

THE DEMISE OF THE LILIACEAE OR LILY FAMILY

HOW THE ONCE-DIVERSE FAMILY HAS
BEEN SPLINTERED INTO MANY PIECES

The broad definition of the Liliaceae has always been a source of controversy and the borders of the family have had many interpretations

- The 1993 *Jepson Manual* took the broadest approach possible, not even recognizing the Agavaceae (agave family) or Amaryllidaceae (amaryllis family), which were recognized as distinctive by most botanists
- Now the new manual has taken a diametrically different view and embraced the evidence that the family is not a natural unit and the plants in it belong to unrelated lines

The result of this change is that suddenly, there are many separate families to learn about and identify

- In California, we recognize 10 native families but in the rest of the world, many others have also been split off from the original Liliaceae
- Unfortunately, many of these separate families are not easy to key out or recognize by easily seen traits, making it harder for the beginner to grasp the different groups

The reasons for these changes are based on many lines of evidence, many of which are not easily seen

- For example, DNA studies have indicated that superficially similar looking plants like *Nolina* and *Yucca* are not at all closely related
- Meanwhile genera in some families do not look superficially similar as, for example, *Agave* and *Chlorogalum* (soap plant), both in the family Agavaceae
- Other lines of evidence for these changes include studies in biochemistry, embryo development, seed and fruit structure, and much more

Currently the original California Liliaceae has been split into families belonging to two different orders

- Orders are groupings of related families, so when families belong to different orders, it indicates there is not a close relationship
- For California Liliaceae, some families belong to the Asparagales (asparagus order), while others have been retained in the Liliales (lily order)
- Neither of these orders is easy to define and therefore beyond the scope of this workshop but we'll be looking at the families in each of these orders to see where the native genera belong

We'll start with the Liliales first, an order that obviously retains the Liliaceae along with

- Melanthiaceae with *Toxicoscordon*, *Hastingsia*, *Leuocrinum*, *Xerophyllum*, *Trillium*, and *Veratrum*
- Smilacaceae with the single genus *Smilax*
- Nartheciaceae with the single species *Narthecium californicum*
- Tofieldiaceae with the single species *Triantha occidentalis*

We'll start first with the type family of the order, Liliaceae. Many members of the family have

- Bulbs or underground rhizomes
- Large, showy flowers
- Often spots or stripes on the petals
- The type genus *Lilium* (true lilies) features bulbous plants with whorls or tiers of narrow leaves on the stem, showy flowers often with recurved tepals, and versatile anthers on the stamens

Here you see the whorled leaves and showy flowers of the leopard lily, *Lilium pardalinum*



Lilies like *Lilium parvum* (alpine lily) have versatile anthers that pivot on their attachment to the filament



The Columbia lily (*L. columbianum*) shows the spots often found on lily flowers



Here you see the upright seed pods with impressions made by the coin-shaped seeds in liliams



Some lilies like *L. washingtonianum* don't have the usual lily colors of reds, oranges, and yellows



Related to the true lilies are the fritillaries (*Fritillaria* spp.), differing from lilies by

- Tiny rice grain bulblets often around the parent bulb (lilies don't have these)
- Flowers often in unusual, drab colors such as purples, browns, and greens and
- Basifixed anthers (anthers firmly anchored to their filaments at the base)

The common checker-lily or mission bells (*Fritillaria affinis*) shows the checkered pattern typical of many fritillaria petals



Here you see the basifixed anthers of *Fritillaria affinis*



Purdy's fritillary (*F. purdyi*) also displays the unusual and somewhat drab colors



A few fritillarias like the adobe lily (*F. pluriflora*) have brightly colored flowers



Fritillaria seed pods also differ from lilies in having six broad wings as seen here



Erythronium (fawn- and glacier-lilies) have broader basal leaves, large flowers borne on short stalks, and slender bulbs

- The genus is divided into species with mottled leaves (fawn-lilies) that live in the foothills and
- Solid green leaves on plants that live in the high mountains, often blooming by melting snow fields (glacier-lilies)

Erythronium californicum is a typical fawn-lily with mottled leaves and white flowers with a yellow center



Erythronium helenae (Mt St Helena fawn-lily) is similar displaying the same basic form and color pattern but is restricted to the region around Mt.St. Helena



A typical glacier-lily is *E. grandiflorum* found in the high North Coast Ranges and Klamath Mountains on northward to Mt Rainier and Glacier National Park



The beautiful coastal fawn-lily, *E. revolutum*, features pink instead of white or yellow flowers. The genus name comes from the Greek *erythros* meaning red



One of the showiest genera is *Calochortus* (Greek for beautiful grass) containing plants with narrow, strap-shaped leaves and flowers with sepals and petals different in shape and often color

- Three subgroups of the genus include
- Globe-tulips with nodding, nearly closed, globe-shaped flowers
- Star-tulips with open, upright, shallowly bowl-shaped flowers and
- Mariposa-tulips with tulip-shaped flowers often elaborately marked inside

Calochortus amabilis (diogene's lantern) is one of the globe-tulips as is



C. amoenus. Note the difference in sepal and petal shape



C. clavatus, the goldenbowl mariposa shows the typical tulip shape and markings on the petals of the mariposa tulips



C. superbus (the superb mariposa-tulip) is another example of the mariposa-tulip group. Note the intricate color patterns on the inner petals



C. monophyllus, aka yellow pussy ears, is a member of the star-tulip group



In addition to these “core” lilies, we also find the strange, redwood-forest slink pods (*Scoliopus bigelovii*) with its striped sepals and mottled leaves and



Prosartes (formerly *Disporum*), the fairy bells, with leafy stems and bell-shaped flowers hidden under the leaves near the branch tips. Here is *D. smithii*



Fairy bells are also noted for their fleshy, berry type fruits



The Melianthaceae contains fewer species than the core lilies in California.

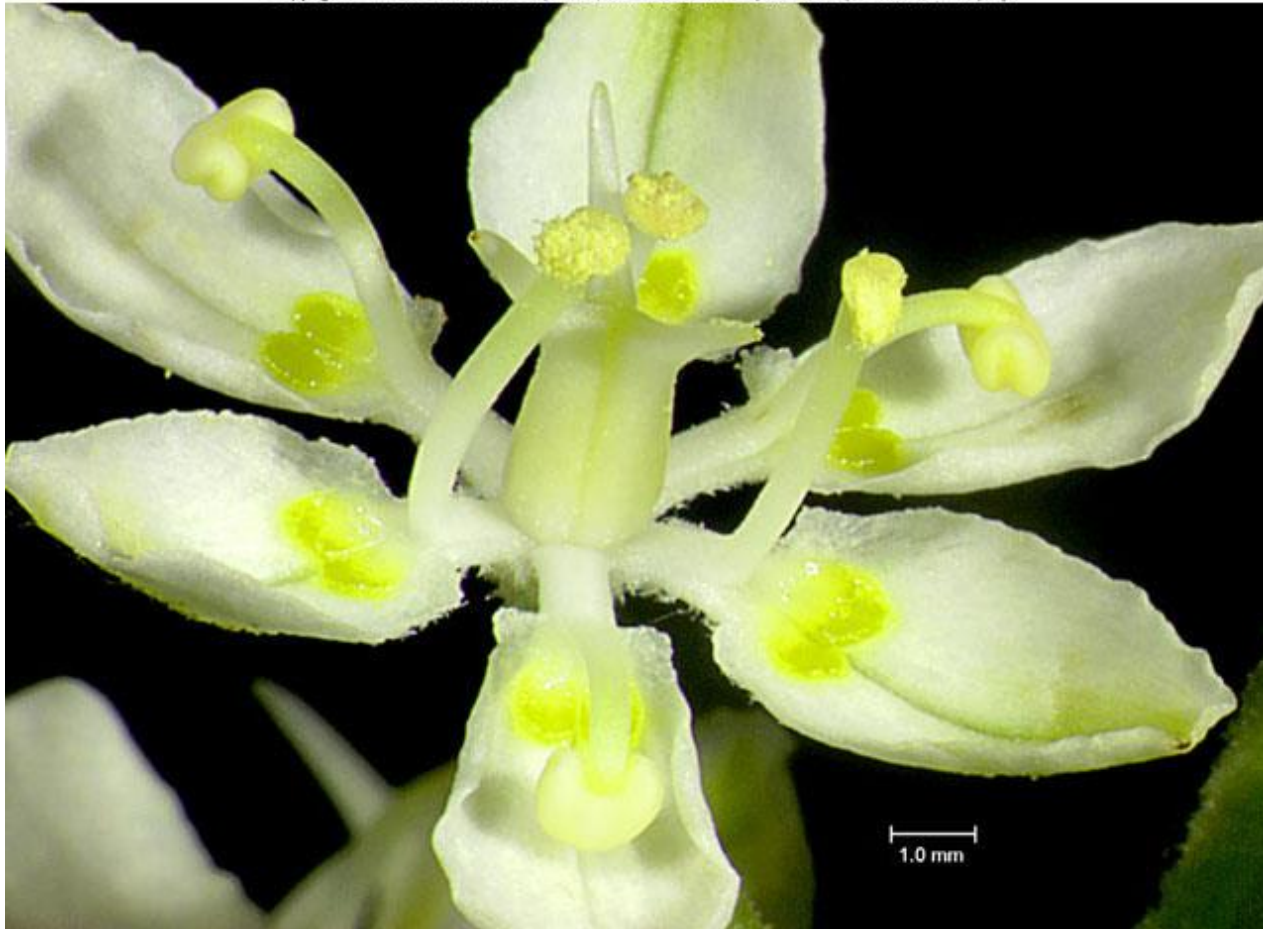
- Its members are rather diverse but generally have smaller, often white flowers, often in large clusters
- Genera include *Toxicoscordion* (formerly *Zigadenus* or death-camass), *Xerophyllum tenax* (bear grass), *Trillium*, *Hastingsia*, *Veratrum* (corn-lily), and *Stenanthium occidentale* (bronze bells)

The death-camasses comprise a genus of bulbous plants with basal, strap-shaped leaves and racemes or panicles of white, star-shaped flowers with distinctive glands. Here is *T. fremontii*



The flowers of *T. fremontii* (fremont's star-lily) show the typical pattern and glands for the genus

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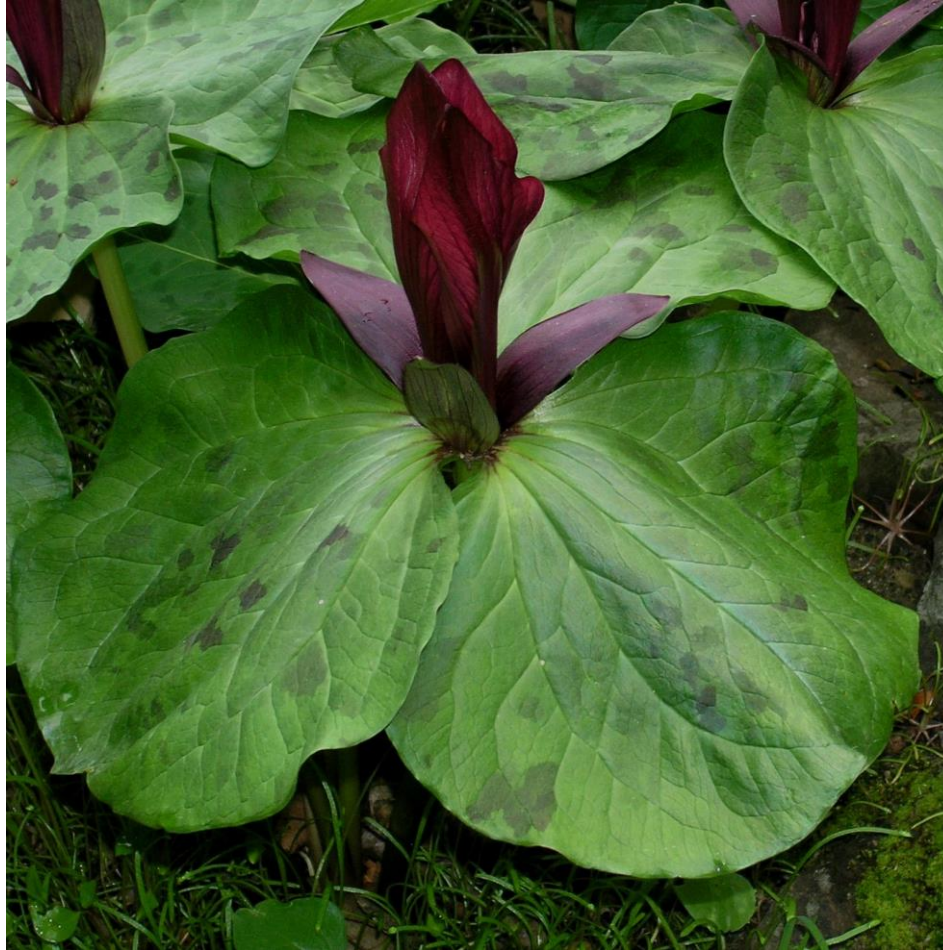
Bear-grass (*Xerophyllum tenax*) features large basal clumps of tough, fibrous leaves and huge panicles of tiny white flowers. Here are the distinctive leaves



And here are the numerous flowers borne above the leaves



The trilliums (*Trillium* spp.) as well as *Pseudotrillium rivale* have three broad, net-veined leaves and a single, large central flower. Giant trillium features flowers without a stalk, in several colors.



Whereas *T. ovatum* (wake-robin) has stalked flowers that open white and fade rose purple



The corn-lilies (*Veratrum*) feature large, conspicuously pleated leaves and immense panicles of usually white, starlike flowers. Here are the leaves.



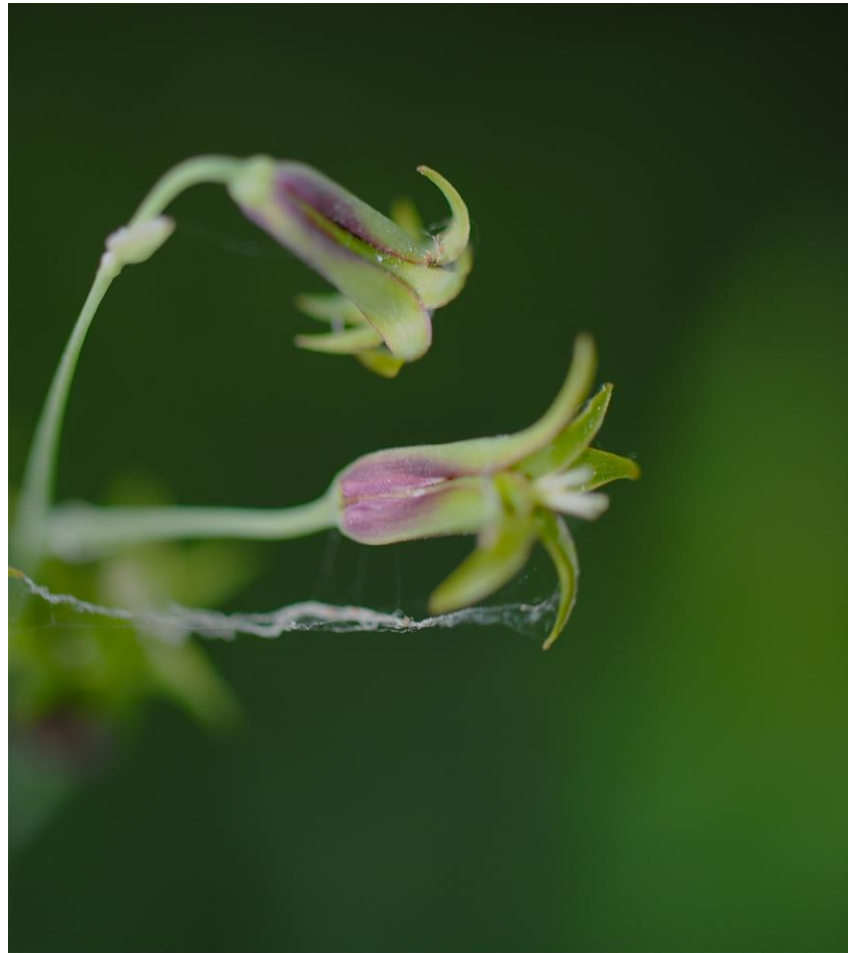
And these are the flowers of *V. californicum*



Hastingsia is a small genus with clumps of linear basal leaves and narrow spikelike clusters of tiny white flowers. This is *H. album*



Finally, bronze bells (*Stenanthium occidentale*) differs from the others in having bell-shaped bronze-green flowers



The remaining families of Liliales fall out like this

- Smilacaceae (smilax family) consists of woody vines with broad leaves and prickly-lined stems. The tiny green flowers are in umbels
- Tofieldiaceae has equitant, irislike leaves, and spikes of small white flowers. The inflorescence is covered in dense sticky glands
- Nartheciaceae also has equitant leaves and racemes of yellow flowers with furry filaments on the stamens

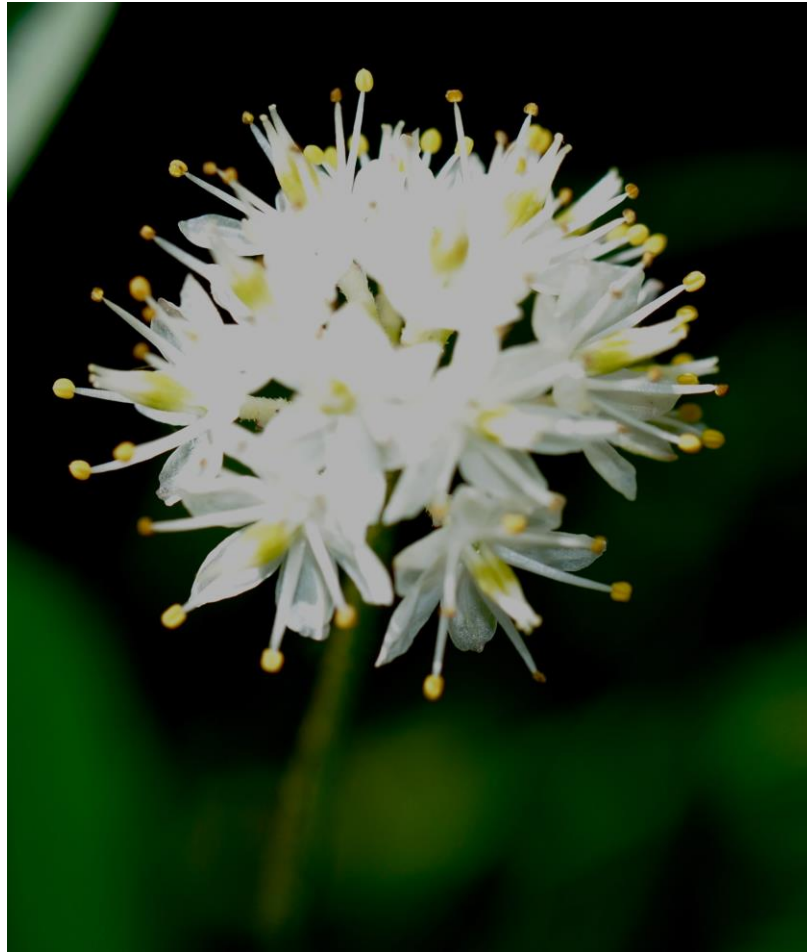
Here is *Smilax californica*, one of two green briars that live in the northern part of the state in dry woods.



Here are the equitant leaves of *Triantha occidentalis* (formerly *Tofieldia*) found in bogs in the northern part of the state



And here are the flowers of *Triantha*



Narthecium californicum is our only species in the Nartheciaceae, also living in bogs in the north. Here you see the furry stamens



Next we'll visit the Asparagales order, a group of families that are particularly prominent in Europe and Africa

- The order contains a rather diverse array of families native to California including
- Agavaceae (agave family) with not only the usual desert genera such as agave and yucca but soap plant and camas
- Alliaceae (onion family) with the diverse genus *Allium*
- The Themidaceae (brodiaea family) with several closely related genera

And two more families

- Ruscaceae (butcher broom family) with two different genera, *Maianthemum* (may flower) and *Nolina* (bear grass) and
- Tecophilaeaceae, a mainly southern hemisphere family with the single species *Odontostomum hartwegii*

- The Agavaceae was once noted for its desert-adapted plants with tough, succulent leaves, woody stems, and huge panicles of flowers but currently the family includes the soap plants (*Chlorogalum* spp.); camas (Camassia spp.), and desert-lily (*Hesperocallis undulata*)
- Racemes or panicles of many flowers, and
- Flowers with often separate (not joined) tepals
- These traits by themselves do not exclude the possibility of other families
- The family features basal leaves that are sometimes wavy,

Agaves or century plants feature massive, fibrous leaf rosettes lined with spines and huge panicles of yellow, tubular flowers that appear only after 10 to 20 years' growth. Here are the leaves of *Agave deserti*



The massive panicles of tubular yellow flowers only occur once from a leaf rosette; after flowering the parent dies but leaves behind “pups” to carry on



Here are the flowers of *A. deserti*, loaded with nectar and attractive to myriad pollinators



The yuccas, also large woody desert plants, differ from agaves by having narrower leaves lacking side spines and with panicles of white or purple-tinted bell-shaped flowers. Here is the Mojave yucca (*Yucca schidigera*)



Note the waxy, bell-shaped creamy flowers of *Y. schidigera*



Another prominent yucca is the bizarre Joshua tree, *Y. brevifolia*



Camassia leichtlinii (camas) is one of the non-desert genera of the Agavaceae, growing in wet meadows in the mountains. Although its leaves may be confused with the poisonous *Toxicoscordon*, the flowers are very different.



The soap plants (*Chlorogalum* spp.) besides having saponin-containing bulbs, feature basal rosettes of wavy leaves (most species)



The common soap plant (*C. pomeridianum*) puts up tall panicles of small white flowers that open in late afternoon.



One final herbaceous member of Agavaceae is the desert-lily (*Hesperocallis undulata*)



Like the soap plants, desert-lily has decidedly wavy leaves



The onion family, Alliaceae, was once part of the Amaryllis family (Amaryllidaceae) but differs by

- Having a superior ovary, not an inferior one and
- Possessing highly fragrant sulfurous compounds that impart an onion odor to all parts of the plants
- The two families have in common a bracted umbel type inflorescence
- California has the single genus *Allium* (wild onions) in a wide range of species

Typical onion flowers like *A. haematochiton* (red-skinned onion) feature six separate, nearly equal tepals and six stamens



Here you see the colorful flowers of the paper onion (*A. unifolium*). Onions are partly identified by their leaf designs and shapes.



Although wild onions are usually small plants from rocky habitats, the swamp onion (*A. validum*) grows in wet mountain meadows



The crimped onion, *A. crispum*, is exceptional in having flowers with the inner tepals a different shape from the outer.



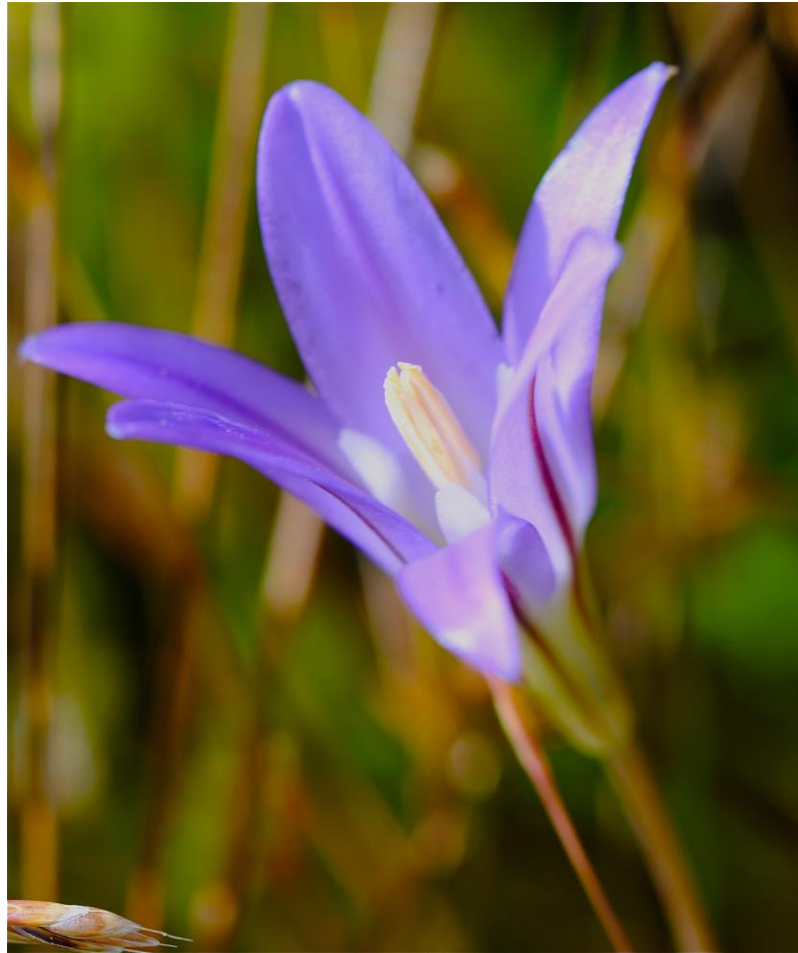
The brodiaea family, Themidaceae, has usually been lumped with the amaryllis family or the onion family but is not considered closely related to either.

- Although Themidaceae features flowers in bracted umbels on scapes like those other families, it lacks an onion odor
- Has flowers with a superior ovary,
- Corms instead of bulbs, and
- Tepals that are usually partly joined to form a tube

The brodiaea family includes such small genera as *Muilla* and *Bloomeria*, neither of which have a flower tube but the other genera do

- The so-called brodiaea complex has flowers with tubes and is quite diverse
- The genus *Dichelostemma* features headlike umbels of flowers, (usually) 3 stamens, and colorful appendages behind the stamens
- The genus *Brodiaea* features open umbels of waxy flowers, 3 fertile stamens alternating with 3 sterile, petal-like stamens and
- The genus *Triteleia* has open umbels of non-waxy flowers with 6 fertile stamens and seldom has appendages

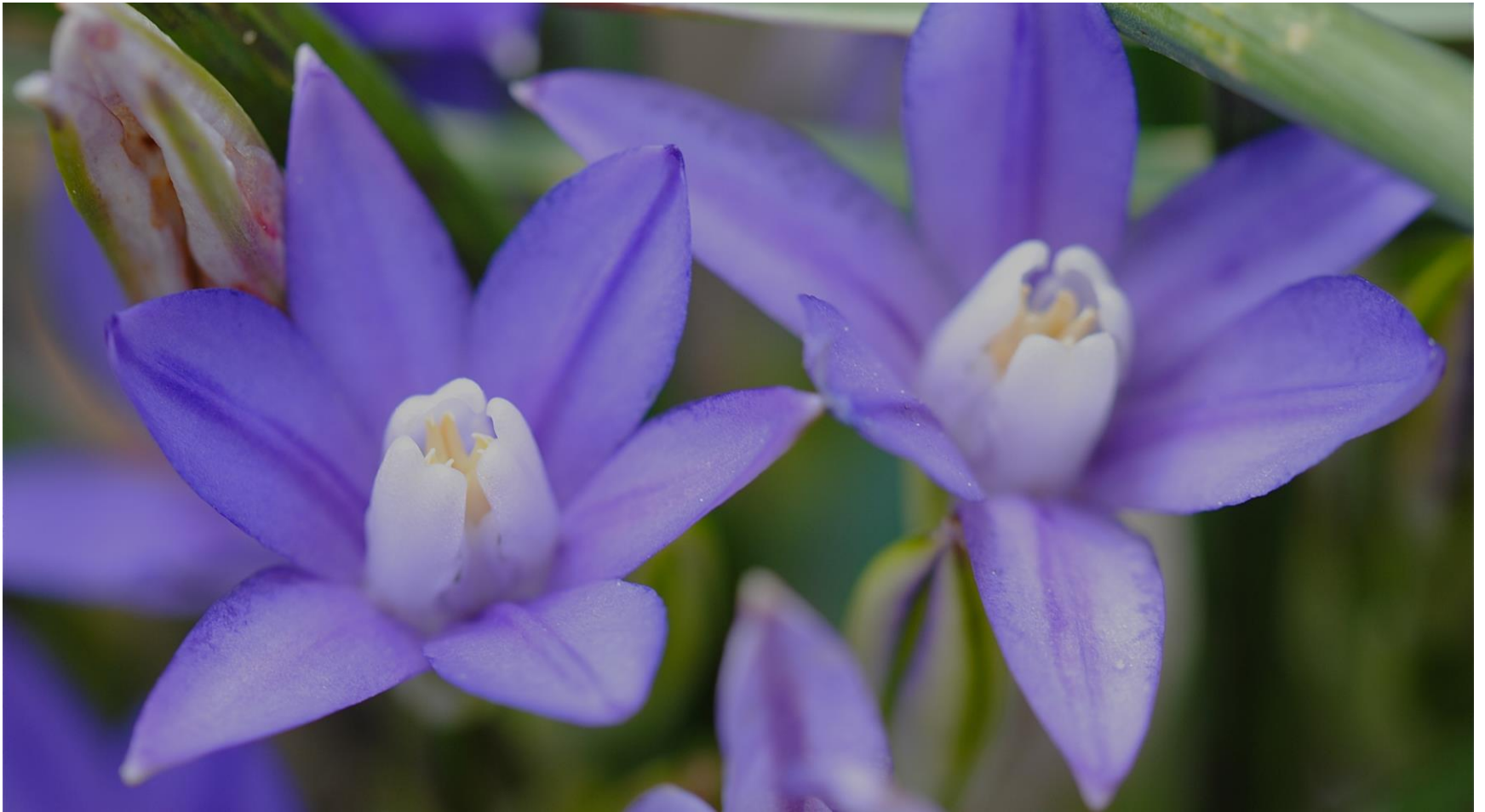
The true brodiaeas mostly have blue or purple flowers, bloom late in the season, and occur in open areas. Here you see the widespread *B. elegans* (elegant brodiaea)



Another widespread brodiaea is *B. coronaria*, the harvest brodiaea. Note the difference in the sterile stamens (staminodes) between this and elegant brodiaea



Many of the brodiaeas are relatively rare and restricted to special habitats like the serpentine endemic *B. stellaris* found in north coastal counties



The dichelostemmas comprise a small genus, mostly with pink, blue, or purple flowers such as the widespread blue dicks (*D. capitatum*)



The most unusual species in the brodiaea complex is *D. ida-maia* (firecracker flower) noted for its long tubular red flowers pollinated by hummingbirds



The triteleias live in many habitats from seashore to above timberline and have a great range of flower colors including

- Yellows
- Whites
- Blues and purples

Ithurriel's spear (*T. laxa*) is the most widespread blue-purple species



T. hyacinthina (the white brodiaea) is a widespread white to pale purple species



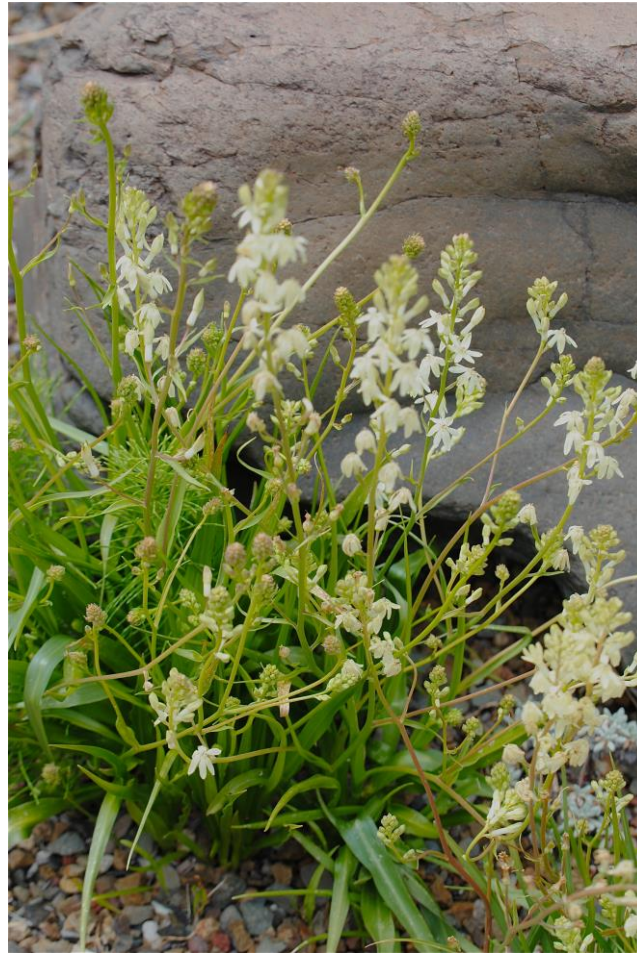
Finally, the pretty face brodiaea (*T. ixioides*) is a widespread yellow-flowered species



The Tecophilaeaceae is a family found mainly in South America and Africa with only one California species

- *Odontostomum hartwegii*, our native, is an unusual, little noticed plant from lava outcrops in the northern and central Sierra foothills
- Like others in the family it features corms and flowers with recurved tepals and stamens that open by terminal pores
- It might sometimes be confused with soap plant out of blossom because of the wavy leaves

Odontostomum flowering plant



Odontostomum flower detail



Our last family is the Ruscaceae or butcher-broom family, closely related to the Asparagaceae (asparagus family) and

- Often with woody stems
- The flowers in ours are small, white, and bell-to star-shaped
- The two genera look highly dissimilar with *Nolina* (bear-grass) a large desert plant and *Maianthemum* (may flower) containing small woodland plants

The nolinias superficially resemble yuccas. They are noted for large basal clumps of narrow, grasslike leaves on woody stems and huge panicles containing hundreds of tiny, white, bell-shaped flowers. Here is *N. interrata*



N. parryi features numerous bell-like flowers subtended by conspicuous bracts



The very different looking may flowers (*Maianthemum*) are forest plants with either basal heart-shaped leaves or leaves along stems, and tiny creamy starlike flowers

- The false lily-of-the-valley (*M. dilatatum*) has creeping stems and heart-shaped leaves; its flowers feature 4 tepals instead of the usual 6
- By contrast the false solomon's seals (*M. stellatum* and *M. racemosum*, formerly in the genus *Smilacina*) have upright stems with ovate leaves and starlike flowers with 6 petals
- All species have berrylike fruits, while the nolinias have papery, winged capsules

Here is *M. dilatatum* in flower.



M. stellatum (starry false solomon's seal) forms loose colonies and has racemes of starry flowers. It occurs from coastal forests into the subalpine regions of the mountains



By contrast, *M. racemosum* (fat false solomon's seal) makes clumps with fragrant tiny flowers in panicles

