The Identification Of Brodiaea Specimen #662 From Otay Mesa

Click The PDF Icon To Read This Article In Acrobat Reader

Right Click On The PDF Icon To Save File To Your Computer.

Table Of Contents:

1. Introduction

Brodiaea terrestris ssp. **kernensis** (BTK), including coastal & montane forms, is a widespread species complex that extends from Santa Barbara and Kern Counties to the Mexican border. Data from Principle Components Analysis (PCA) thus far indicate that BTK is one variable species that does not warrant segregation. BTK consists of variable populations on the Santa Rosa Plateau of Riverside County and at Cuyamaca Lake and Camp Pendleton in San Diego County. Fertile clonal variants have hooded staminodes, staminodes that are flattened and strap-shaped or inrolled along upper margins, and narrow staminodes that are tapered toward the apex. In addition, the staminodes may be erect, leaning slightly outward or leaning inward.

Herbarium specimen labeled **Brodiaea jolonensis** from Otay Mesa, San Diego County. This specimen is Niehaus #662. It was determined to be a hexaploid sporophyte (6n = 36) by T.F. Niehaus in "A Biosystematic Study of the genus Brodiaea (Amaryllidaceae)," University Of California Publications in Botany Vol. 60, 1971. [Image courtesy of the Jepson Herbarium.]

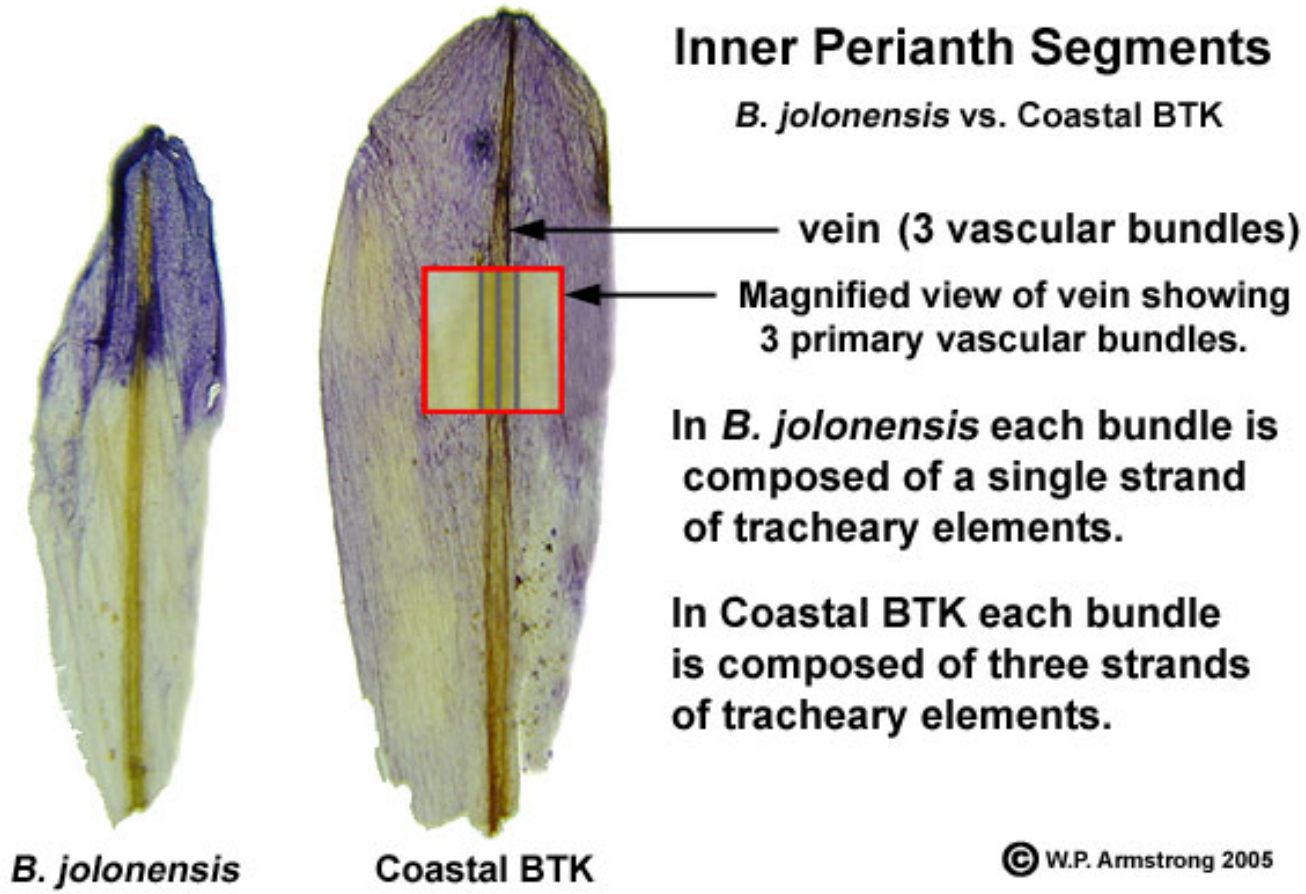
According to quantitative data and images compiled by Wayne P. Armstrong and Tom Chester, **Brodiaea** populations from San Marcos, Kearny Mesa, Mission Trails and Otay Mesa in San Diego County are coastal populations of **Brodiaea terrestris** ssp. **kernensis** (coastal BTK) rather than **B. jolonensis**. In "A Biosystematic Study of the Genus **Brodiaea**," Univ. of Calif. Publications in Botany Vol. 60 (1971), T.F. Niehaus cites a collection of **B. jolonensis** (# 662) from Otay Mesa. As of June 2005, we have been unable to locate any brodiaeas at this site, probably because of the extirpation of Niehaus' original collection site. Unfortunately, herbarium specimens do not show some of the detailed floral characteristics that distinguish **B. jolonensis** from coastal BTK. According to Niehaus (1971), the vascular strand pattern of inner perianth segments may be used to distinguish between **B. jolonensis** and **B. terrestris**

ssp. **kernensis**. In July, 2005 Tom Chester and I examined the vascular strand pattern of inner perianth segments of #662. Our results are published on-line in this report.

---

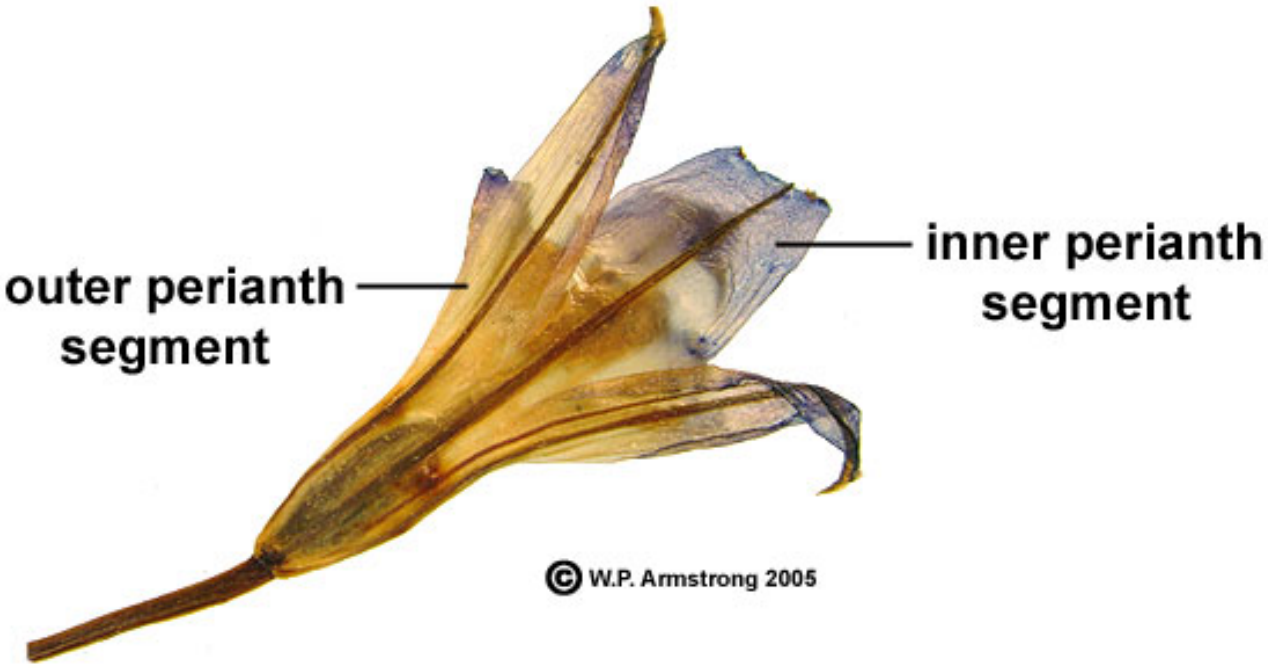
2. Discussion

Table 4 on page 12 of Niehaus' monograph compares the vascular pattern of perianth segments from all species of **Brodiaea** in California. The outer and inner perianth segments contain three primary vascular bundles, visible under 10x magnification. Each of these bundles contains one-several strands of vessels with spirally thickened secondary walls. The pattern of these strands is different depending on the species. In **B. terrestris** ssp. **kernensis** each inner perianth segment contains three strands per vascular bundle, a pattern described as 3-3-3 by Niehaus (1971). Coastal BTK also has three strands per vascular bundle, a total of nine strands. In **B. jolonensis** each inner perianth segment contains one strand per vascular bundle, a pattern described as 1-1-1 by Niehaus. I have also observed **B. jolonensis** with four vascular strands. The strands are not always well-defined all along the vein, and appear to merge in places. This may explain why the number of strands is three or four; however, **B. jolonensis** appears to have a different vascular strand pattern compared with coastal BTK in southern California.



Inner perianth segments from dried herbarium specimens of **B. jolonensis** (Monterey County) and coastal BTK (San Marcos). The veins of both segments are composed of three vascular bundles. According to Niehaus (1971) bundles of **B. jolonensis** consist of single strands of tracheary elements (vessels), while those of **B. terrestris** ssp. **kernensis** consist of triple strands of tracheary elements. Coastal BTK also has three sets of triple strands, a total of nine strands. The primary vascular bundles are visible macroscopically (10x). Strands of vessels are visible with a compound microscope at 100x magnification. Perianth segments and primary vascular bundles of coastal BTK are larger than those of **B. jolonensis**.

In order to view the strand pattern, an inner perianth segment is soaked in 10 percent NaOH. This clears away tissue surrounding the vein so that the vascular strands are more prominent. The segment is placed on a microscope slide with a cover slip. A drop of stain, such as safranin, may be added to intensify the vascular strands. The entire strand pattern can be viewed with a compound microscope at 100x magnification. The strands of individual bundles can be viewed at 400x, although it is difficult to clearly show all of the strands due to the limited depth of field at this magnification.

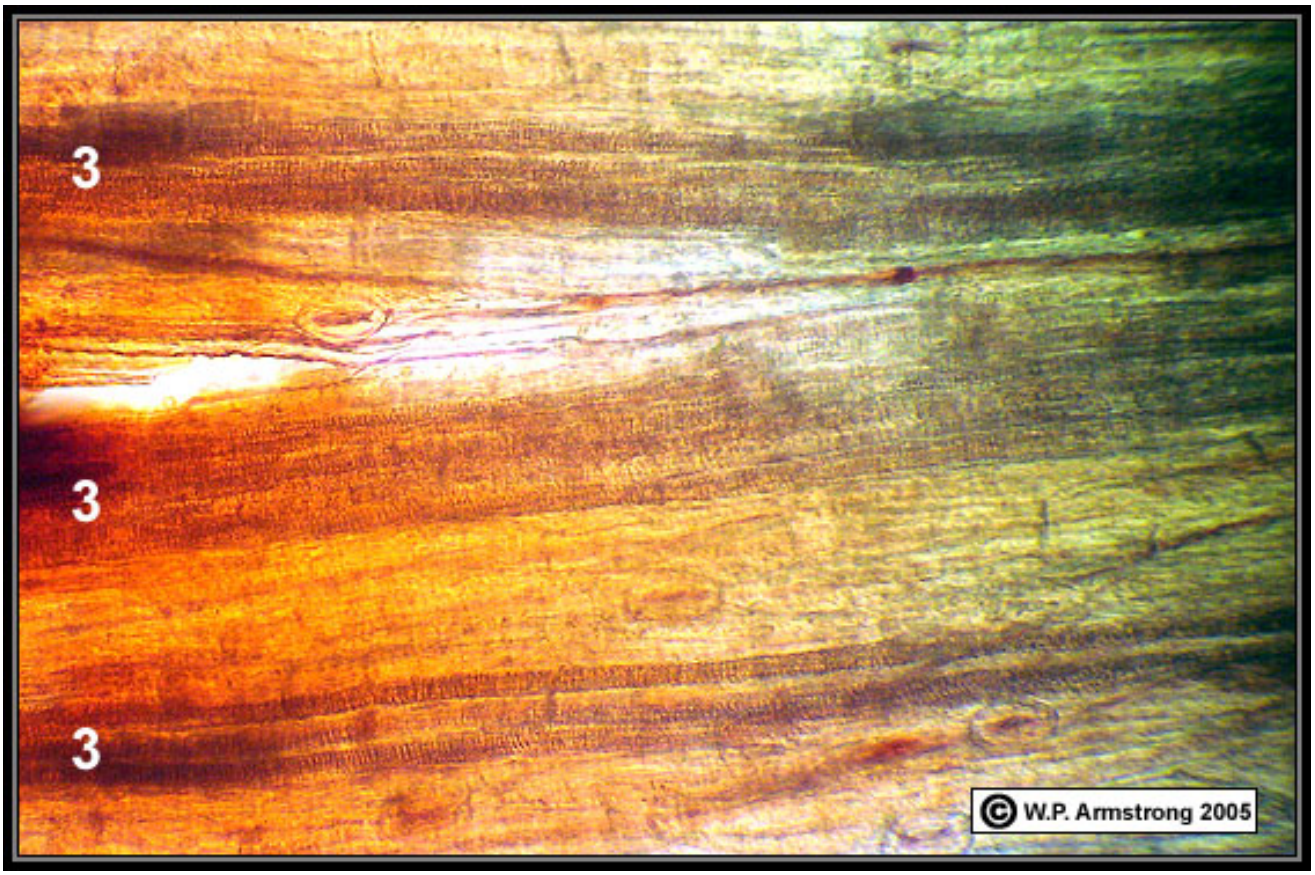


Flower from herbarium specimen #662. The prominent midvein on each segment is composed of three vascular bundles, each divided into three strands of tracheary elements. The triplet strands are visible with a compound microscope at 100x magnification.

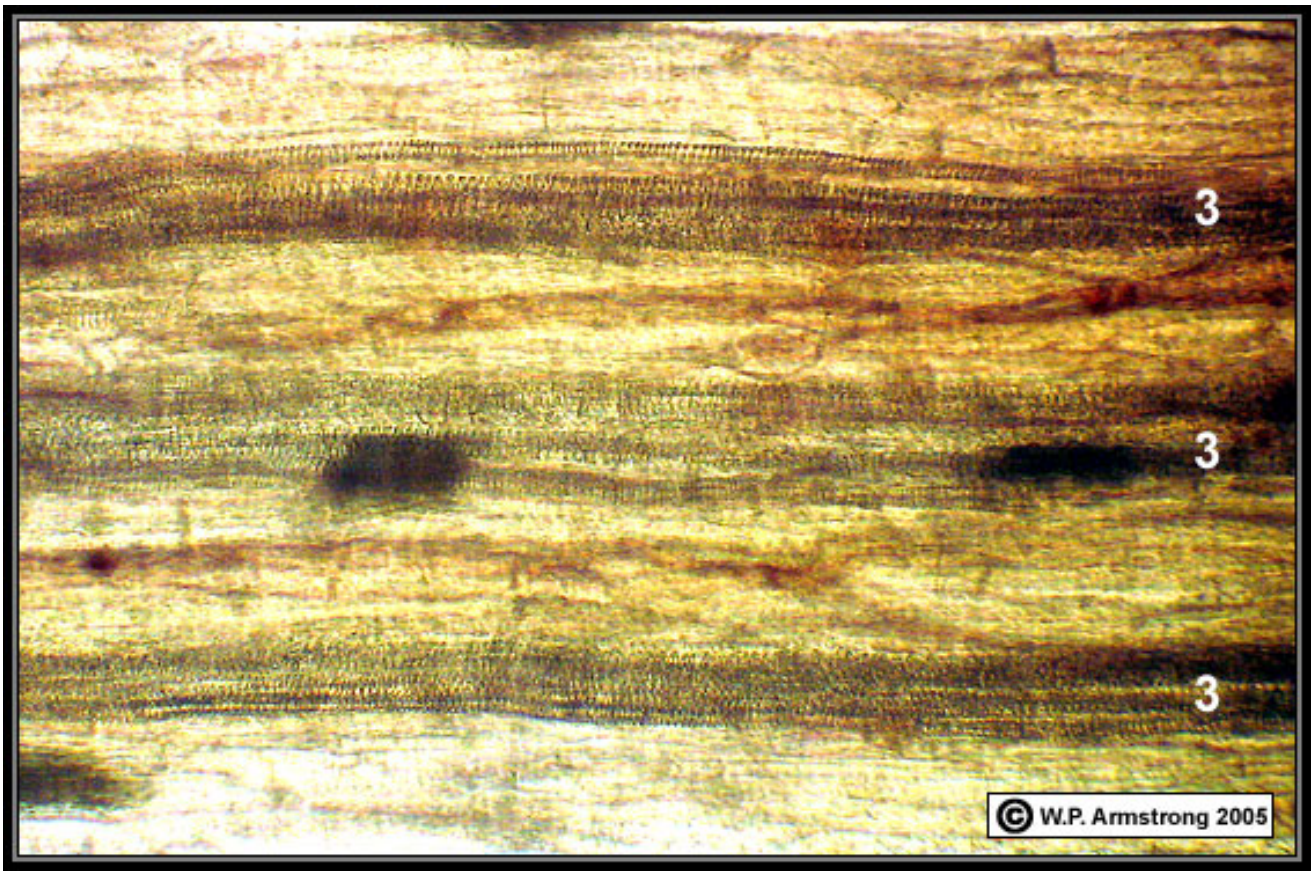
---

3. Images of Vascular Pattern of #662

The following four images show the vascular strand pattern of an inner perianth segment from #622. Each vascular bundle is composed of multiple strands, unlike the single strands of **B. jolonensis**. Because of limited depth of field and orientation (overlapping) of the vascular strands, it is often difficult to capture well-defined triplet strands of all three bundles in a single image. The following images collectively indicate that the vascular bundles contain multiple (triplet) strands. Therefore, we must conclude that #622 is not **B. jolonensis**. **B. jolonensis** from Monterey County has a total of only three or four vascular strands compared with up to nine for coastal BTK. #662 appears to be the same species as other populations of coastal BTK in coastal San Diego County with a tentative sporophyte chromosome number of 36. This may also be the same species that occurs on Catalina Island. More chromosome studies and observations are needed to determine whether coastal BTK is different from populations of **B. terrestris** ssp. **kernensis** in Kern County and populations of montane BTK in the mountains of southern California.



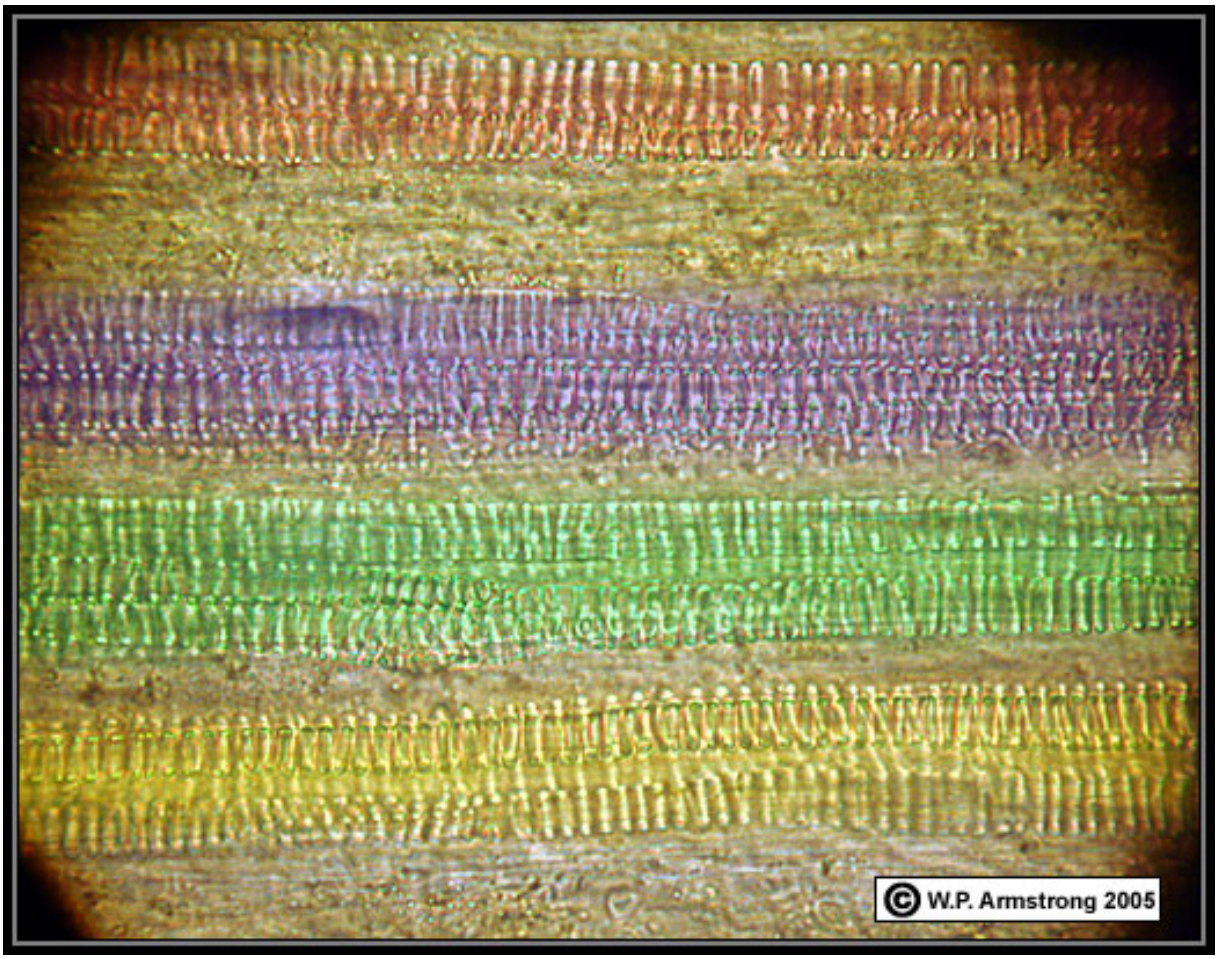
Coastal BTK (#662) showing three primary vasular bundles, each composed of several (at least 3) vascular strands. This does not appear to be the 1-1-1 pattern desribed by Niehaus (1971) for **B. jolonensis**. 100x



Coastal BTK (#662) showing three primary vasular bundles, each composed of several (at least 3) vascular strands. This does not appear to be the 1-1-1 pattern desribed by Niehaus (1971) for **B. jolonensis**. 100x

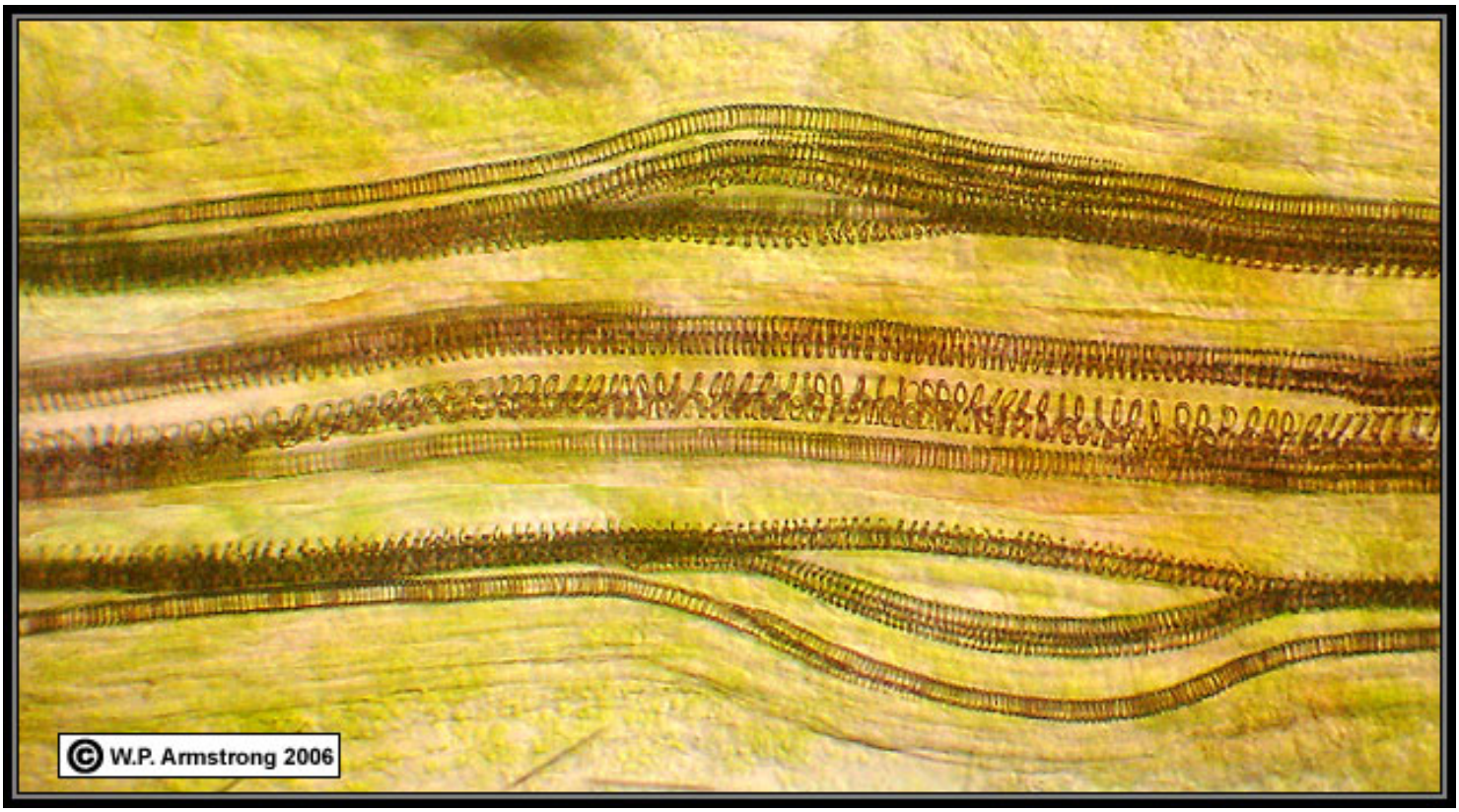
---

4. Brodiaea jolonensis from Monterey County



Magnified view (400x) of an inner perianth segment of **Brodiaea jolonensis** from Monterey County showing four vascular strands. Each strand consists of several vessels with spirally thickened walls. This pattern is different from the 3-strand pattern described by Niehaus. The four strands appeared to merge into three strands in some places along the vein, and this may explain Niehaus' 1-1-1 pattern. In coastal BTK there are three triplet sets of strands, a total of nine strands. Although this image does not exactly fit Niehaus' 1-1-1 pattern for **B. jolonensis**, it is clearly different from the 3-3-3 pattern of coastal BTK in southern California. The bottom line here is that coastal BTK has more vascular strands (up to nine), compared with only three or four strands for **B. jolonensis**. The four strands were colorized with Adobe Photoshop.

5. Coastal BTK from Santa Barbara County



Microscopic view of the inner perianth segment of a coastal BTK flower from above Gaviota Pass, Santa Barbara County. There are three primary vascular bundles each containing at least three vascular strands. Each strand is composed of vessels with spirally thickened secondary cell walls. This is an exceptional view because it is usually difficult to show all three strands of each primary bundle in a single image. Under the microscope, it is often necessary to move along the midrib of the perianth segment to see where each primary bundle separates into multiple strands. In dried herbarium specimens, the strands often become broken or distorted, especially if the segment is wrinkled or creased. In **Brodiaea jolonensis** there are fewer vascular strands, typically three or four. Perianth segment cleared in 10% NaOH and stained with safranin. (Magnification 200 x).

Comparison of BTK and B. jolonensis Vascular Patterns
More Vascular Strand Patterns Of BTK & B. jolonensis

---

6. Conclusions Regarding Niehaus #662

Niehaus #662 does not have the characteristic vascular pattern of the inner perianth

segments described by Niehaus (1971) for **B. jolonensis**. As of June 2006, Tom Chester and I have not found any populations of **B. jolonensis** in southern California, from Santa Barbara and Los Angeles Counties to Otay Mesa in San Diego County. #662 appears to be the same species as other populations of coastal BTK throughout coastal southern California. Coastal BTK has the vascular pattern described by Niehaus for **B. terrestris** ssp. **kernensis**. According to Niehaus, its sporophyte chromosome number is 36 (6n), compared with 48 (8n) for species in Kern and Tulare Counties.

Niehaus reported a hexaploid sporophyte number of 36 for #662 on Otay Mesa. It seems likely that the chromosome number of 36 is typical of other populations of coastal BTK in southern California that have been confused with **B. jolonensis** for decades. Niehaus also determined a chromosome number of 36 for a sample of "**B. jolonensis**" from Santa Barbara County, different from the number 12 determined from plants in Monterey County. In addition, the vascular pattern of "**B. jolonensis**" in Santa Barbara (Gaviota Pass) and from Santa Catalina and San Miguel Islands appears to be the same as coastal BTK in southern California. **Brodiaea jolonensis** appears to be endemic to the Coast Ranges of central California, primarily in Monterey County, and does not occur in southern California.

Chromosome numbers need further study. Niehaus' numbers of 36 for "**B. jolonensis**" in San Diego and Santa Barbara Counties obviously refer to coastal BTK. My count for coastal BTK in San Marcos is at least 36. Preliminary studies by Dale McNeal at University of the Pacific indicate that the number for coastal BTK on Otay Mesa may be greater than 40. An exact count is difficult because small chromosomes are often obscured by the larger ones.

See Discussion of BTK Chromosome Numbers

Southern California populations of coastal BTK and montane BTK do not key out adequately in the Jepson Manual (1996), which is based on Niehaus' 1971 monograph. Couplets 18 and 18' (page 1182) separate **B. jolonensis** from **B. terrestris**:

18. Anther axis tissue entire; ovary purple ..... **B. jolonensis**

18' Anther axis tissue dentate; ovary green ..... **B. terrestris**

The terms "purple ovary" and "green ovary" are only reliable in fresh flowers because all ovaries in pressed herbarium specimens typically turn purple or purplish-brown. They are useful in separating these species in the field. The characteristic shape of soft anther connective tissue is difficult to preserve is dried herbarium specimens.

See Discussion & Images Of Green Vs. Purple Ovaries

The apex of the anther axis (anther connective) of **B. terrestris** ssp. **terrestris** of central California clearly terminates in a toothed appendage. Some populations of ssp. **kernensis** in Kern County have this dentate anther axis and others have a V-shaped notch. The dentate appendage is formed from a proliferation of the connective tissue. Coastal BTK and montane BTK in southern California generally do not have this prominent dentate anther axis. Instead they have an entire, V-shaped or U-shaped notch that is also characteristic of **B. jolonensis**. In some populations of coastal BTK there may be a minute lobe at the base of this notch. The term "dentate anther axis" is not useful or reliable in keying out coastal BTK or montane BTK in southern California.

See Discussion & Images of Dentate Anther Connective

We are confident that Niehaus #662 is coastal BTK and not **B. jolonensis**. Populations of coastal and montane BTK in southern California have similar characteristics, but are variable with respect to the shape of staminodes. Montane BTK from the Laguna Mountains typically have inrolled staminodes; however, when grown in Escondido from a corm (June 2006), the staminodes were conspicuously hooded like coastal BTK. In general, BTK populations in southern California are similar to populations of BTK observed in Kern County. Additional research is necessary, but at this time they all appear to be one variable subspecies.

Wayne P. Armstrong and Tom Chester, 3 June 2006

References

1. Hickman, J.C. 1993, Editor. The Jepson Manual: Higher Plants of California. University of California Press, Berkeley.

2. Niehaus, T.F. 1971. "A Biosystematic Study of the Genus Brodiaea (Amaryllidaceae)." University of California Publications in Botany 60: 1-67.


Return To WAYNE'S WORD Home Page


Go To The LEMNACEAE ON-LINE Page