Plant Species Evaluation Form

*Calicium adspersum* Pers.

**Family:** Caliciaceae  
**PLANTS Symbol:** CAAD4  
**Calif. Endemic:** No

**Synonyms/Other Names:** The genus *Calicium* was first described by Christiaan Hendrik Persoon (1794). The type specimen of *C. adspersum* was collected in Germany and the specimen is housed at Leiden, Netherlands (L). Because *Calicium adspersum* is found worldwide, some authors have recognized geographical varieties. Hence, *C. adspersum* var. *adspersum* has been used to refer to North American material (Christy 2009), but this is not currently standard practice in North American literature. Other previously applied names are: *C. rosidum* (Ach.) Ach. nom. superfl., *C. rosidum* var. *rosidum* = *C. adspersum* (GBIF 2017), and *Calicium cretzoii* Nádv. (IUCN 2017).

**Identification Issues:** *Calicium adspersum* is a lichenized fungus. Its stalked ascomata with a surface of loose spores (a type of apothecium known as a mazaedium) make it recognizable as a “pin-lichen”. The stalk and spores are black (under dissecting scope) but this species has a trait unique among Pacific Coast pin-lichens: a yellowish pruina (a dusty coating from either cell wall remnants or calcium oxalate crystals) on the surface of the mazaedium, which combines with the black spore mass to give the head of the ascomata a yellowish to dark-greenish cast. A second distinctive trait of this species is that its spores are ornamented with a spiral ridge. One other North American species of the interior continent, *Calicium trabinellum*, also has a yellow pruina, but it has roughly cracked spores rather than spirally ornamented ones. Of the other Pacific Coast species with spirally ornamented spores, none have the yellow pruina (Peterson 2006; CNPS 2017).

**Taxonomy:**

Species in Genus: from 30 to 40 species worldwide have been recognized in recent treatments.

Etymology: (Latin *adspergo*, to strew, scatter, sprinkle, from the exposed ascospores on the stalked ascomata).

Description: Lichenized calicioid fungus with green alga photobiont (*Trebouxia* sp.). Thallus tiny, crustose, grayish, generally verrucose. Spore-producing structure a stalked mazaedium, 0.8 – 1.4 mm tall, with a cup-shaped capitulum on slender cylindrical unbranched black stipe, 0.2-0.3 mm thick, smooth. Capitulum with chalky, yellowish surface deposits (pruina) over on the excipular rim and mixed with the spores covering the mazaedium (sometimes faint) and causing a greenish cast to the mazaedium. Spores two-celled (sometimes 4), 13-17 um x 6-8 um, with a distinctive ornamentation of spirally arranged ridges. Chemistry: Thallus K+ red or yellow, PD+ yellow to orange, with norstictic acid. Stipe I- (Goward 1999) or faintly I+ blue (Tibell 1999). Pruina with vulpinic acid. (Adapted from: Peterson 2006; Tibell 1999; Christy 2009.)
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### Status:

Note: Federally recognized Endangered, Threatened, Proposed, or Candidate species under the Endangered Species Act are omitted as they do not meet the definition of a Species of Conservation Concern (FSH 1909.12 § 12.52).

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<th>State Listing</th>
<th>G-rank</th>
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<th>CRPR</th>
<th>R5 FSS</th>
<th>NFP SM</th>
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| SWAP: Not listed | NNHP: Not listed | NNPS: Not listed | ORBIC: 4: Watch list | OCS: Not listed | IUCN: Not listed |

Expanded abbreviations and citations: State Listing=California Endangered Species Act Listing (CDFW 2017b), Nevada Division of Forestry Fully Protected Plant Species (NAC 527) (NDF 2012), Oregon Department of Agriculture Listed Plants (ODA 2014); G-rank=Global Conservation Status (CDFW 2017a; NatureServe 2017); S-rank=Subnational (state or province-level) Conservation Status (CDFW 2017a; NatureServe 2017; NNHP 2017; ORBIC 2016); CRPR=California Rare Plant Rank (CNPS 2017); R5 FSS=USDA Forest Service Region 5 Regional Forester Sensitive Plant Species List (USDA 2013); NFP SM=Forest Service and Bureau of Land Management Northwest Forest Plan Survey and Manage Species (USDA 2001); CA BLM=California Bureau of Land Management Designated Sensitive Species (BLM 2010); SWAP=California State Wildlife Action Plan Status (CDFW 2015); NNHP=Nevada Natural Heritage Program Status (NNHP 2017); NNPS=Nevada Native Plant Society Status (NNHP 2017); ORBIC=Oregon Biological Information Center Status (ORBIC 2016); OCS=Oregon Conservation Strategy Species (ODFW 2016); IUCN=International Union for Conservation of Nature Red List Status (IUCN 2017).

### Distribution:

The species has a global, anti-tropical range (Peterson and Rikkinen 1999) and is known in North America from the Pacific Northwest in areas of maritime-influenced cold climates, and from widely scattered specimens from forests of the eastern U.S. (Selva 2010). Although some taxonomists have recognized the North American collections as a separate variety, there are no morphological or genetic studies to confirm their distinctness. The species appears to be infrequent to rare in the better-surveyed part of its range (North America, UK, and Europe). Its rarity elsewhere in its cosmopolitan range (Australia, Africa, Eurasia, Mexico, New Zealand, southern South America) cannot be evaluated at this time.

Known within California from a single specimen from a *Sequoia sempervirens* stand in Jedediah Smith Redwoods State Park, Del Norte County (CNPS 2017; Rikkinen 2003). In Oregon, the species has been found on *Sequoia sempervirens*, *Pseudotsuga menziesii*, and *Abies grandis* bark (Rikkinen 2003). Recorded sites are: Little Sink RNA in the Salem BLM District and in the McDonald-Dunn Research Forest north of Corvallis (Rikkinen 2003), and is reported to occur in Bent and Polk Counties (ORBIC 2016). In Washington it has been found at Bald Hill Natural Area Preserve in Thurston County (Rikkinen 2003). In British Columbia, it is known from about 5 sites (Peterson 2006; Christy 2009).

Given that there is only a single known site in California and that appropriate habitats (old-growth forest) for this sporadically occurring species are themselves limited and patchy within California, the species is likely to continue to be rare.
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**Locations within California:**
(\*Note: Record numbers indicate sites that contain an individual, population, or groups of populations located within ¼ mile of each other (per the California Natural Diversity Database (CNDDDB) definition of Element Occurrences in California). Official Element Occurrence (EO) numbers for plants in California are determined solely by the CNDDDB and are included within the Reference (Source) column for CNDDDB data. Duplicate records from the same site are given the same record number and included in red. The Population Info column includes total number of individuals and total number and size of populations/sub-populations when provided. Elevations in meters from source were converted to feet. If not provided in original source, Land Manager information was obtained using the California Protected Areas Database (CPAD 2016) and Quad information was obtained using 24K Quads, SDE Feature Class (CDFG 2013). All other information is directly from the Reference (Source) column unless additional citation is given.\*

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<th>Rec. #</th>
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<th>County</th>
<th>Quad</th>
<th>Reference (Source)</th>
<th>Date Last Observed</th>
<th>Population Info</th>
<th>Threats</th>
<th>Land Manager</th>
<th>Elev. (ft.)</th>
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<td>Hiouchi (4112471)</td>
<td>CNDDDB, May 2017 (EO 1)</td>
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<td>ONLY SOURCE OF INFORMATION FOR THIS OCCURRENCE IS AN UNDATED RIKKINEN COLLECTION (CITED IN &quot;CALICICUM ADSERSUM, SPONSORSHIP FOR THE CALS CONSERVATION COMMITTEE&quot; BY PETERSON, 2006). SPECIMEN LIKELY COLLECTED PRIOR TO 1999. NEEDS FIELDWORK.</td>
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**Distribution on National Forest System (NFS) Lands:**
(Please see Reference column of Locations table above for references pertaining to Record Numbers indicated on NFS lands.)

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<th>CNDDDB EOs</th>
<th>Non-CNDDDB Records</th>
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<th>Historic (not seen in past 20 yrs.)</th>
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**Demographic and Population Trends:** Demographic or population trends cannot be described for the California population of this species as it is known from a single specimen only. Trends elsewhere in North America are not available, although this species is widely interpreted to appear in forests only after they are at least a century old (Selva 2010, Peterson 2006).

Although this species is not cryptic, its distinguishing traits are either difficult to discern without magnification (pruina color) or require magnification (spore ornamentation). Therefore, successful field observation requires persons trained in recognizing the general traits and microhabitats of pin lichens, plus the particular traits of this species, along with followup...
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identification. This species is therefore highly likely to be overlooked without dedicated field surveys, and is rarely found during extensive surveys dedicated to pin lichens (e.g. Peterson and Rikkinen 1999). Therefore, absence of collections of this species in general floristic or general lichen surveys should not be taken as evidence of its absence in an area.

**Life History:** Life history studies are not available for *Calicium adspersum* specifically, although its congeners are fungi which disperse via sexually-produced spores, and that probably grow for a short period of time on tree bark as independently living saprophytes before capturing a unicellular alga (*Trebouxia*) as a photosynthetic symbiont (Werthe and Sork 2017), becoming lichenized, and then growing slowly over multiple years. According to Peterson (2006), substrate requirements are such (rain-protected bark of the lower trunks of old trees) that this species does not appear in forests until they are 1 to 2 centuries old. For this reason, it has been documented as an indicator of forest age and continuity (Selva 1996).

**Diversity:** Peterson (2006) noted the distinctness of the North American specimens thus: “Although the anatomy of Pacific Northwest specimens matches well with European specimens, the general morphology may be distinct (Tibell pers. comm., email Dec. 2006), suggesting the possibility of phylogenetic divergence, perhaps at a subspecies level.” Peterson further stated that a future genetic study including the North American lineage would hinge on the availability of new specimens from North America. No such study of North American material has thus far been published, although phylogenetic surveys on European material have been done. Prieto and Wedin (2016) in a phylogenetic study of Calicioid lichens, included a specimen of *C. adspersum* of European origin (*Prieto 3037*, housed at S). This specimen nested within the core *Calicium* clade (equating to a narrowed concept of *Calicium* proposed by that study), which consists of epiphytes on tree trunks or decorticated stumps (of both conifer and deciduous species). Within the core *Calicium* clade, *C. adspersum* fell within a subclade with two other species (*C. nobile* and *C. chlorosporum*, also of North America and worldwide) with which it “shares a distinctive yellow pruina (rarely brown) on the lower surface of the capitulum and on the mazaedium, and distinctly ornamented spores with spirally arranged ridges”.

**Habitat:** All confirmed North American sites are old-growth conifer forest in relatively cool-humid stands with maritime climatic influence (Peterson 2006), e.g. lower montane coniferous forest and north coast coniferous forest at up to 600 meters elevation. In North America, this species appears to be restricted to aged, living bark of conifers, typically old-growth trees over 200 years of age (CNPS 2017). The California specimen reports it as being collected on a *Sequoia sempervirens* live tree trunk bark, although host conifers noted worldwide include: *Abies grandis, Pseudotsuga menziesii, Quercus* sp., *Sequoia sempervirens, Thuja plicata* (especially in British Columbia (Goward 1999), *Acer rubrum* and *Thuja plicata* (Selva 2010)). It occurs in relatively open stands in drier microhabitats where sheltered from precipitation, such as in crevices of bark, the dry side of leaning trunks, or the underside of limbs. In other parts of its range (Europe) it occurs on oak (e.g. *Q. robur*), *Picea* sp., and decorticated wood (Christy 2009).

**Habitat Status or Trend:** Logging has removed vast areas of historically old-growth forests in North America and Europe that were appropriate habitat for this species. It is reasonable to presume that the species has experienced significant historical declines due to logging of old-
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growth trees throughout its worldwide range. However, such logging has slowed in North America and Europe. In North America, fire in the limited remaining old-growth forests may now be a greater threat to the species (Peterson 2006).

The pattern of wildfires in western North American forests has been trending toward more geographically extensive fires and fires of greater intensity, and a better understanding of the relationship of fire intensity to lichen survival on trunks and in the canopy is needed. On the other hand, lack of fire may be a threat as well, as this species occurs rather low on the trunk of old trees and thus could possibly be threatened by overly dense understory vegetation. Trunk-inhabiting lichens may be best suited to a frequent, light fire regime that clears understories without significantly burning trunks (Peterson 2006).

The California Natural Diversity Database (CNDDB) has a single element occurrence from a pre-1999 specimen (Rikkenen 8232, located at Helskini (H), Finland, (Rikkenen 2003)), without precise location information, and is marked “needs fieldwork”. Because it is from a protected old-growth grove on state lands, this population is unlikely to be exterminated by direct human action (e.g. logging, road-building), although remaining vulnerable to indirect human-caused catastrophic events (e.g. wildfire, forest death due to climate shifts).

**Capacity for the Species to Disperse:** Calicium belongs to a group of ascomycete fungi that are characterized by producing thin-walled evanescent asci covered in thousands of loose fungal spores (a mazaedium) (Prieto and Wedin 2016). The genus Calicium itself has stalked asci, which are thought to facilitate passive dispersal of the spores by passing animals (e.g. arthropods or birds) or by wind (Peterson 2006). The distance or efficacy of dispersal has not been studied in this group, but fungal spores are known to be highly successful at dispersal and highly tolerant of extreme environments (Werthe and Sork 2014), so it is not surprising that this species, like many other fungal species, is cosmopolitan in distribution.

Calicium is only dispersed via sexually-produced fungal spores, as it does not have the vegetative dispersal structures that allow co-dispersal of the mycobiont (fungal symbiont) and the photobiont (algal symbiont) cells. In Calicium lichens, the photobiont is Trebouxia, a genus of unicellular alga almost always found in lichenized form, but which has also been demonstrated to live independently in low numbers on tree bark (Bubrick et al. 1984). Therefore, one might infer that dispersal events of Calicium fungal spores that result in a lichen forming at a new site would be rare, but a study in western North America on another lichen species that similarly disperses only via fungal spores, Ramalina menziesii, showed that the genetic diversity of photobionts in that species is very high and correlates both with geography and with substrate tree species (Werthe and Sork 2014). This study suggests that independent “capture” of the photobiont upon germination of a dispersed fungal spore is a relatively frequent and therefore likely event. Dispersal may therefore not be the limiting factor for this species (Peterson 2006).

**Threats:** The most significant threat to the future of this species may be the narrowness of its habitat requirements (Peterson 2006). Since few sites of Calicium adspersum are known in North America, it is difficult to make generalizations about habitat specificity, but the species appears to be restricted to rain-protected bark on the lower trunks of old trees, especially old-growth trees.
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greater than 200 years of age. Several species of conifers are reported as hosts for the North American collections, although ancient Quercus trees are primarily reported for Scandinavian collections (Peterson 2006). Groves of ancient trees are a habitat that is relatively restricted in area and highly patchy in distribution, and made more so by a history of heavy logging throughout the range of Calicium adspersum (CNPS 2017). The rate of removal of appropriately old-growth forest habitat has slowed in recent decades, but this habitat is becoming more vulnerable into the future due to climate change impacts and alteration of fire regimes threatening protected areas (CNPS 2017), either by hot wildfire (e.g. caused by fuels buildup due to fire suppression) or by prescribed burning that scorches the lower part of tree trunks (Peterson 2006). Potential threats listed by CNDDB (2017) therefore remain: logging and alteration of habitat through shifts in fire regimes.

This species is not known to be utilized locally or collected, or have other special uses.

Literature Cited


[CDFG] California Department of Fish and Game. 2013. 24K Quads, SDE Feature Class. Index for 1:24,000-scale (24K), 7.5-minute by 7.5-minute, paper U.S. Geological Survey maps in California.

[CDFW] California Department of Fish and Wildlife, Natural Diversity Database. 2017. RareFind 5 [Internet application] and CNDDB Maps and Data. Available at: https://www.wildlife.ca.gov/Data/CNDDB/Maps-and-Data [Government Version, June 2017].


[CDF] California Department of Forestry and Fire Protection. 2009. 1:24,000 County Boundaries (cnty24k09_1_poly) [shapefile]. California Department of Forestry and Fire Protection, California Department of Fish and Game. Berkeley Library Geodata. Available at: https://geodata.lib.berkeley.edu/catalog/ark28722-s73w23 [10 December 2017].
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Persons Contacted:
Carlberg, T., S. Benson, S. Loring, E. Peterson, J. Villela. 2018. Email of draft profile for review. 8 January 2018.

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January 25, 2018

Reviewer(s) and Date:
David Magney, Rare Plant Program Manager, California Native Plant Society, (916) 447-2677 ext. 205, dmagney@cnps.org. January 26, 2018.

Formatting: Form is set up as 508 compliant. Please use the “styles” if further formatting is necessary.

Purpose: This is to maintain the best available science on a species that could be used by the Forest Service in a variety of functions. Specifically, there would be additional steps and evaluations to determine whether or not this species would be considered a Species of Conservation Concern under the 2012 Planning Rule or a Sensitive Species under the 1982 Planning Rule.

Additional Considerations at the Forest Level: Habitat amount and juxtaposition of both the species and habitat locations.