

# CHROMOSOME VARIATION IN ECOTYPES OF LARREA DIVARICATA IN THE NORTH AMERICAN DESERT

TIEN WEI YANG and CHARLES H. LOWE

A recent report has suggested the presence of a difference in chromosome number between populations of creosotebush, *Larrea divaricata* Cav., in the Chihuahuan Desert and in the Sonoran Desert (Yang, 1967). Chromosome counts from additional populations further confirm the hypothesis that  $2n = 52$  is associated with the western *Larrea* of the Sonoran Desert subdivision and  $2n = 26$  characterizes the eastern *Larrea* of the Chihuahuan Desert subdivision of the North American Desert. Chromosomes of flower buds and root tip cells were examined using aceto-carmin and aceto-orcin squashes.

Table 1 gives a summary of the chromosome numbers of seven new populations recently examined, as well as the earlier reports on the chromosome counts of six other North American creosotebush populations (Covas, 1949; Powell, 1966 (pers. comm.); Yang, 1967). Figure 1 shows that all 13 populations which have provided this chromosome information are located within a distance of 100 miles either north or south of an 800-mile transect between Val Verde Co. Texas (east), and Imperial Co., California (west). This transect traverses essentially the entire longitudinal extent of the Chihuahuan Desert and the Sonoran Desert along the Mexican boundary. The transect also constitutes the only continuous east-west span of *Larrea* distribution in North America (Shreve, 1940; Garcia, Soto, and Miranda, 1960).

Nine of the populations have counts of  $n = 26$  or ca. 26 and all are located well within the boundary of the Sonoran Desert (Shreve, 1942, 1951; Benson and Darrow, 1954; Lowe, 1964). Three of the four populations with  $n = 13$  or ca. 13 occur in Trans-Pecos Texas and are within the Chihuahuan Desert proper. The remaining population with the same chromosome number ( $n = 13$ ) is located immediately west of the San Pedro Valley in southeastern Arizona, where the westernmost extension of the Chihuahuan Desert flora occurs (Benson and Darrow, 1954; Lowe, 1964). Between this Pima Co. population of Arizona and the Val Verde Co. population of Texas, covering a distance of 550 miles along the 800-mile transect, all the known chromosome counts have been in the order of  $n = 13$  or ca. 13 and  $2n =$  ca. 26. Between the easternmost Sonoran Desert population at 15 miles southeast of Tucson and the westernmost of the Imperial Co. populations of California, a span of 250 miles, all the known chromosome counts have been in the order of  $n = 26$  or ca. 26 and  $2n = 52$  or ca. 52 (Table 1).

The difference in chromosome number between the eastern creosotebush and the western creosotebush appears to be associated with the major



TABLE 1. SUMMARY OF CHROMOSOME NUMBERS OF 13 *LARREA* POPULATIONS ALONG AN 800-MILE TRANSECT IN THE SONORAN AND CHIHUAHUAN SUBDIVISIONS OF THE NORTH AMERICAN DESERT (see Fig. 1).

Population	Locality	Chromosome Count
1. California Imperial Co.	30 mi (US 80) W Colorado R.	$n = \text{ca. } 26$ $2n = \text{ca. } 52$
2. California Imperial Co.	20 mi (US 80) W Colorado R.	$n = 26$ (Yang, 1967) $2n = \text{ca. } 52$ (Yang, 1967)
3. Arizona Maricopa Co.	10.8 mi (Ariz 84) W Pinal Co. line	$n = \text{ca. } 26$ $2n = \text{ca. } 52$
4. Arizona Pinal Co.	0.1 mi (Ariz 84) W Maricopa Rd.	$n = \text{ca. } 26$ $2n = \text{ca. } 52$
5. Arizona Pima Co.	0.4 mi (Ariz 86) E Sells	$n = 26$ (Yang, 1967) $2n = \text{ca. } 52$ (Yang, 1967)
6. Arizona Pinal Co.	Boyce Thompson SW Arboretum	$2n = 52$ (Covas, 1949)
7. Arizona Pima Co.	Tucson	$n = \text{ca. } 26$ $2n = \text{ca. } 52$
8. Arizona Pima Co.	15 mi (US 80) SE Tucson	$n = \text{ca. } 26$ $2n = \text{ca. } 52$
9. Arizona Pima Co.	Saguaro Nat. Monument, Rincon Mts.	$n = \text{ca. } 26$ $2n = \text{ca. } 52$
10. Arizona Pima Co.	16.6 mi (US 80) W San Pedro R.	$n = 13$ $2n = \text{ca. } 26$
11. Texas Brewster Co.	Alpine	$n = \text{ca. } 13$ (Powell, 1966, pers. comm.)
12. Texas Brewster Co.	65.1 mi (Tex 118) S Alpine	$n = 13$ (Powell, 1966, pers. comm.; Yang, 1967) $2n = \text{ca. } 26$ (Yang, 1967)
13. Texas Val Verde Co.	1.0 mi (US 90) W Pecos R.	$n = 13$ (Yang, 1967) $2n = \text{ca. } 26$ (Yang, 1967)

ecotypic differences in morphological and physiological traits reported earlier (Yang, 1967a). The Chihuahuan Desert *Larrea*, the eastern ecotype, is distinguished by a bushy and more compact growth form, distinctly more incurved leaflets, more rapid germination rate, faster initial growth rate of the seedling, greater tolerance for low temperature, and lesser tolerance for low moisture. The Sonoran Desert *Larrea*, the western ecotype, on the other hand, has a more erect growth form, less incurved leaflets, slower germination rate, slower initial growth rate of the seedling, lesser tolerance for low temperature, and greater tolerance for low moisture.

The morphological and physiological differences between the eastern and the western *Larrea* reflect the diverse climatic regimes under which the two major populations have been evolving. The Chihuahuan ecotype is adapted to a climate of greater precipitation and relatively low winter temperature; the Sonoran ecotype had developed under a macroclimate of lower rainfall and higher winter temperature. The cytological difference in chromosome number between these two ecotypes appears to be the result of the interaction of the same genetic and ecological processes



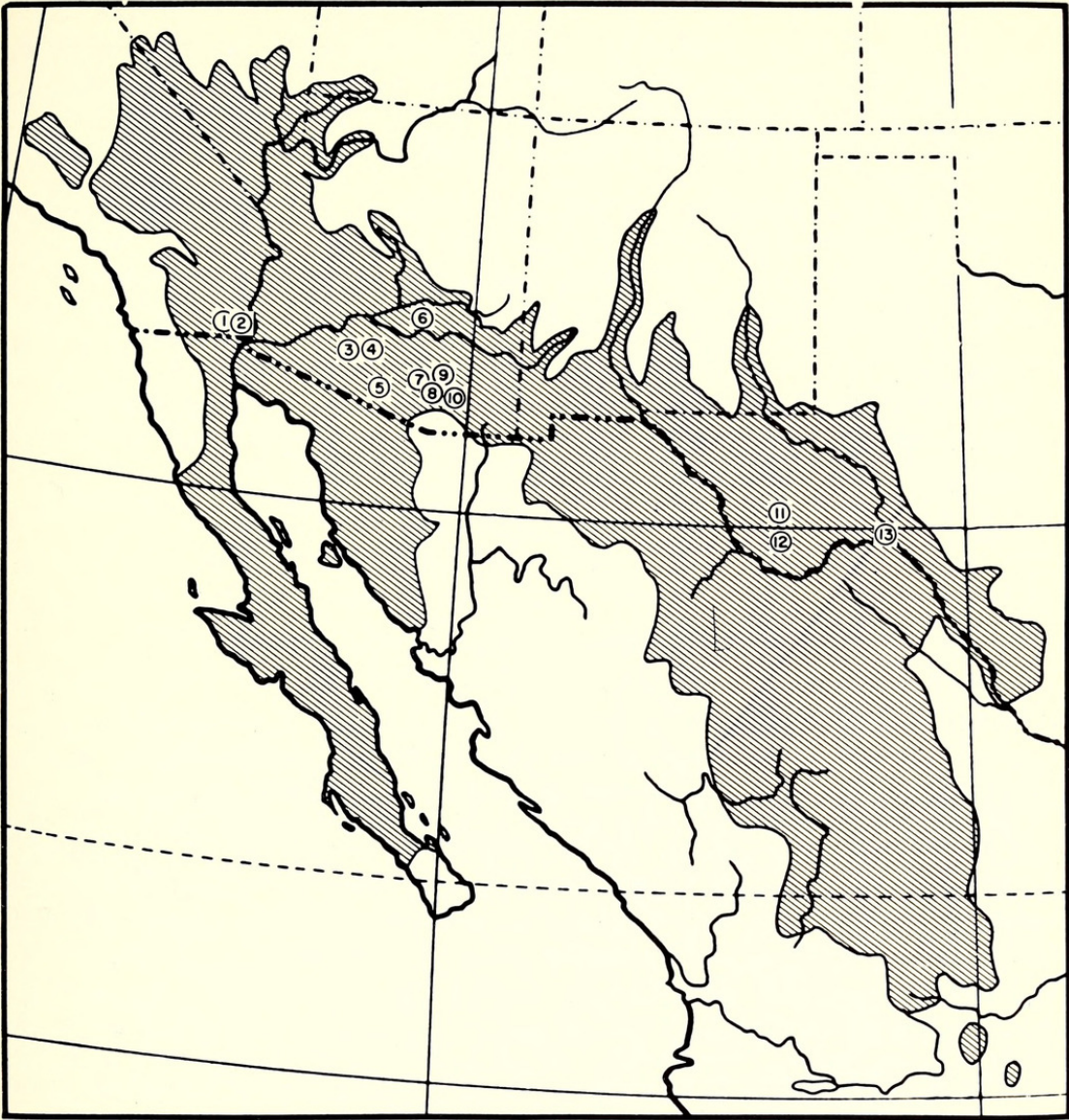


FIG. 1. Creosotebush populations studied along an 800-mile transect. Populations 1-9 are situated in the Sonoran Desert and are tetraploid. Populations 10-13 are located in the Chihuahuan Desert and are diploid (see text). Shaded area shows the generalized distribution of *Larrea divaricata* in North America, adapted from Shreve (1940), Garcia, Soto, and Miranda (1960), and modified by unpublished data from the authors.

which have brought about the series of morphological and physiological variations in the evolution of the North American creosotebush.

The authors are grateful to Walter V. Brown for suggestions, to James L. Patton for assistance in the preparation of the illustration, and to A. M. Powell for providing unpublished data. Voucher specimens are deposited at University of Texas Herbarium, University of Arizona Herbarium, and the Ecology Herbarium in the Department of Biological Sciences, The University of Arizona.

Department of Botany, The University of Texas, Austin  
 Department of Biological Sciences, The University of Arizona, Tucson



## LITERATURE CITED

- BENSON, L., and R. A. DARROW. 1954. The trees and shrubs of the southwestern deserts. Univ. Ariz. Press, Tucson, and Univ. New Mex. Press, Albuquerque.
- COVAS, G. 1949. Estudios cariológicos en antófitas. III Darwiniana 9:158-162.
- GARCIA, E., C. SOTO, and F. MIRANDA. 1960. Larrea y clima. Anal. Inst. Biol. México. 31:133-190.
- LOWE, C. H. 1964. Arizona landscapes and habitats. In The vertebrates of Arizona. Univ. Ariz. Press, Tucson.
- SHREVE, F. 1940. The edge of the desert. Year. Assoc. Pacif. Coast Geogr. 6:6-11.
- . 1942. The desert vegetation of North America. Bot. Rev. 8:195-246.
- . 1951. Vegetation and flora of the Sonoran Desert. Carnegie Inst. Wash. Publ. 591.
- YANG, T. W. 1967. Chromosome numbers in populations of creosotebush (*Larrea divaricata*) in the Chihuahuan and Sonoran subdivisions of the North American Desert. Jour. Arizona Acad. 4:183-184.
- . 1967a. Ecotypic variation in *Larrea divaricata*. Am. Jour. Bot. 54:1041-1044.

## NOTES AND NEWS

NOTES OF THE FLORA OF ARIZONA. IV—Five collections worthy of special note have been added to the University of Arizona Herbarium. Three represent new species for the state, including one new genus, and two are range extensions.

*Urtica urens* L. represents a new weed in the Arizona flora. Our collections, made by Dr. K. C. Hamilton, came from the John Jacobs Citrus Grove on the northeast corner of the Black Canyon Highway and Peoria Avenue, in the Salt River Valley, Maricopa Co. The Dwarf or Slender Nettle is an annual from Europe which has become naturalized in the eastern United States and California.

*Chaerophyllum tainturieri* Hook. is a genus and species new for the state. Our specimen was collected by Stephen Bingham (871), eight miles north of the Safford airport, at an elevation of 4800 feet in the Gila Mountains of Graham Co. Mathias and Constance (North American Flora 28b:117-119, 1944) do not record any species of this genus west of Texas. In this work our material is determined as *C. texanum* Coult. & Rose; however, in their more recent publication on the Umbelliferae (*Flora of Texas* 3:288-290, 1951), they consider *C. texanum* a synonym of *C. tainturieri*.

*Erigeron lonchophyllus* Hook. was collected in deep grass near Aspen Spring, Lukachukai Mountains, Apache Co. (Niles & Mason 2486). This collection adds a new species to the flora of Arizona, but it is not an unexpected addition. Cronquist in his monograph of the genus (*Brittonia* 6:127-302, 1947) cites a specimen from the Tunitcha Mountains of San Juan Co., New Mexico, a mountain range which is adjacent to the Lukachukai-Chuska chain.

*Paronychia sessiliflora* Nutt. was first recorded for Arizona by McDougall (Plateau 37:107, 1965) from a specimen collected at Meteor Crater. An earlier collection by Eastwood and Howell (6918) from the same area had been misdetermined as *P. Jamesii*. More recently a third collection (Reese & Niles 850) from the East Side Game Road, Kaibab Plateau, Coconino Co. extends the range approximately 125 air miles northward and closer to the center of distribution of the species.

*Hippuris vulgaris* L., previously reported from lakes in the White Mountain area of Apache Co., has now been collected from lakes in the vicinity of Wide Lake, Lukachukai Mountains, Apache Co. (Niles & Mason 2487). This new locality is about 175 aerial miles north of the previous collection. —CHARLES T. MASON, JR., Herbarium, University of Arizona, Tucson, and WESLEY E. NILES, New York Botanical Garden.



Yang, Tien Wei and Lowe, Charles H. 1968. "CHROMOSOME VARIATION IN ECOTYPES OF *LARREA DIVARICATA* IN THE NORTH AMERICAN DESERT." *Madroño; a West American journal of botany* 19, 161–164.

**View This Item Online:** <https://www.biodiversitylibrary.org/item/185219>

**Permalink:** <https://www.biodiversitylibrary.org/partpdf/170412>

#### **Holding Institution**

Smithsonian Libraries and Archives

#### **Sponsored by**

Biodiversity Heritage Library

#### **Copyright & Reuse**

Copyright Status: In Copyright. Digitized with the permission of the rights holder

Rights Holder: California Botanical Society

License: <http://creativecommons.org/licenses/by-nc/3.0/>

Rights: <https://www.biodiversitylibrary.org/permissions/>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.