanum</i>	var. <i>elatum</i>	var. <i>occidentale</i>
Habit	plants usually less than 25 cm tall, often densely branched from the base with branches spreading to slightly upright;	plants mostly 25–75 cm tall, either solitary or branched from the base (if the latter, then branches upright);	plants nearly always less than 30 cm tall, solitary or branched from the base, branches upright to somewhat spreading;
Leaves	leaf blades mostly less than 15 cm long, with sharp basal teeth and acute apices, upper surfaces very sparsely to moderately farinose, appearing yellow-green to light green with rare plants approaching var. <i>occidentale</i> in color;	leaf blades 10–23 mm long (usually not less than 12), basal teeth sharp to rounded and apices obtuse to acute, upper surfaces to moderately farinose, usually appearing yellow-green even when nearly glabrous;	leaf blades 6–18 mm long, with rounded and often inconspicuous basal lobes, apices mostly obtuse, upper surfaces very sparsely farinose to glabrous and often appearing green;
Inflorescence	glomerules crowded in the inflorescence and axillary inflorescences well-developed;	glomerules somewhat spaced in the inflorescence, axillary inflorescences usually not well-developed;	glomerules usually spaced in the inflorescence, axillary inflorescences mostly not well-developed;
Seeds	most seeds .90–1.10 mm diam.	seeds (1.0) 1.10–1.25 mm diam.	seeds (1.0) 1.05–1.20 mm diam.

plants (Fig. 3). In addition, the leaf blades are relatively large, and the seeds are often larger than those of any other *C. incanum*.

A third phase of *C. incanum*, here treated as var. *occidentale*, occurs in the Great Basin and south into the Mohave Desert (Fig. 1, dotted lines). Although the combination of features characteristic of the variety are given in Table I, it is worthwhile to mention that the leaf blades with their generally rounded or inconspicuous lobes, obtuse apices, and greenish upper surfaces provide the most prominent differential character (Fig. 4 c–f).

The three varieties are reasonably distinct in view of the combination of characters given in Table I. It is sometimes difficult, if not impossible, to apply a single "key" character for identifying every plant of *C. incanum* encountered in the field. This, however, is to be expected in a notoriously difficult and variable genus such as *Chenopodium*. Also, it must be noted that occasional plants are encountered which are somewhat difficult to place into one of the varieties, even when applying all characters presented in Table I. In spite of this fact, it seems advisable to recognize the variation taxonomically. First, the variability has a geographic pattern, and given the origin of a plant, one can predict with reasonable certainty its morphological features. Secondly, the combination of distinguishing characters for each variety remains intact when plants are grown under uniform conditions in the greenhouse, and this is a significant factor in a phenotypically plastic group such as *Chenopodium*.

Nine collections representing the three varieties have been counted chromosomally. All were diploid with  $2n = 18$ , and thus there is as yet no evidence that polyploidy is associated with morphological variability.



FIGS. 2-4. *Chenopodium incanum*. Fig. 2. Specimen of var. *incanum* showing low, branching habit and dense, axillary inflorescences,  $\times \frac{1}{2}$ . Fig. 3. Specimen of var. *elatum* illustrating the upright branches,  $\times \frac{1}{2}$ . Fig. 4. Leaves of *C. incanum*,  $\times 1$ : a, b var. *incanum*; c-f var. *occidentale*.

*Chenopodium incanum* is morphologically closest to *C. fremontii*, but the two may be separated by the following combination of features. *Chenopodium incanum* has rather thick leaves and crowded glomerules. The sepals cover the fruit at maturity and are normally rather strongly keeled. The seeds do not exceed 1.25 mm in diameter and the majority are .95-1.15 mm. By contrast, *C. fremontii* has relatively

thin leaves. The sepals open to expose the fruit at maturity and usually are not as strongly keeled as in *C. incanum*. The seeds range from 1.10 to 1.40 mm in diameter and the majority are between 1.20 and 1.40 mm. Although *C. fremontii* is variable ecologically and may occur with *C. incanum* at lower elevations, it tends to be more of a montane species whereas *C. incanum* is found characteristically at lower elevations.

Plants are encountered which, superficially at least, appear to be intermediate between *C. fremontii* and *C. incanum*. These individuals were referred by Wahl to *C. fremontii* forma *farinosum* Aellen. Wahl commented that they have smaller, thicker, more grayish-farinoso leaves which resemble those of *C. incanum*. He indicated, however, that the habit and seed characters are those of typical *C. fremontii*. Wahl found the *C. incanum*-*C. fremontii* f. *farinosum* situation rather puzzling, as evidenced by the fact that he annotated duplicates of several different collections as different taxa. The situation is complex, but several observations can be made. First, *C. fremontii* f. *farinosum* as viewed by Wahl (1952-53) is represented by plants from throughout much of the range of the species as a whole. Part of what Wahl considered f. *farinosum* represents what I have here treated as var. *elatum*. Other specimens annotated as f. *farinosum* by Wahl are small-leaved and farinose forms of *C. fremontii*. It must be admitted that the only consistently good features for separating the southwestern form of *C. incanum* from the farinose forms of *C. fremontii* lie in the seeds and the sepals. In the former the seeds average 1.20 mm or less in diameter whereas in the latter seeds are more often 1.20 mm or more. Most important is the fact that in *C. incanum* the sepals cover the fruits at maturity and are rather strongly keeled whereas in *C. fremontii* the sepals expose the fruits at maturity and are less strongly keeled.

#### ACKNOWLEDGMENTS

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