CHROMOSOME COUNTS IN SECTION *SIMIOLUS* OF THE GENUS *MIMULUS* (SCROPHULARIACEAE). X. THE *M. GLABRATUS* COMPLEX

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Abstract

Chromosome numbers were ascertained from aceto-carmine squash preparations for members of the *Mimulus glabratus* complex that had been little studied previously. Representative populations of *M. glabratus* var. *fremontii* from Chihuahua, Durango, and Baja California Sur were found to have $n = 15$ chromosomes. Populations from Colombia, the disjunct South American range of *M. glabratus* var. *glabratus*, have $n = 31$ chromosomes. Populations from Peru of *M. andicolus* and *M. pilosiusculus* have $n = 46$. An intergrading population between *M. glabratus* var. *glabratus* ($n = 31$) and *M. andicolus* ($n = 46$) was found at Pasto on the southern border of Colombia.

This cytological study is an integral part of our long-range, experimental studies on the evolution of species in *Mimulus* (Vickery 1950, 1964, 1978). The chromosome counts here reported are for populations of the *M. glabratus* complex of related species—*M. glabratus* H.B.K. (and its varieties), *M. andicolus* H.B.K., and *M. pilosiusculus* H.B.K. Not only do these counts help provide baseline data for the larger project, but they are of intrinsic interest for a better understanding of this highly polymorphic and plastic complex.

Materials and Methods

The study populations sampled areas of the Western Hemisphere range of the complex that had been little studied previously (McArthur et al. 1972, Vickery 1978), although they represent some of the main taxa comprising the complex (Table 1). Cultures of 20 to 30 plants of each population were grown in the University of Utah greenhouse.

The chromosome counts were obtained from aceto-carmine squash preparations of pollen mother cells as before (Mia et al. 1964, McArthur et al. 1972). Twenty or more cells were studied from five or more plants of the culture of each population. Representative cells were recorded with sketches, camera lucida drawings or photographs (Fig. 1).

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TABLE 1. CHROMOSOME COUNTS IN THE *Mimulus glabratus* COMPLEX OF RELATED SPECIES AND VARIETIES. All populations, except as noted, were collected by R. K. Vickery, Jr. and grown under his culture numbers. Vouchers are in the Garrett Herbarium of the University of Utah (UT).

Mimulus glabratus var. *fremontii* (Bentham) Grant. $n = 15$

Cuauhetemoc, Chihuahua, Mexico, 2060 m, culture no. 12183; Aldama, Chihuahua, Mexico, 1150 m, culture 12185; Durango, Durango, Mexico, 1677 m, culture 12215; San Bertola Oasis, Baja California Sur, Mexico, 75 m, culture 12223.

Mimulus glabratus H.B.K. var. *glabratus.* $n = 31$

Sierra de Toluca, Toluca, Mexico, 2830 m, culture 7306; Duitama, Dept. Boyaca, Colombia, 2760 m, culture 13021; Aquitania, Dept. Boyaca, Colombia, 2975 m, culture 13026; Lago Tota, Dept. Boyaca, Colombia, 3010 m, culture 13029.

Mimulus andicolus H.B.K. $n = 46$

Río Grande, Dept. Ancash, Peru, 3000 m, culture 13066 (*Emma Cerrate de Ferreya #6547*); Anta, Dept. Cuzco, Peru, 3468 m, culture 13096 (Leonardo Flórez 3/7/81).

Mimulus andicolus H.B.K. × *M. glabratus* H.B.K. var. *glabratus.* $n = 40–48$

Pasto, Dept. Nariño, Colombia, 2750 m, culture 13033 has $n = 40–48$ typically, but ranges from $n = 31$ to $n = 55$ chromosomes (the median is between $n = 44$ and $n = 45$).

Mimulus pilosiusculus H.B.K. $n = 46$

Thermas Baños de Yura, Dept. Arequipa, Peru, 2475 m, culture 13069; Bolneario Tingo, Dept. Arequipa, Peru, 2250 m, culture 13070; Chilina, Dept. Arequipa, Peru, 2350 m, culture 13071.

RESULTS AND DISCUSSION

Mimulus glabratus var. *fremontii* (Benth.) Grant has the diploid $n = 15$ chromosome number (see Table 1 and Vickery 1978) throughout its range from eastern Canada to western Mexico, except for a single questionable $2n = 28$ count from Manitoba (Löve and

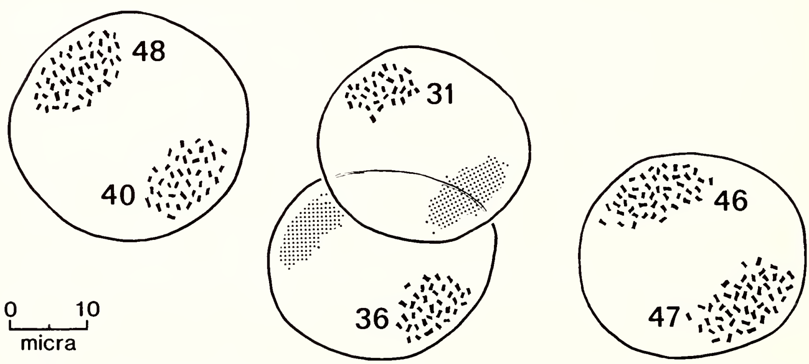

FIG. 1. Anaphase I configurations of pollen mother cells from plants of the intergrading population from Pasto, Colombia (culture 13033).

TABLE 2. CHROMOSOME COUNTS OBSERVED IN POLLEN MOTHER CELLS OF THE PASTO, COLOMBIA, POPULATION (13033) OF *M. andicolus* H.B.K. × *M. glabratus* H.B.K. var. *glabratus*.

Chromosome number, n =	Number of cells observed
31	1
35	1
36	2
37	1
39	1
40	8
41	4
42	3
44	7 median
45	5
46	10
47	6
48	4
51	1
53	1
55	1
	56

Löve 1982) and except for populations in the Rio Grande drainage, where *M. glabratus* var. *fremontii* has the tetraploid $n = 30$ chromosome number (McArthur et al. 1972). The present study shows that the pervasive $n = 15$ chromosome number occurs also in the populations of the geographic races of the Chihuahuan desert of northern Mexico (Table 1, e.g., culture numbers 12183, 12185) and of the Mexican Mesa Central (e.g., culture number 12215) as well as in the distinctive erect, delicate but wiry form from a palm oasis (San Bertola) of southern Baja California (culture number 12223). The last mentioned is suggestive of the typically erect and branched form of the tetraploid, $n = 30$ populations of *M. glabratus* var. *fremontii* from Texas. Except for the erect, more or less wiry forms that probably represent separate taxa, the rest of the *M. glabratus* var. *fremontii* group constitutes a diploid, polymorphic complex of geographic races and sibling species separated by an intricate network of partial to complete barriers to gene exchange (Vickery 1978).

Mimulus glabratus var. *glabratus* has the aneuploid tetraploid chromosome number, $n = 31$, both in its Meso-American range in Mexico and Guatemala (e.g., culture 7306 and see Vickery 1978) and in its South American range in Colombia (e.g., culture numbers 13021, 13026, 13029). *Mimulus glabratus* var. *glabratus* appears to intergrade morphologically and chromosomally with the Ecuadorian and Peruvian *M. andicolus* ($n = 46$) in the southern Colombia population (culture 13033) near Pasto. The chromosome numbers we observed in microsporocytes of this population ranged from $n = 31$

to $n = 55$ (Table 2). The median number of chromosomes fell between $n = 44$ and $n = 45$. This suggests to us that the chromosome number is truly lower and variable, as well as showing aberrant segregations, such as 45/47, 44/48, etc., from the normal hexaploid $n = 46$ chromosome number of *M. andicolus*. The Pasto population appears to be closer to *M. andicolus* than to *M. glabratus* var. *glabratus* both chromosomally and morphologically. We found, as expected from earlier work (Vickery 1978), that our two populations of *M. andicolus* (cultures 13066 and 13096) from central Peru were $n = 46$.

Lastly, we found three populations (cultures 13069, 13070, 13071) of *M. pilosiusculus* from southern Peru to have $n = 46$ chromosomes. These counts agree with our earlier reports (McArthur et al. 1972, Vickery 1978) for related forms from farther south in Argentina and Chile.

Thus, this study fills in several important geographic lacunae—Chihuahua, Baja California, Colombia, Peru—in the north-to-south series of polyploid and aneuploid adaptive radiations of the *Mimulus glabratus* complex (Vickery 1978).

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