

# A NEW SPECIES OF OREONANA, A GENUS OF SNOW-ADAPTED UMBELLIFERAE

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## ABSTRACT

A new species, *O. purpurascens*, is described from California. A chromosome number of  $n = 11$  is reported for each of the three species of the genus. Observations are recorded on the adaptation of the life cycle to conditions of heavy snowfall and the unique mode of seed dispersal. Comments on generic relationship and a key to the species conclude the paper.

### ***Oreonana purpurascens* Shevock & Constance, sp. nov.**

Plantae perennes acaulescentes e radice palari, foliis et inflorescentia dense pubescentibus vel inflorescentia glabrata; vaginae longae, foliorum laminis anguste ovatis pinnatis bipinnatisectis, divisionibus ultimis lanceolatis oblongisve; petioli quam laminae plerumque breviores; inflorescentia crescens primum ante folia, umbellis maturis magnis globosis cinereo-hirsutis, pedunculis folia distincta excedentibus; radii quoquoersus radiantes ad basin versus breve dilatati, radiis exterioribus scarioso-alatis connatisque; umbellulae 1–3-floribus fertilibus et 15–30 floribus staminalibus sterilibusve obsitae; involucellum lobatum; flores albi umbellis post anthesin purpureis; sepala purpurea conspicuissima, pedicellis staminalibus sterilibusve dense hirsutibus fructum aliquantum excedentibus; fructus ovalis orbicularisve, superficie albo-hirsuta glabratave; vittae in intervallis et in commissuris plures; seminum superficies involuta (Fig. 1).

Plants perennial, acaulescent, 8–22 cm tall, the taproot massive and often branched, the leaf blades and petioles and the inflorescence densely short-grayish-hirsute, or the inflorescence  $\pm$  glabrate; bladeless sheaths 3–6 cm long, the lamina of foliage leaves narrowly ovate, 5–10 cm long, 4–8 cm broad, obtuse at apex, truncate at base, pinnate and then bipinnatisect, the ultimate divisions lanceolate or oblong, mucronate, but not evidently cartilaginous-margined, 1–3 mm long, up to 1 mm broad; petioles 4–7 cm long, purple, persistently hirsute, mostly shorter than lamina; inflorescence appearing well before foliage leaves, the umbels globose, grayish-hirsute, 2.5–4.5 cm in diameter at maturity, the peduncles rather stout, 12–18 cm long, glabrous or glabrate, definitely exceeding leaves; rays 20–35, stout to slender, 5–15 mm long, spreading in all dimensions, the outer broadly scarious-winged and scarious-webbed, but all shortly dilated at base; umbellets of 1–3 fertile and 15–30 either staminate or entirely sterile flowers;



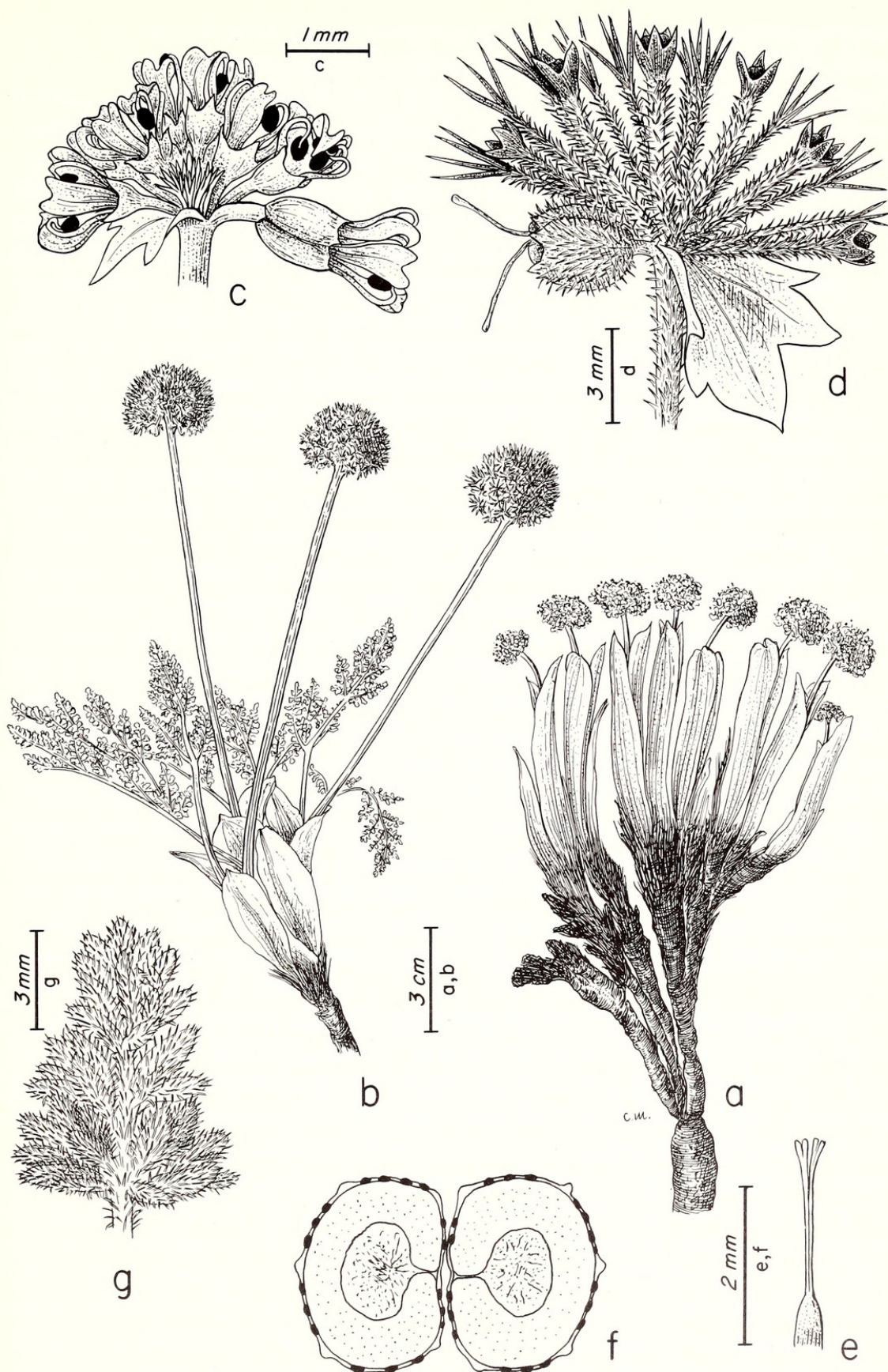


FIG. 1. *Oreonana purpurascens*. a. Flowering habit. b. Fruiting habit. c. Flowering umbellet (opened and some flowers removed). d. Fruiting umbellet. e. Carpophore. f. Fruit transection. g. Leaflet. All from Shevock 5412, 5428.



involucel with 5 or more irregular lobes, the lobes lanceolate-attenuate, mostly glabrate dorsally, scarious with prominent purple veins; flowers white, but heads turning purple after anthesis due to the purple sepals, the anthers purple; sepals usually 3 or 4, conspicuous, lanceolate to linear-subulate, mostly 1.5–3 mm long, those of staminate flowers joined at base to form a narrow cup, the sepals spreading-ascending and calyx hence somewhat stellate-spreading, the pedicels of staminate and sterile flowers 3–10 mm long, densely short-hirsute and considerably exceeding fruit when mature; petals usually 4, oblanceolate to obovate-spatulate, 1.5–2.5 mm long, early deciduous; styles 1.5–3 mm long; ovaries white-hirsute; fruit oval to orbicular, 4–5 mm in diameter, the surface short-white-hirsute to glabrate, the ribs filiform; vittae 3–5 in the intervals, 3–5 on the commissure; seed face involute.

TYPE: USA, CA, Tulare Co.: Slate Mt., T21S R32E S19, Sequoia Natl. Forest, 2690 m, 14 Jun 1977, *Shevock 5537*. Holotype: UC; Isotypes: COLO, F, GH, K, MO, NY, RSA, US.

Additional specimens examined: USA, CA, Tulare Co.: Weaver Lake trail, Jul 1946, *Buckalew s.n.* (UC); Big Meadows, 7 Jun 1952, *Buckalew s.n.* (FSC); Slate Mt., T21S R31E S25, 15 Jul 1976, *Shevock 5212* (CAS), T21S R32E S19, 19 Apr 1977, *Shevock 5411* (UC), T21S R31E S24, 19 Apr 1977, *Shevock 5412* (UC), T21S R32E S19, 26 Apr 1977, *Shevock 5428* (UC); summit trail between Mountaineer Cr. & Jacobsen Meadow, T20S R31E S3, 26 May 1977, *Shevock 5474* (UC). Nearly all populations so far discovered occur on open metamorphic ridge tops in Red Fir forest at 2625–2790 m, a habitat that appears to favor dispersal by wind and gravity. The plants are most common on rocky, sparsely vegetated ridges, considerably less abundant where the ripe fruits become lodged and germinate in pine mat manzanita, and very scarce among the red fir and white pine adjacent to the ridges.

*Oreonana* comprises a small group of montane herbaceous California Umbelliferae (Apiaceae) adapted to low-temperature environments and extensive winter snow cover. These belong to the ecological class of spring ephemerals, which grow from underground storage organs and develop rapidly both vegetatively and reproductively as the snow melts (Salisbury et al., 1973). Their life cycle appears to resemble that of *Orogenia linearifolia* Wats., in which “flowers were completely formed within an apical sheath while still beneath the soil surface and under snowy cover” (Kimball et al., 1973, p. 161). As stated by Billings, “Almost all alpine plants . . . produce flower primordia at least the year before flowering and sometimes 2 or 3 years before. These preformed flower buds insure that there is no delay in flowering after snowmelt and that there is time for seed-set, assuming all other environmental conditions are met. The preformed flower bud is a ubiquitous arctic-alpine adaptation” (1974, p. 126). In the case of *Oreo-*



*nana*, "Its acaulescent nature, with the small leaves and scapes arising directly from the root crown, contribute to its early blooming since time is not consumed in growing a main stem," as remarked by Buckalew (unpublished, 1956. Copies are available from L. C.).

The senior author has made extensive observations and numerous photographs of *O. clementis* and *O. purpurascens* during the course of their ontogeny. In *O. clementis* the flower buds emerge directly from the ground after or at the same time as the leaves, but never before them. There is no protective sheath surrounding the buds as they force their way up through the granitic gravel. Occasionally one may find a laggard bud working its way to the surface even after the majority of them has developed. In *O. purpurascens*, on the other hand, as soon as the snow melts, the mature flower buds push their way up through the large sheaths that extend well above the ground surface, presenting a display reminiscent of that of some of the small Sierran species of *Allium*. Once a sheath breaks the surface of the ground, no more buds emerge from that sheath. The foliage leaves emerge only after the flowers are fully expanded; only two leaves develop on each flowering stalk. As the white petals fall, the heads become quite purple from the deep color of the calyx; at the same time, the dark purple peduncles elongate markedly. Eventually, however, both heads and peduncles lose their purple coloring.

At the inception of this study, no cytological information was available for any species of *Oreonana*. We are now able to report chromosome counts on all three species (Table 1). We are most grateful to Tsan-Iang and Fei-mei Chuang of Illinois State University, Normal, for making these counts. The somatic count for *O. purpurascens* was obtained from root tips secured by germinating fruit soaked for 24 hours in a 1 percent solution of Clorox and kept for two months at a temperature of approximately 4°C. The meiotic counts were secured from buds fixed in the field.

Obtaining buds of *O. purpurascens* in the meiotic stage proved to be particularly difficult. In 1977, buds were collected while the snow was melting, but these proved to be too mature. Late in April, 1978, the senior author snow-shoed up Slate Mountain, dug down through 8–10 feet of snow and found purple anthers, an indication of pollen. On the basis of this experience, we concluded that flower buds must form at the end of the summer growing season and that meiosis must occur during late fall or winter. Bud-collecting trips were commenced in August, and very minute flower buds were detected at that time, but such buds showed very little enlargement even late into October. After the occurrence of three small snowstorms earlier in the month, however, buds which provided dividing pollen mother cells were secured on 27 November.

The mode of fruit/seed dissemination is also remarkable. Buckalew (loc. cit.) described it as follows: "The fruiting head, freed from the



TABLE 1. CHROMOSOME NUMBERS IN *Oreonana*.

Species	$n =$	$2n =$	Collection
<i>O. clementis</i>	11		Lloyd Meadows, Sequoia Natl. Forest, Tulare Co., 29 Mar 1977, <i>Shevock</i> 5406.
	11		Dome Rock, Sequoia Natl. Forest, Tulare Co., 19 Apr 1977, <i>Shevock</i> 5408.
<i>O. purpurascens</i>	11	22	Slate Mt., Sequoia Natl. Forest, Tulare Co., 14 Jun 1977 (27 Nov 1978), <i>Shevock</i> 5537.
<i>O. vestita</i>	11		Mt. Baldy notch, Angeles Natl. Forest, San Bernardino Co., 4 May 1977, <i>Shevock</i> 5429.

plant by the withering scape, is very light and quite round, so that it can be moved by a comparatively light breeze to shake out its seeds as it rolls." Wind dispersal (anemochory) is not unique in Umbelliferae. As quoted by Dawson (1967), Philipson and Hearn comment on a particular New Zealand scree plant: "As the seeds ripen on the female plants the thin base of the stem breaks and the whole visible part of the plant dries up and becomes stiff. This ball-like mass acts as a tumbleweed, being blown along the surface of the scree shedding seeds as it goes" (1962, p. 31). Van der Pijl cites instances from other families in which globular infructescences break off and roll along the ground (chamaechores), notably *Fedia* (Valerianaceae) from the Mediterranean region and *Spinifex* (Gramineae) from Australia and Indonesia, the so-called "wind-balls" (1969, p. 59). What is unique about *Oreonana*, however, is not only the abscission of the whole infructescence, but the fact that the pedicels of sterile and staminate flowers, which surpass those of fertile ones, become rigid and, with the aid of the persistent calyx, act like the spokes of a three-dimensional wheel, with the fruits carried near the hub until they are jarred loose—a true "tumble umbel"!

The genus *Oreonana* was proposed by Jepson to accommodate what he believed to be an undescribed plant (*O. californica* Jepson) from the Mount Whitney region of the Sierra Nevada, and *Deweya vestita* Wats., which had been named much earlier from the San Gabriel Range of southern California. *Oreonana californica* was subsequently shown to be conspecific with *Drudeophytum clementis* M. E. Jones. Jones (1912) referred to the instability of generic lines in this part of the family, as reflected in the synonymy of *O. vestita*, which has been placed at various times also in *Velaea* DC., *Deweya* Torr. & Gray, *Drudeophytum* Coult. & Rose, and *Tauschia* Schlecht. The vicissitudes of these genera need not concern us here. Mathias and Constance (1944, pp. 89–90) concluded that *Oreonana*, distinguished by its prominent



and persistent sterile pedicels, deserved generic status, although it appears to be closely related to *Tauschia* and *Arracacia*.

The discovery that all three of its species are diploid and have a chromosome complement of  $n = 11$  is not particularly helpful in determining the affinities of *Oreonana* within the family. Both *Tauschia* and *Arracacia* have a base number of  $x = 11$ , and four western American species of *Tauschia* (*T. arguta*, *T. glauca*, *T. hartwegii*, *T. parishii*) are diploid. All species of *Arracacia* and the Mexican species of *Tauschia* that have been investigated cytologically appear to be polyploid, but the chromosome numbers of most species have not yet been determined. Thus, a relationship of *Oreonana* to *Tauschia* is at least not precluded by the cytological data.

### Key to *Oreonana*

Foliage and inflorescence grayish-hirsute with short stiff hairs; umbels globose, the rays spreading in all dimensions, the outer rays usually conspicuously scarious-winged; flowers white with purple anthers; sepals conspicuous, stellate-spreading; pedicels of staminate/sterile flowers 3–10 mm long.

Inflorescence appearing simultaneously with or a little after foliage leaves; bladeless leaf sheaths 0.5–2 cm long; umbels 1–3 cm in diameter, the rays 5–15 (20), 2–8 mm long; flowers either perfect or staminate; sepals of staminate flowers yellow, mostly 0.5–1.5 mm long . . . . . 1. *O. clementis* (M. E. Jones) Jeps.

Inflorescence appearing well before foliage leaves; bladeless leaf sheaths 3–6 cm long; umbels 2.5–4.5 cm in diameter, the rays 20–35, 12–18 mm long; flowers perfect, staminate, or entirely sterile; sepals of staminate and sterile flowers deep purple, mostly 1.5–3 mm long. . . . . 2. *O. purpurascens* Shevock & Constance

Foliage and inflorescence densely white-tomentose with long silky hairs; umbels hemispherical, the rays spreading horizontally to ascending, the outer rays not scarious-winged; flowers mostly yellow or maroon with yellow anthers; sepals inconspicuous, not stellate-spreading; pedicels of staminate flowers 10–25 mm long. . . . . 3. *O. vestita* (S. Wats.) Jeps.

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