

CUSHENBURY OXYTHECA

Oxytheca parishii var. *goodmaniana*

Author: Andrew C. Sanders, Herbarium, Department of Botany and Plant Sciences,
University of California, Riverside, CA 92521-0124

Management Status: Federal: Endangered
California: S1.1, G4?T1 (CDFG, 1998)
CNPS: List 1B RED code 3-3-3 (Skinner and Pavlik, 1994)

General Distribution:

Cushenbury oxytheca is endemic to the San Bernardino Mountains of southern California and is restricted to the dry carbonate slopes on the north side of the range. It has never been found outside of this limited area.

Distribution in the West Mojave Planning Area:

Barely entering the WMPA along the north foot of the San Bernardino Mountains on limestone and other carbonate slopes, Cushenbury oxytheca is one of the most geographically restricted plant species of the WMPA, but most of its populations are on the San Bernardino National Forest, above the WMPA margin. As a result of surveys in 1998, it is now known to occur in at least 50 locations from near Terrace Spring west to White Mountain (V. Sosa, pers. comm.), but as recently as 1992 only four locations were known for this plant (Tierra Madre, 1992).

Natural History:

Cushenbury oxytheca is an annual herb of the buckwheat family (Polygonaceae). It is poorly known and was almost unknown before it began to be studied as a result of the realization that most of its limited habitat was subject to elimination by limestone mining. Little has been published on the natural history of the plant and much of what follows is based on personal observation and the study of a limited number of herbarium specimens. It occurs on dry open slopes, mostly in loose scree and talus derived from limestone (Hickman, 1993; pers. obs.).

Oxytheca plants germinate in the fall following the first rains and exist as a vegetative rosette through the winter months. The basal rosette consists of relatively broad, oblong-obovate, green leaves, which are followed in the spring by a slender leafless inflorescence. As the inflorescence matures the leaves wither and dry, so that by the time of late flowering or fruit ripening the plant typically has no living leaves at all. All late season photosynthesis is presumably carried on by the green stems and the involucre bracts. The flowers are white with a reddish midrib, and are apparently insect pollinated. Specific pollinators, germination requirements, seed longevity, and most other aspects of the biology of this species are largely unknown, but there are some recent observations on the insect associates of this plant.

Based on limited observations in the summer of 1998, it appears that the insect pollinators of this species are generalists, such as various flies and possibly small beetles (S. Morita, pers. comm.), rather than highly specialized pollinators tied closely to this

species. Small gray beetles of the family Dasitidae were found visiting the flowers (S. Morita, pers. comm.). At least two plant feeding insects have been identified attacking this species, including the bordered plant bug (Largidae: *Largus cinctus californicus*), which is a generalist sap feeder, and an otherwise unidentified leaf beetle (Chrysomelidae) which was observed eating the flowers (S. Morita, pers. comm.). In addition to the above, a number of big-eyed bugs (Lygaeidae: *Geocoris*) were found on the plants (S. Morita, pers. comm.), but these were probably predators on other insects rather than plant feeders (G. Ballmer, pers. comm.).

The taxonomy of Cushenbury oxytheca is in need of clarification, with respect to the distinctiveness of this taxon relative to the other two varieties of *Oxytheca parishii* in the San Bernardino Mountains, var. *parishii* and var. *cienegensis*. Cushenbury oxytheca is most readily separated from the other two San Bernardino Mountains varieties by its possession of only four (or rarely 5) involucre awns (Reveal, 1989). These awns are also shorter (ca. 2-3 mm) and more slender and inconspicuous than those in the other two varieties. Parish's oxytheca (var. *parishii*) is the most widespread and distinctive variety with its numerous (10-36) long (ca. 4-4.5 mm) awns on the involucre lobes. These awns are thicker and much more conspicuous than those in the other varieties. It is also the most widespread variety, due to its habitat preferences -- openings on granitic slopes in yellow pine forest. It is widespread from Big Bear, west through the Crestline/Arrowhead area, and then continuing through the San Gabriel Mountains to the mountains of Ventura County (Reveal, 1989). Variety *cienegensis* is the most poorly known of the three varieties and the one most similar to variety *goodmaniana*. It is intermediate in involucre awn number (7-10) and length (3-4 mm) between the other two varieties. Variety *cienegensis* occurs on various substrates from Tip-Top Mountain to Cienega Seca near Onyx Peak, and plants near Tip-Top Mountain are on limestone and appear to be morphologically transitional toward var. *goodmaniana*. Being recently described (Ertter, 1980), and not being in an area of high environmental impact, this variety has received much less attention from botanists and environmental consultants than has Cushenbury oxytheca. All three varieties are illustrated in the Jepson Manual (Hickman, 1993).

Habitat Requirements:

Cushenbury oxytheca occurs only on carbonate slopes, usually steep ones, and almost always on loose scree or talus. This preference is revealed in the data from the only published results from plot-based population sampling of limestone endemics in the San Bernardino Mountains (Gonella and Neel, 1995). Cushenbury oxytheca was never (0 of 30 plots) found on sample plots centered on Cushenbury milkvetch (*Astragalus albens*) plants but was fairly regularly found on plots lacking this species (Gonella and Neel, 1995). Cushenbury milkvetch is a species typical of stable, often bedrock, slopes. Likewise, Cushenbury oxytheca appears to be negatively correlated with the presence of Cushenbury buckwheat (*Eriogonum ovalifolium* var. *vineum*), another species which prefers stable slopes (Gonella and Neel, 1995). However, recent surveys conducted by Rancho Santa Ana Botanic Garden for the U.S. Forest Service did find Cushenbury oxytheca growing with *Astragalus albens* and *Eriogonum ovalifolium* var. *vineum* in some areas (V. Sosa, pers. comm.).

Populations occur at elevations between 4000 and 7800 ft. (1200-2380 m) in the pinyon-juniper woodland (Reveal, 1989) and Jeffrey pine-western juniper (M. Neel, pers. comm.) vegetation zones which, of course, occurs on the desert-facing slope of the mountains. In this zone air movement is primarily descending and hence often removes moisture from vegetation, rather than depositing moisture as rain as it does on the coastal slope. The resulting lack of rainfall and consequent substrate aridity makes it important that plants be either early flowering or deep rooted, so that they can take advantage of the limited water supply. Cushenbury oxytheca is late flowering (May-June), but has a relatively long straight taproot and presumably is able to tap into supplies of soil moisture below the surface where low atmospheric humidity results in moisture being removed from the soil.

The loose gravel and rock substrate preferred by Cushenbury oxytheca has several important ecological characteristics that may favor this species. The first and most obvious is that, because the slopes are unstable, it is difficult or impossible for larger, potentially competing, trees and shrubs to become established. This leaves the habitat open for smaller annuals like Cushenbury oxytheca to occupy. A second noteworthy characteristic is the coarse and well-aerated character of the substrate, which permits rapid infiltration of rainfall and thus less moisture loss to runoff than would otherwise be expected. It is probable, also, that soil moisture in occupied talus is supplemented by runoff from rocky slopes, cliffs and bedrock outcrops above, where those are present. The loose character of the soil also permits the easy penetration of roots and the coarse surface material serves as a "rock mulch" to retard the loss of soil moisture to the atmosphere. These characteristics permit plant growth after the soil surface has dried.

Population Status:

Cushenbury oxytheca was found at nine of 88 sites sampled on carbonate substrates in the San Bernardino Mountains in 1992 and 1993 (Gonella and Neel, 1995), which clearly indicates that it is more widespread than formerly known though still uncommon. A total of at least 50 populations were known as of 1998 (V. Sosa, pers. comm.), which is a substantial increase from the four known in 1992 (Tierra Madre, 1992), or the 15 reported more recently (USFWS, 1997). It is apparent that a clear understanding of the abundance and distribution of this plant within its narrow range is still developing.

Populations of Cushenbury oxytheca do not appear to exhibit a general downward trend, given the population fluctuations that are normal in an annual plant, at sites where it is not being directly impacted by mining (pers. obs.). Populations are highly variable (White, 1997) at any given site, but plants can be locally common after particularly favorable years. Populations vary in response to rainfall and other climatic conditions, so that at a given site where there was a substantial population one year there may be few to none the next. Even in years when no plants are present, a living seed bank remains. However, large parts of its range are under heavy pressure by mining interests and so overall Cushenbury oxytheca has certainly declined significantly over recent decades. It has been estimated that over 1600 acres of potential habitat for the various carbonate endemics had been lost to mining by 1993 (Gonella and Neel, 1995). Unfortunately, because this plant was little collected and never censused prior to the 1980s, the historical

pattern of its population sizes and distribution is unknown, except by inference. At best, we can infer former distributions based on habitat type and general range. Sites that are now mined down to bedrock, but which are in areas which were formerly suitable habitat, must be presumed to have formerly supported this plant. A quantitative survey of the abundance and distribution of this species has recently been completed and this has revealed that the species is more widespread than formerly known (V. Sosa, pers. comm.), though it is still seen to be very restricted in its distribution.

Cushenbury oxytheca is a naturally restricted endemic, but populations have apparently been further reduced by mining activity within its range, based on the widespread disturbance of carbonate habitats (Gonella and Neel, 1995).

Threats Analysis:

Limestone mining is the only significant threat to this species and in the absence of mining, this would not be an endangered species because no other significant threats exist in the area (pers. obs.). This impression is confirmed by the Fish and Wildlife Service (USFWS, 1997) which says that mining is the “imminent and primary threat” to all the San Bernardino Mountains carbonate endemics. The extremely steep rocky slopes, and more particularly oxytheca’s preference for unstable sites on those slopes, are powerful barriers to most of the “normal” sorts of destructive activities. The steep slopes it occupies are almost inaccessible by vehicles and even hikers have a difficult time entering its habitat in many areas (pers. obs.). Urban expansion and OHV recreation are generally not feasible in the areas occupied. Grazing does not occur within its habitat. The extent of any threat from introduced weeds is unknown, but appears not to be great. In general, few such plants occur in the habitats occupied (pers. obs.). Because of their difficult nutrient regime (e.g., Gonella and Neel, 1995), the carbonate slopes are not as heavily invaded by alien weeds (pers. obs.) as other substrates. Most of the locally troublesome weeds, especially the grasses, depend on high levels of nitrogen and other nutrients. There are localized areas where weed invasion appears to be a problem, and this is an issue that needs further investigation.

Biological Standards:

Like the other carbonate endemics, the major need for the conservation of this species is preservation of significant areas of undisturbed carbonate that is not subject to mining disturbance. It is critically important to find areas with large populations of this plant that can be protected from disturbance. Such preserve areas should incorporate as wide a range of the environmental conditions occupied by the species as possible. It is also important that as much of the geographical range of the species as possible be protected. Protection of only one or two areas is an inherently risky strategy.

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