



Cryptic speciation: distinguishing serpentine affiliated sister species *Navarretia paradoxiclara* and *N. paradoxinota* from *N. intertexta* (Polemoniaceae)

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Abstract

Two species endemic to California in the western United States, *Navarretia paradoxiclara* and *N. paradoxinota*, are here described. Both species occur on serpentine influenced soils and have been previously collected as *N. intertexta*, with which they are sympatric. However, they vary from *N. intertexta* subtly, yet consistently, in floral features and remarkably in surveyed DNA regions. *Navarretia paradoxiclara* and *N. paradoxinota* are sister species phylogenetically well separated from *N. intertexta*. With respect to each other, these new species are allopatric and diagnosable by differences in their corollas.

Key words: cryptic species delimitation, DNA sequence data, morphometrics, taxonomy, unified species concept

Introduction

The *Navarretia intertexta* (Bentham 1833: 1622) Hooker (1838: 74) complex of *Navarretia* Ruiz & Pavón (1794: 20) section *Navarretia* has doubled in numbers during the past decade from two taxa of uncertain rank to four species: *N. intertexta*, *N. propinqua* Suksdorf (1906: 26; with the latter long treated as a variety or subspecies of the former), *N. saximontana* Spencer (in Spencer & Spencer 2003: 198) and *N. furnissii* L.A.Johnson & L.M.Chan (in Johnson *et al.* 2012a: 56). These species are associated with seasonally moist topography although they are not obligate to vernal pools as are several other species in *Navarretia* section *Navarretia*.

The systematics of *Navarretia saximontana* and *N. furnissii*, species from the intermountain region of the western United States long confused with *N. propinqua* or *N. leucocephala* Bentham (1849: 324 in Bentham 1839–1857) subsp. *minima* (Nuttall 1848: 13) Day (1993: 337), was examined recently (Johnson *et al.* 2012a). Here, we present evidence delimiting two species that are morphologically similar to *N. intertexta*, a large statured and widely distributed species in Western North America.

Navarretia intertexta was first described as *Aegochloa intertexta* Bentham (1833: 1622) from material collected by David Douglas from California and Northwest America. As noted by Bentham, the stamens of this species are exserted. From herbarium surveys and field work, we have observed that the anthers are not just exserted from the throat/tube of the sympetalous corolla, but that they are positioned beyond the tips of the corolla lobes when fully extended—a consistent feature despite some plasticity in gross structure in this species across its considerable distribution that ranges along the west coast of North America from Baja California to British Columbia and eastward into Idaho and Nevada. In Northern California's inner coast range and the north/central Sierra foothills, material heretofore referred to *N. intertexta* but with shorter stamens and equal or larger corollas exists. This material also varies ecologically and molecularly from *N. intertexta*. Following the unified species concept (de Queiroz 1998, 2007) and applying evidence of non-homogenizing gene flow of both morphological and molecular data as criteria for distinguishing the