

# A NEW SPECIES OF CALYCADENIA (ASTERACEAE) FROM NORTH CENTRAL CALIFORNIA

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## ABSTRACT

An unusual form of *Calycadenia* from north central California was studied in greenhouse culture and confirmed to be self-compatible, a condition rare in *Calycadenia*. Based on the distinctive morphology and breeding system of this taxon, it is described and illustrated as a new species, *Calycadenia micrantha*. Although clearly related to *C. truncata* and apparently included in *C. truncata* DC. subsp. *microcephala* H.M. Hall ex D.D. Keck, this name was rejected as a basionym for the new species because of ambiguities regarding the type, the original description, and specimens cited and/or annotated by Keck.

## RESUMEN

Se estudió una forma inusual de *Calycadenia* del centro-norte de California en cultivo de invernadero y se confirmó que es autocompatible, una característica rara en *Calycadenia*. Se describe e ilustra como una nueva especie basada en la diferente morfología y sistema reproductor de este taxon, *Calycadenia micrantha*. Aunque claramente emparentada con *C. truncata* y aparentemente incluida en *C. truncata* DC. subsp. *microcephala* H.M. Hall ex D.D. Keck, este nombre fue rechazado como basiónimo para la nueva especie por algunas ambigüedades relacionadas con el tipo, la descripción original, y los especímenes citados y/o anotados por Keck.

## INTRODUCTION

For some years we have been aware of a unique population of plants related to *Calycadenia truncata* and growing on Elk Mountain in Lake County, California. In 1990 we received a similar specimen from David W. Isle, Forest Botanist for the Mendocino National Forest in California. The plant had been collected near the Wilson Camp area of southern Colusa County. Morphologically, the plant was clearly related to *Calycadenia truncata*. However, like the Elk Mountain specimens, Isle's plant was shorter and more slender than most and had very tiny heads with only 1 or 2 obscure, tiny ray flowers and 1 or 2 disk flowers.

Subsequently, several additional populations of this taxon were located in adjacent Lake County. The heads and rays suggested the possibility of self-compatibility, a condition rare in *Calycadenia*. In conjunction with ongoing biosystematic research on *Calycadenia*, a number of populations of this taxon were studied in greenhouse culture. All individuals were self-compatible, a condition known to exist in only one other species of *Calycadenia*, *C. hooveri* G.D.

Carr. In addition, although dozens of reciprocal crosses of these populations with self-incompatible forms of *Calycadenia truncata* have been made, cypselae with embryos were generated only when the self-compatible form served as the female parent. Carr (1975) noted the same phenomenon in *C. hooveri* and suggested that it may be the result of unilateral interspecific incompatibility, as discussed in Lewis and Crowe (1958).

The investigation of these unique plants led to re-evaluation of a previously described taxon, *Calycadenia truncata* DC. subsp. *microcephala* H.M. Hall ex D.D. Keck. According to Keck (1946), "This subspecies is separated from *Calycadenia truncata* subsp. *scabrella* (Drew) Keck, to which it is most nearly related, by the reduced number of disk-florets (3 or 4 instead of the usual 8 to 15) and the smaller heads." Additionally, he recognized the existence of intergradation between these subspecies. It appears from Keck's description and discussion that his small-headed taxon clearly includes the tiny-rayed self-compatible taxon described here but also includes other small-headed *C. truncata* populations.

Keck (1946) listed a number of specimens, and subsequently annotated numerous additional specimens, representing *C. truncata* subsp. *microcephala*, including locations from southern Trinity County to Lake County and in the Santa Lucia mountains of Monterey County. Some of these specimens are representative of a small-headed, self-compatible taxon but others represent populations of self-incompatible *C. truncata* plants with somewhat larger heads and rays. Depauperate individuals are common in populations of annual plants, especially in harsh years. Specimens of *C. truncata* prepared from such depauperate plants, especially those poorly pressed or without flowering heads at anthesis, could easily be confused with the new, small-headed, self-compatible taxon proposed herein.

To better understand his concept of *C. truncata* subsp. *microcephala*, attempts were made to field-verify all collections referred to this taxon by Keck in his original publication (1946) and subsequent specimen annotations. This was difficult as most collections cited, including the type locality, have not been re-located. Additionally, the type locality cited (*H.M. Hall* 9602, Mill Creek Canyon about 8 miles eastward from Ukiah, Mendocino Co., CA.) has no habitat that would support *Calycadenia* within ca. 3–4 miles. Hall may have accidentally written down the wrong mileage or possibly transposed a 3 with an 8. Regardless, there is very little likelihood that the type specimen was collected near the suggested location. There are sites 2–4 miles east of Ukiah with habitat that may have supported *Calycadenia* in the past but these sites are now largely occupied by agriculture. In any case, there appears to be no way to relate the type specimen to an extant population in the field.

After careful consideration, and for a variety of reasons, we believe the circumscription of Keck's *C. truncata* subsp. *microcephala* is not the same as the

new species proposed herein. The questionable nature of the type, the ambiguity in the description and cited specimens, and the likelihood that Keck had no knowledge of the derived breeding system of the new taxon described below, lead us to conclude that use of the epithet "*microcephala*" for this new species is untenable.

#### RESULTS AND DISCUSSION

***Calycadenia micrantha*** R.L. Carr & G.D. Carr, sp. nov. (**Fig. 1**). TYPE: U.S.A. CALIFORNIA, TRINITY CO.: ca. 1 mi N of Mad River Rock on rd. to Mad River Rock from Low Gap, S of the Mad River Ranger Station, 40°23'10"N, 123°29'01"W, 1340 m, 22 Aug 2003, R.L. Carr 3801 (HOLOTYPE: UC; ISOTYPES: OSC, US).

Herba annua. Caules graciles 1-5 dm ramorum saepe multis glabris curvatis ascendentibusve. Folia basalia 2-5 cm × 2-3 mm proximaliter rosulata distaliter deminuta linearia. Bractee pedunculares 2-4 mm hispidulae plus minusve pectinato-fimbriatae glande una grandi capitata terminali. Capitula 1(-3) in quoque nodo; phyllariis 1-2, 4-5 mm; paleis 2-3, 5-6 mm hispidulis villosulis ad marginem superum interdum cum glande una parva capitata terminali; flosculis radialibus 1-3 lamina 2-2.5(-3.5) mm sinu 0.5(-1) mm; flosculis disci 1-3; cypselis radialibus aspero-rugosis glabris epapposis; cypselis disci plerumque abortivis glabris epapposis.

Annual herbs. **Stems** 1-5 dm, slender, generally less than 2(-3) mm diameter at the base, branches often many, generally beginning near mid-stem, arcuate to ascending; glabrous, often purplish, especially distally. **Leaves** in basal rosette 2-5 cm long, 2-3 mm wide, sessile by a widened base, becoming more remote and reduced distally, linear, hispidulous adaxially and along the margins, often with longer, hispid hairs adaxially; leaves of the inflorescence 5-20 mm long, linear with a widened base, hispidulous, sometimes with a few awn-like bristles along the margin. **Heads** 1(-3) per node, sessile or nearly so. **Peduncular bracts** 2-4 mm, these and associated reduced leaves terete to strongly flattened, glabrous to hispidulous, commonly also with 1-8 long, pectinate bristles on the margins; apex bearing 1 large tack-shaped gland. **Phyllaries** 1-3(-6); 4-5 mm, each partly enfolding a ray cypselae, the abaxial surface glabrous to more or less hispidulous, especially toward the tip, sometimes bearing a few scattered, stout bristles; distal margins with shaggy hairs; apex occasionally with a single small tack-shaped gland. **Receptacle paleae** 2-3; 4-6 mm, each associated with a disk cypselae, the abaxial surface glabrous to more or less hispidulous, especially toward the tip, sometimes bearing a few scattered, stout bristles, distal margins with shaggy hairs; apex occasionally with a single, small, tack-shaped gland. **Ray florets** 1-3(-6); fertile, corolla bright yellow, laminae 2-2.5(-3.5) mm long by 2-4 mm wide, 3(-4)-lobed, sinuses ca. 0.5 mm, the middle lobe(s) smallest, symmetric, oblong to narrowly triangular, the outer lobes asymmetric, basically oblong to obovate but excursion of outer margin from midline greater than that of the inner margin, the tube 1-1.5 mm. **Disk florets** 1-3, 3-4 mm, yellowish. **Ray cypselae** ca. 3 mm long, ca. 2 mm wide, more or less triangular, rough-wrinkled, glabrous, pappi none. **Disk cypselae** ca. 3 mm long, mostly abortive,



FIG. 1. *Calycadenia micrantha*. A. Habit. B. Capitulum, lateral view. C. Capitulum from above. D. Peduncular bract (appressed to capitulum). E. Ray cypselae. F. Peduncular bract tip with tack-shaped gland. Photos of Holotype, R.L. Carr 3801 (UC).

terete when developed and tapered toward the base, smooth to very slightly ridged, glabrous, pappi none. Self-compatible.  $2n = 14$  (Carr 1977).

Flowering (Jun-)Jul-fall.

PARATYPES: U.S.A. CALIFORNIA. Colusa Co.: Wilson Camp SW of Stonyford, near the Colusa/Lake Co. line, ca. 3 air mi SE of Goat Mtn., 1400 m, 23 Sep 1994, R.L. Carr 2656 (UC). Lake Co.: 0.4 mi S of Elk Mtn. summit along Elk Mtn. Rd., 1140 m, 10 Aug 1974, G.D. Carr 771 (UC); S side of Elk Mtn. along Elk Mtn. Rd., 0.45 mi N of 14 mi marker, N of Upper Lake, 1150 m, 30 Sep 1986, R.L. Carr 2258 (UC); 0.7 mi NE of Pinnacle Rock Rd. on Bartlett Springs Rd., 2.1 mi NE of Lakeview Campground, 6.8 mi from jet. with Hwy. 20, 1150 m, 23 Sep 1994, R.L. Carr 2658 (UC); S facing slope on Elk Mtn., Elk Mtn. Rd. to Upper Lake at jet. with forest rd. (17N28), ca. mile post 16.6 on rd., 1100 m, 23 Sep 1994, R.L. Carr 2660 (UC); S facing slope of Elk Mtn., 3.3 mi N of the entrance to Middle Creek Campground on rd. from Upper Lake to Elk Mtn., ca. 1100 m, 23 Sep 1994, R.L. Carr 2661 (UC); E of Elk Mtn. Rd. on Deer Valley Campground Rd. (16N01), 1.3 mi W of Deer Valley Campground, 1005 m, 18 Jul 1997, R.L. Carr 3353 (UC); rd. to Bear Creek (16N01) ca. 2.1 mi E of Deer Valley Campground, 0.8 mi W of Dry Oak Campground, 1130 m, 18 Jul 1997, R.L. Carr 3354 (UC); ca. 200 yds SW of Little Pinnacle Rock Peak, on forest

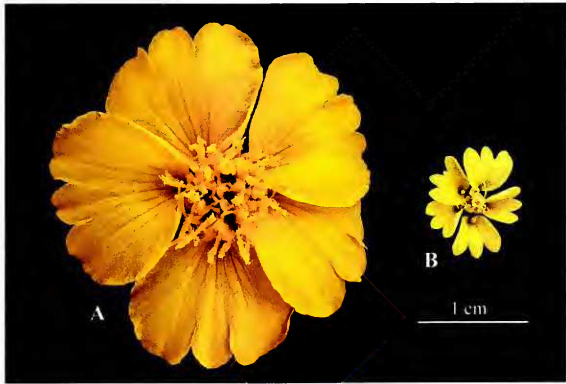


FIG. 2. Capitulae from greenhouse-grown plants. **A.** *Calycadenia truncata*, R.L. Carr 2224. **B.** *Calycadenia micrantha*, G.D. Carr 771.

rd. 16N01 ca. 1.9 mi W of its jct. with rd. to Bartlett Springs, 1350 m, 07 Oct 1997, R.L. Carr 3395 (UC); above Old Rd. to Witter Springs, ca. 0.2 mi E of Witter Springs site N of Lakeport, 39°11'29"N, 122°59'30"W, 500 m, 23 Aug 2003, R.L. Carr 3802 (UC); along Hwy. 175, W of Lakeport, ca. 2.5 mi W of jct. with Hwy 29, 38°59'43"N, 122°55'48"W, 500 m, 23 Aug 2003, R.L. Carr 3803 (UC). **Monterey Co.:** Fort Hunter Liggett boundary, ridge crest near South Coast Ridge Rd., ca. 12.9–13 rd. mi S of jct. with Nacimiento-Fergusson Rd. and ca. 0.3 mi S of jct. with Burma Rd., 1000 m, 15 Jun 1998, E. Painter & E. Neese (s.n.) (SBBG); Fort Hunter Liggett (Training Area 17), near Burro Rd., ca. 2.0 km N of Three Peaks, ca. 3.25 km W of Burro Mtn., 700 m, 15 Jun 1995, E. Neese & E. Painter HL902 (SBBG); Fort Hunter Liggett (Training Area 17), near Burro Rd., ca. 2.0 km N of Three Peaks, ca. 3.25 km W of Burro Mtn., 700 m, E. Painter, E. Neese & A. Hazebrook HL3005 (SBBG). **Trinity Co.:** Threeforks of the Mad River, ca. 0.2 mi E of end of county rd. across Mad River, 40°09'48"N, 123°13'21"W, 899 m, 21 Aug 2003, R.L. Carr 3800 (UC).

**Distribution and ecology.**—Dry, open, rocky ridges, hillsides and talus; 500–1,500 m; Colusa, Lake, Trinity and Monterey counties, California. This species grows only in areas of low plant density, in or closely associated with exposed rocky areas or areas of packed mineral materials. For this reason and because survivorship is low, populations are generally small with few individuals. The species is surviving in an extremely limited and very fragile habitat.

**Etymology.**—Name Gr., *micr*, small; *anth*, a flower. Referring to the reduced ray flowers compared to most other species of *Calycadenia*.

Compared to some other taxa of *Calycadenia*, *C. micrantha* is remarkably uniform morphologically. The variation that is seen between populations is

TABLE 1. Comparison of selected features of *Calycadenia micrantha* and *C. truncata*.

Character	<i>Calycadenia micrantha</i>	<i>Calycadenia truncata</i>
Stem height	1–5 dm	2–12 dm
Leaf length	2–5 cm	2–10 cm
Peduncular bract length	2–4 mm	1–12 mm
Phyllary length	4–5 mm	5–10 mm
Ray floret number	1–3(–6)	3–6
Ray corolla lamina length	2–2.5(–3.5) mm	(4–)5–12 mm
Disk floret number	1–3	3–25
Disk floret length	3–4 mm	4–6 mm
Breeding system	Self-compatible	Self-incompatible

about that seen within populations. The overall size, branching and coloration of the plants, the overall size and position of the heads, the number, size, and position of the peduncular bracts, involucre bracts, ray ligules, ray achenes, receptacular bracts, disk flowers, and disk cypselae is very constant. The major variation seen is in the vestiture of the basal/proximal cauline leaves and that of the leaves associated with heads and the peduncular, involucre, and receptacular bracts. The basal and proximal cauline leaves are nearly always hispidulous but the presence of longer, stiff, bristly hairs ranges from sparse to rather dense. The leaves and bracts of the inflorescence are nearly always more or less hispidulous but the presence of pectinate hairs and other bristles varies considerably, as does the presence of hairs on or near the tips of the involucre and receptacular bracts. Additionally, the presence of the smaller tack-shaped gland on the tips of the involucre or receptacular bracts is variable, although uncommon overall.

As discussed above, the populations treated here as *Calycadenia micrantha* have previously been considered conspecific with *C. truncata*. Salient features that help distinguish the two species as circumscribed here are presented in Table 1. Some of the most striking differences relate to the reduced capitulum associated with the self-compatible breeding system found in *C. micrantha* (Fig. 2).

In greenhouse cultivation of *C. micrantha*, we have noted that the middle lobe of ray flower laminae is commonly subdivided, yielding a 4-lobed lamina with two small symmetric central lobes and two larger, asymmetric outer lobes. Heads may contain a mixture of ray flowers with 'normal' and 'aberrant' laminae. It is not known to what extent this phenomenon occurs in natural populations. We have noted the same phenomenon at very low frequencies in other species or hybrids of *Calycadenia* in cultivation.

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