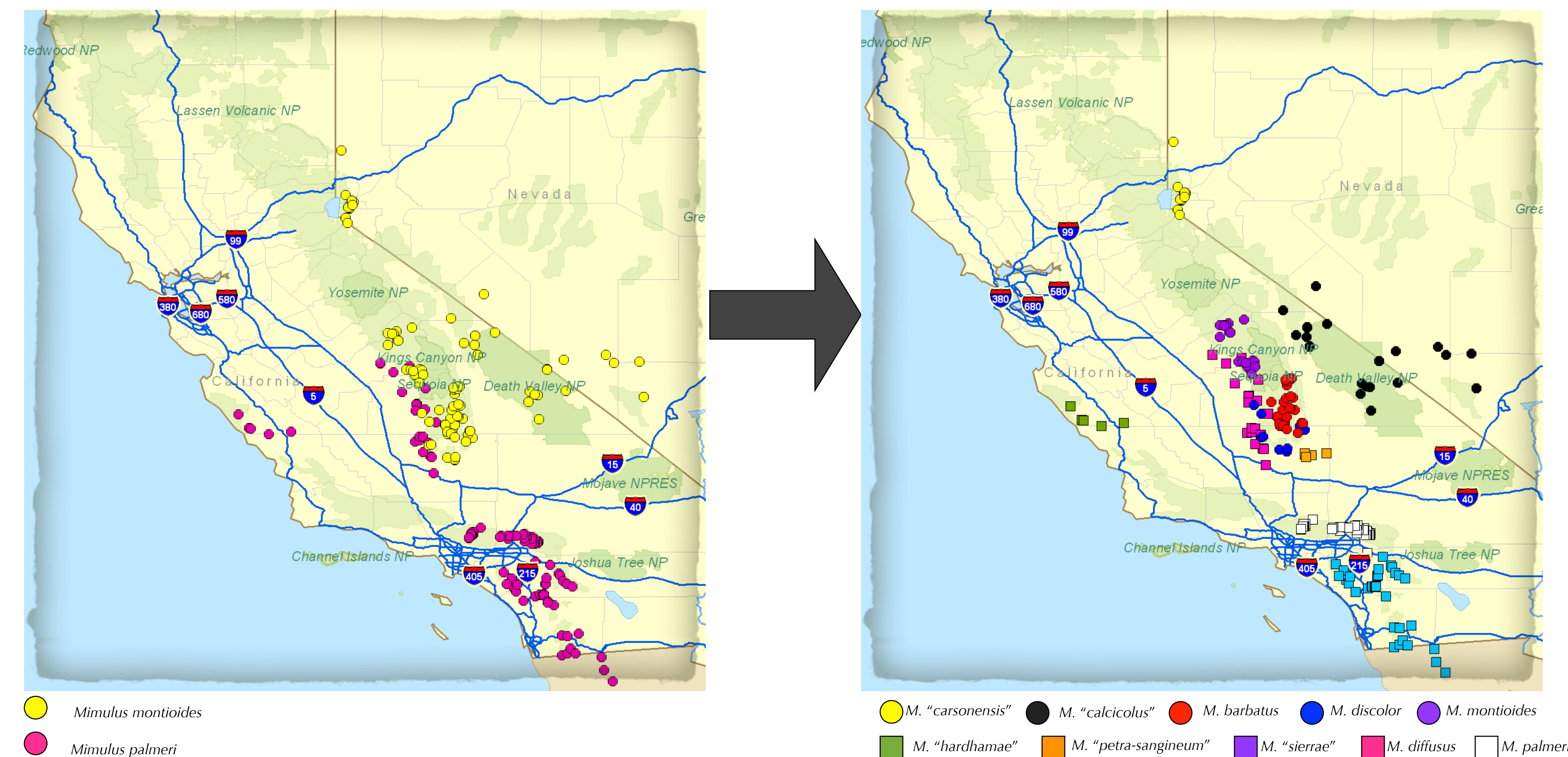


# An overview of the *Mimulus montioides* and *Mimulus palmeri* species complexes (Phrymaceae): Hidden species revealed

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## Abstract:

At least 66 species of *Mimulus* are currently listed by U.S. government agencies and native plant societies as sensitive, rare, or endangered, making *Mimulus* a group of conservation concern. However, species delimitation and taxonomic relationships in *Mimulus* remain unclear, with 90 to 170 species recognized. In many recent regional treatments of the group, some previously recognized rare species with limited distributions have been lumped with more common species. Taxonomic confusion in *Mimulus* persists in part because diagnostic floral characters are often obscured when plants are pressed and dried for preservation as museum specimens. These easily obscured characters are informative in understanding species diversity and delimiting species boundaries within the genus. A primary objective of my dissertation research is to resolve taxonomic issues and identify taxa that are in need of conservation. Because previous taxonomic treatments in *Mimulus* have been based primarily on study of herbarium specimens, more field studies are needed. Over the course of my work I have conducted extensive field research and photographed and collected data and plant material from more than 60 populations. As a result I have identified five undescribed species of *Mimulus*.



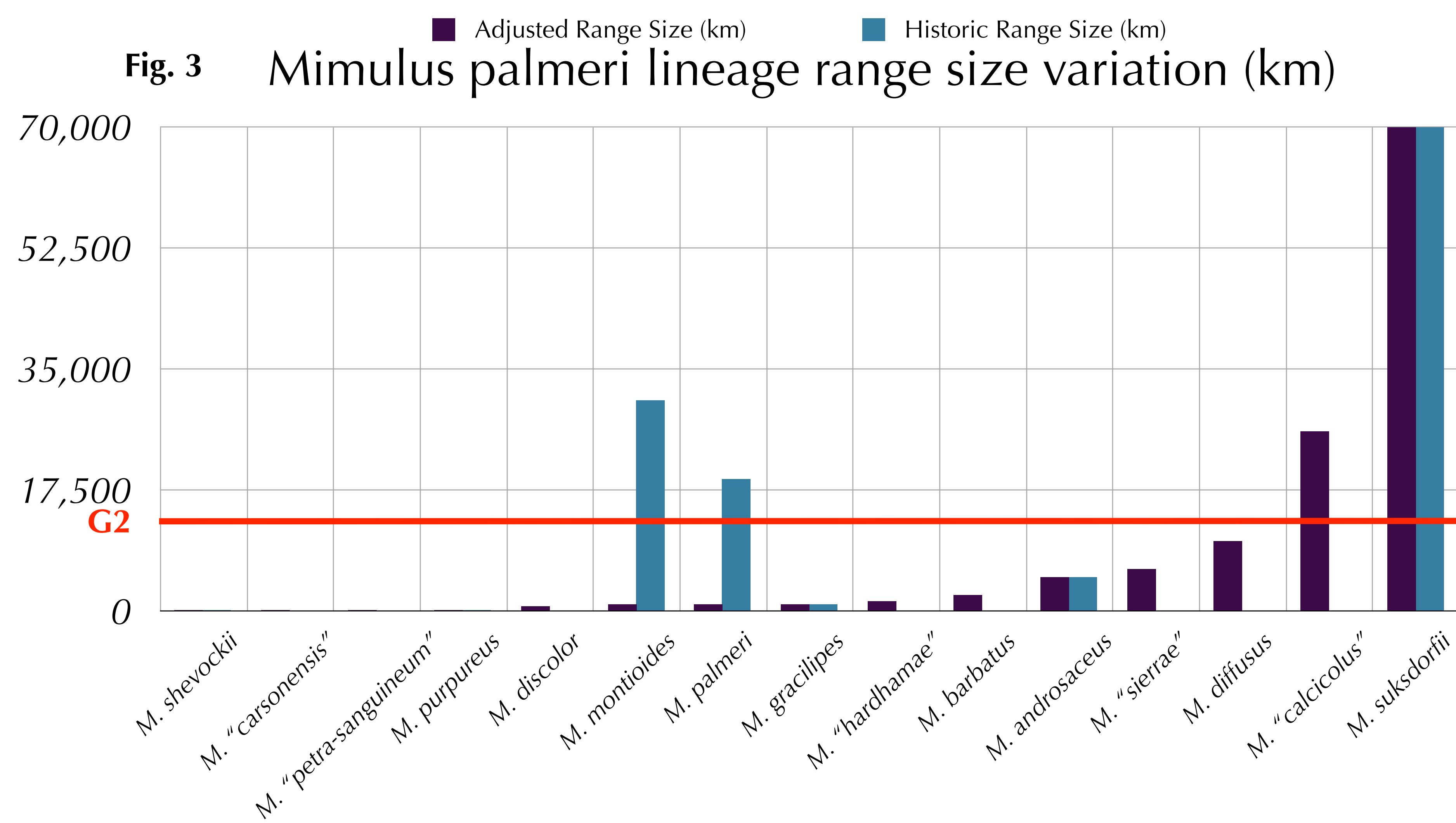
**Fig. 2.** Historic distributions of *M. montioides* and *M. palmeri* as treated in TJM2.

Redefined distributions of species formerly treated as *M. montioides* and *M. palmeri*

## Methods:

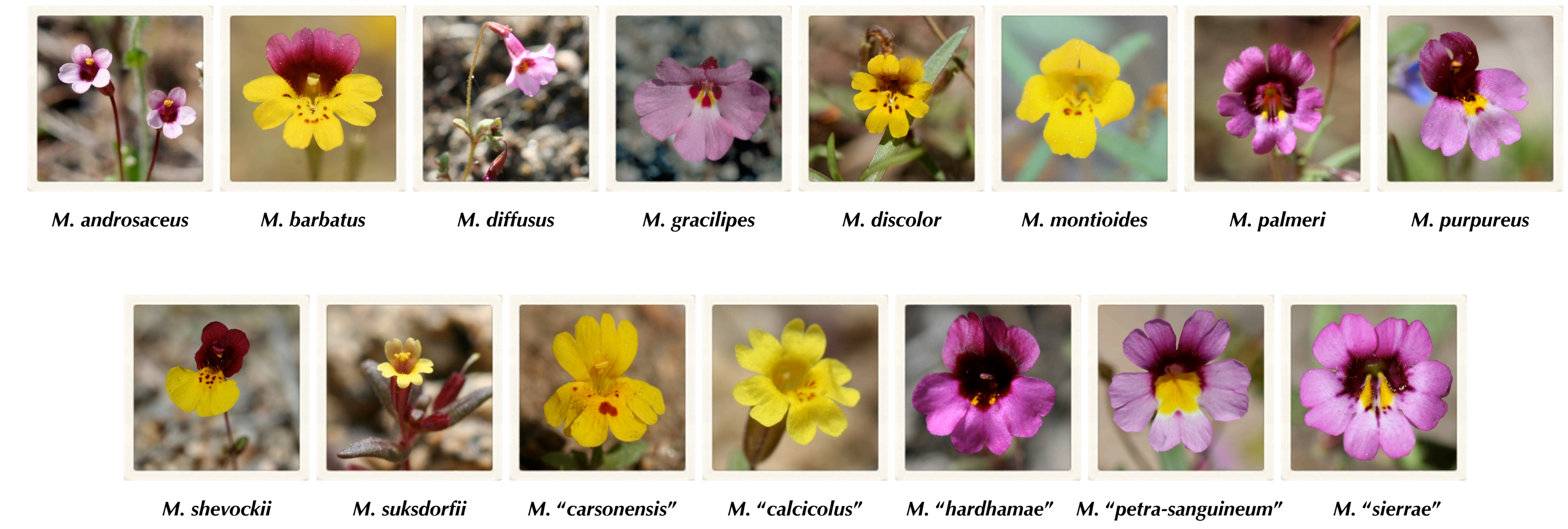
The present research will form the basis for a taxonomic revision of the *Mimulus palmeri* lineage (fig. 1) from study of herbarium specimens, populations in the field, living plants in the green house, relevant literature, and a phylogenetic analysis of DNA sequence data. Morphological descriptions of species will be further informed by a morphometric study. As a result of this study accurate species descriptions, illustrations, photographs, and range maps will be produced. Chromosome squashes will also be performed from root tips to determine chromosome numbers for each species included in the study.

Previous taxonomic treatments in the genus *Mimulus* have been based primarily on morphological studies of herbarium specimens. I have found field observations and photography key to documenting and understanding diversity in the *Mimulus palmeri* lineage. However additional study is needed for several taxa. Therefore, I propose a study of morphology on living plants that have been grown in a common garden. A morphometric study of approximately 35 quantitative characters and five qualitative characters will be employed to examine morphological character variation and identify characters that demonstrate the best separation of species belonging to the *Mimulus montioides* and *Mimulus palmeri* species complexes.



**Fig. 3** *Mimulus palmeri* lineage range size variation (km)

## Species included in the study



**Fig. 1.** Floral diversity of the *Mimulus palmeri* lineage (Phrymaceae). Names in quotes are manuscript names at present.

## Understanding species diversity in this group has been made challenging by:

- Small stature
- Ephemeral habit
- Dependence on winter rains
- Highly specific habitat requirements
- Restricted distributions (fig. 2, 3)
- Preservation of diagnostic features on herbarium specimens is poor
- Intraspecific floral color polymorphism (fig. 4)

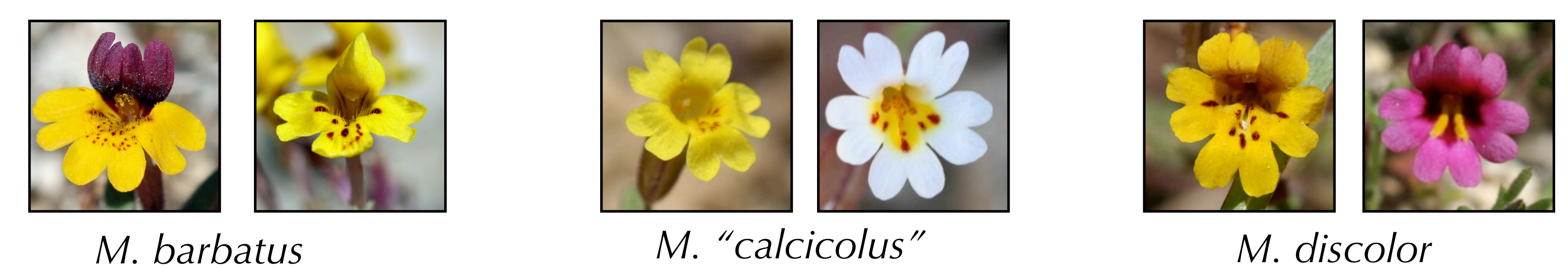
**Table 1.** Species included in the study. Epithets in quotes are manuscript names at present. TJM2=Second Edition of the Jepson Manual: Vascular Plants of California. Global Conservation Ranks: G1=critically imperiled; G2=imperiled; G3=vulnerable; G4=apparently secure; G5=secure; T2=imperiled infraspecific taxon; Q= Questionable taxonomy.

Treatment in Current Study	NatureServe Ranking	Synonym in TJM2
<i>M. androsaceus</i>	G3 (proposed change to G2)	
<i>M. barbatus</i>	G3 (proposed change to G2)	<i>M. montioides</i>
<i>M. diffusus</i>	G4Q (proposed change to G3)	<i>M. palmeri</i>
<i>M. discolor</i>	G1 (proposed)	<i>M. montioides</i>
<i>M. gracilipes</i>	G3 (proposed change to G2)	
<i>M. montioides</i>	G3 (proposed change to G2)	
<i>M. palmeri</i>	G4 (proposed change to G3)	
<i>M. purpureus</i> var. <i>pauillus</i>	G2T2Q	<i>M. purpureus</i>
<i>M. purpureus</i> var. <i>purpureus</i>	G2T2Q	<i>M. purpureus</i>
<i>M. shevockii</i>	G2	
<i>M. suksdorfii</i>	G4	
<i>M. "calcicolus"</i>	G3 (proposed)	<i>M. montioides</i>
<i>M. "carsonensis"</i>	G2 (proposed)	<i>M. montioides</i>
<i>M. "hardhamae"</i>	G1 (proposed)	<i>M. palmeri</i>
<i>M. "petra-sanguineum"</i>	G1 (proposed)	<i>M. palmeri</i>
<i>M. "sierrae"</i>	G2 (proposed)	<i>M. palmeri</i>

## Results to date:

- Surveyed and photographed over 60 populations in the field
- Uncovered five undescribed species
- Examined and georeferenced specimens from all major California herbaria
- Recorded life history attributes, ecological requirements to aid in conservation assessments of these narrow endemics.

## Flower Color Polymorphisms



**Fig. 4.** Examples of flower color polymorphism exist within the group. High variation in floral color has been in part responsible for some of the taxonomic confusion.

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