

Keeler-Wolf 1995) within annual grassland communities (CNDDDB 2002). However, it is found on Northern Basalt Flow vernal pools on Hideaway soils series at one location in the San Joaquin Valley. It is known from both small and large pools (EIP Associates 1999). Although not all pools occupied by this taxon have been studied in detail, Stebbins *et al.* (1995) collected data on six occupied pools in Fresno and Madera Counties. Some were typical "bowl-like" pools, whereas others were more similar to swales. This subspecies has been reported from pools with both long and short inundation periods (EIP Associates 1999), and from both shallow and "abnormally deep vernal pools," but approximate depth of these pools was not given (CNDDDB 2002).

Soil series supporting *Castilleja campestris* ssp. *succulenta* include Amador, Anderson, Corning, Fallbrook, Keyes, Pentz, Ramona, Redding, San Joaquin, Vista, and Yokohl, as well as the Pollasky-Montpellier complex. Soil textures at those sites range from extremely stony loam to loamy clay. In the proposed University of California-Merced campus and community area, the species is found primarily on Redding gravelly loam; however, Corning, Keyes, and Pentz soils also contain occurrences of the species (EIP Associates 1999). Occurrences of *C. c.* ssp. *succulenta* have been reported from elevations of 80 ft (24 m) at the San Joaquin County site to 2,300 ft (700 m) at Kennedy Table in Madera County (CNDDDB 2002). We are uncertain about specific soils that may correlate with the presence of this species, although it is irregularly found on Redding soil series. Vernal pool complexes that provide habitat for this species include pools ranging in depth from 6 in (15 cm) to 10 in (25 cm), but the species is also found less frequently in shallower and deeper pools. Soil pH values for some of the vernal pools in Merced County occupied by *C. c.* ssp. *succulenta* range from 4.3 to 6.2. Although no comprehensive study has been conducted, some vernal pools occupied by *C. c.* ssp. *succulenta* vary in size from 0.02 ac (81 m²) to 0.12 ac (486 m²) in Merced County. Merced County contains the largest aggregations of *C. c.* ssp. *succulenta*; occurrences are found on mild to strongly acidic soils on Laguna, Mehrten, North Merced Gravels, and Riverbank Formations, as well as on Ione, Mehrten, and Valley Springs geological formations. The parent material of vernal pools greatly influences species composition and hydrologic functioning of the vernal pool (Holland and Jain 1981, 1988;

Hanes and Stromberg 1998). *Castilleja campestris* ssp. *succulenta* appears to prefer the more-weathered acidic, higher-terrace vernal pool complexes that are composed of volcanic tuff sand quartzite parent materials.

Further discussion on the life history and habitat characteristics of *Castilleja campestris* ssp. *succulenta* can be found in the final rule to list the species (62 FR 14338).

Orcuttieae Tribe

Neostapfia colusana (Colusa grass), *Orcuttia pilosa* (hairy Orcutt grass), *Tuctoria mucronata* (Solano grass), *Tuctoria greenei* (Greene's tuctoria), *Orcuttia viscida* (Sacramento Valley Orcutt grass), *Orcuttia inaequalis* (San Joaquin Valley Orcutt grass), and *Orcuttia tenuis* (slender Orcutt grass) belong to the tribe Orcuttieae in Poaceae, the grass family, (Reeder 1965). Many life history characteristics are common to all members of the Orcuttieae. All are wind pollinated, but pollen may not be carried long distances between occurrences (Griggs 1980, 1981; Griggs and Jain 1983). Local seed dispersal is by water, which breaks up the inflorescence (Reeder 1965; Crampton 1976; Griggs 1980, 1981). Long-distance dispersal is unlikely (Service 1985c), but seed may have been carried occasionally by waterfowl (family Anatidae), tule elk (*Cervus elaphus nannoides*), or pronghorn (*Antilocapra americana*) in historical times (Griggs 1980). The seeds can remain dormant for an undetermined length of time, but at least for 3 or 4 years, and germinate underwater after they have been immersed for prolonged periods (Crampton 1976; Griggs 1980; Keeley 1998a). Unlike typical terrestrial grasses that grow in the uplands surrounding vernal pools, members of the Orcuttieae flower during the summer months (Keeley 1998a).

Members of the Orcuttieae tribe share a suite of characteristics that separate the genera within the tribe from all other grasses and have no close terrestrial relative tribes. The semi-aquatic annual plants in this distinct group contain glands that produce a viscid aromatic exudate (sticky aromatic substance) exhibit no distinction between the leaf blade and blade sheath, lack leaf ligules (small membranous appendages at the base of a leaf), and possess small sunken mushroom-shaped bicellular microhairs. These seasonally submerged species germinate and grow as submerged aquatic plants for several weeks to 3 months. With the exceptions of *Tuctoria* and the variable aquatic and terrestrial leaves of *Neostapfia*, *Orcuttia* species produce floating aquatic

juvenile leaves that lack stomata (openings for gas exchange). These partly amphibious *Orcuttia* species within this tribe replace their juvenile leaves with terrestrial leaves as the vernal pools dry out.

All members of the Orcuttieae tribe have large soil seed banks that may be 50 times (or more) larger in numbers than the aboveground population in any given year. In general, years of above-average rainfall promote larger expressions of occurrences of Orcuttieae, but occurrence responses vary by pool and by species (Griggs 1980; Griggs and Jain 1983). Population sizes have been observed to vary by one to four orders of magnitude among successive years and return to previous levels even after 3 to 5 consecutive years when no mature plants were present (Griggs 1980; Griggs and Jain 1983; Holland 1987). Thus, many years of observation are necessary to determine whether any occurrence of a species is increasing, stable, or declining.

Eight members of the Orcuttieae tribe are endemic and restricted to vernal pools in California. The Orcuttieae tribe contains the three genera *Neostapfia*, *Orcuttia*, and *Tuctoria*. The genus *Neostapfia* contains one species, *Neostapfia colusana*. The genus *Orcuttia* has five species and *Tuctoria* has two species. Although the various species within the tribe have been found in vernal pools ranging widely in size, the vast majority are found within vernal pools of 0.03 ac (0.01 ha) to 24.7 ac (10 ha) (Stone *et al.* 1988). Larger vernal pools retain water until May or June, creating optimal conditions for Orcuttieae (Crampton 1959; Crampton 1976; Griggs 1981; Griggs and Jain 1983). Orcuttieae usually occur in patches within the pools that are essentially devoid of other plant species (Crampton 1959, 1976). Typically, these plants near the center of a vernal pool grow larger and produce more spikelets than those near the margins, but patterns vary depending on individual pool characteristics and seasonal weather conditions (Griggs 1980).

A discussion of each of the seven Orcuttieae species in this rule is provided below. The number of subject extant occurrences of the 3 genera within the tribe total 219, and an additional 80 occurrences have been extirpated or are considered possibly extirpated by intensive agriculture, land use conversions, urban development, and other factors (CNDDDB 2002).

Neostapfia colusana

Joseph Burt-Davy (1898) first described *Neostapfia colusana* (Colusa grass) and gave the Latin name *Stapfia*