Rare Plant Status Review: *Pentagramma rebmanii*
Proposed Addition to California Rare Plant Rank 1B.3, G3 / S3

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Changes to the original text are in blue font

This status review is being expedited through an agreement between the California Native Plant Society and the Center for Plant Conservation (CPC), with contributions from the State of California, CPC, and the California Plant Rescue initiative. Aside from being advanced as part of this agreement, the process, content, and information provided herein is not altered, modified, or developed differently in any way or form compared to other status reviews developed by CNPS.

Background and Taxonomy

Pentagramma rebmanii (Winner & M.G. Simpson) Schuettp. & Windham is a perennial fern in the Pteridaceae. It is endemic to the southernmost part of the California Floristic Province (Howell 1957) in San Diego and Imperial counties, California, and northwestern Baja California, Mexico. It was originally described as *P. triangularis* subsp. *rebmanii* (Winner and Simpson 2008) but later recognized at species rank (Schuettpelz et al. 2015) and more recently as *P. triangularis* var. *rebmanii* (Tiehm 2023). It was not treated in *The Jepson Manual* (Smith and Lemieux 1993) or the *Flora of North America* (Yatskievych and Windham 1993) but is included in the *Jepson eFlora* (Rothfels et al. 2016). The genus *Pentagramma* is a polyploid complex restricted to western North America and includes *P. rebmanii* and five other named diploid species (chromosome number 2*n*=60; Schuettpelz et al. 2015, Rothfels et al. 2016, Wefferling et al. 2016). Polyploids resembling the diploid species have also been found; the taxonomy of these polyploids is still unresolved since they were not treated by Schuettpelz et al. (2015) or Rothfels et al. (2016). We are assuming that most if not all the locality records for *P. rebmanii* represent diploid plants, because the unnamed polyploids resembling this species are evidently rare (E. Schuettpelz 2023, pers. comm.). *Pentagramma rebmanii* has a dense, white farina (powdery-waxy secretion) on the lower leaf surface but differs from other *Pentagramma* taxa in having sparse, white farina on the upper leaf surface as well (Winner and Simpson 2008, Schuettpelz et al. 2015, Rothfels et al. 2016). The species-name *rebmanii* is in honor of Dr. Jon P. Rebman (botany curator at the San Diego Natural History Museum).

Ecology

The habitat of *Pentagramma rebmanii* is around seeps and other seasonally moist sites on ± shaded, generally north-facing, rocky slopes or canyon bottoms in chaparral, cismontane woodland, or riparian woodland (Winner and Simpson 2008, Rothfels et al. 2016, CCH2 2023). The elevational range in California is mostly from 1,200 to 4,100 feet (rarely as low as 570 or as high as 5,775 feet). The plants depend on winter rains for spore germination and growth of new leaves from perennial rhizomes; the sporangia mature in late winter and throughout the spring (Winner and Simpson 2008). Frequently noted plant associates include trees *Quercus agrifolia*, *Platanus racemosa*, and *Salix laevigata*; and shrubs *Adenostoma fasciculatum*, *Rhus ovata*, *Eriogonum fasciculatum*, *Quercus berberidifolia*, *Q. ×acutidens*, *Arctostaphylos glauca*, *Toxicodendron diversilobum*, *Heteromeles arbutifolia*, *Keckiella antirrhinoides*, and *Salix lasiolepis* (CCH2 2023). Other rare or uncommon plants co-occurring with *P. rebmanii* include

Allium marvinii (CRPR 1B.2), *Asplenium vespertinum* (CRPR 4.2), *Ceanothus cyaneus* (CRPR 1B.2), *Diplacus clevelandii* (CRPR 4.2), *Horkelia truncata* (CRPR 1B.3), *Lathryus splendens* (CRPR 4.3), *Lilium humboldtii* subsp. *ocellatum* (CRPR 4.2), and *Packera ganderi* (CRPR 1B.2) (CCH2 2023, CNPS 2023). Another *Pentagramma* species, *P. triangularis*, is sometimes found growing together with *P. rebmanii* (Winner and Simpson 2008, CCH2 2023).

Comment from M. Mulligan: "I agree that the description of habitat needs updating. It is restricted to shady granitic boulders/outcroppings which can be located in decomposed granite or gabbro soils. It can be found upslope in shade or in wet seeps but always under these boulders." "I have observed it at sites after fire (Valley Fire) but these are usually locations that are in boulders in streams which are more protected. I have not observed it in the upslope habitat in these locations but I can't say definitely it is affected by fire."

Distribution and Abundance

Currently, there are an estimated 71 occurrences of *Pentagramma rebmanii* in California, all but one of them in San Diego County; record # 16 in our locations table is from the extreme southwestern part of Imperial County (Schuettpelz et al. 2015, Green and Sims 2018, Calflora 2023, CCH2 2023; Rebman 2023, pers. comm.). Sixty-one (86%) of this species' occurrences are recent (observed within the past 20 years), thanks largely to Dr. Jon Rebman and others associated with the San Diego County Plant Atlas (SDNHM 2023). Forty-seven of the occurrences have no population data. Of those with observations, the species has usually been listed as rare or uncommon (18 occurrences); only three observations list the plants as locally common, and three as common (CCH2 2023). Therefore, although this species has approximately 62 recent occurrences, often of unknown quality, the number of individuals may be smaller than would be expected from the occurrence number.

Most of the occurrences are on the Cleveland National Forest (33 occurrences) or lands of unknown (presumably private) ownership (20), with the remainder divided among the BLM (5 occurrences), the state of California (5), the County of San Diego (4), and the City of San Diego (4). Two occurrences (record #s 40 and 43) are partly within the federally designated Pine Creek Wilderness.

In addition to the California locations, we estimated there are nine occurrences of *P. rebmanii* in Baja California (Green and Sims 2018, CCH2 2023, Rebman 2023, pers. comm.). Six of the Baja occurrences are based on recent observations, and three are historical. The southern range limit is evidently in the Sierra San Pedro Mártir. Using GeoCAT (Bachman et al. 2011), the overall extent of occurrence (EOO), including localities in California and Baja California, is estimated as 9,404 km^2. However, because of the evidently spotty distribution, the area of occupancy (AOO) is much less, estimated as 288 km^2 (sum of occupied 4 km^2 grid squares). It should be noted that some of the iNaturalist (2023) observations reported as *P. rebmanii* could not be verified because the associated photos do not show important identifying characters (Rebman 2023, pers. comm.).

Distribution and abundance comments from J. Rebman: "It appears to have a rather limited range and based on iNat observations I do think that some of the [iNat] occurrences may be the "unnamed polyploids" referenced above as some of these look to be closer to P.

triangularis with a little farina on the adaxial blade surface and not true P. rebmanii. However, I am sure that there are likely more occurrences out there that we have not yet documented. Unfortunately, its population number and microhabitat selection is also a bit concerning to me. Most all of the time when I find it in the field it is very rare with few individuals or just one in the occurrence.

Weferling attached a location spreadsheet with his Forum comments and believes this may be a new location: "I think KMW370 is the only one that is really unique relative to your data: [K.M.Wefferling_370, San Diego County, Somewhat uncommon. Under granitic rock, N-facing; associated taxa: Galium, Toxicodendron diversilobum, Quercus spp., Marah, Selaginella bigelovii.Cleveland National Forest; N of Boulder Creek Road toward Cedar Creek, NE of Three Sisters Falls trailhead. 32.9894, -116.6688, 731]"

Distribution and abundance comments from M. Mulligan: "I also agree with Jim that the populations are very small with usually only a few plants at each point. And, when found usually only 1-2 locations at a site, never locally common. I cover a lot of ground in the County and I do feel like the points are a good representation of the range."

Status and Threats

Pentagramma rebmanii has had no prior conservation status in California or Baja California. Schuettpelz et al. (2015) assigned it a preliminary status of Near Threatened (NT) in accordance with the IUCN Red List categories and criteria (IUCN 2012), but many new occurrences have been added since. The species has a limited distribution, and its microhabitat (seeps and other seasonally moist sites) is also limiting (Rebman 2023, pers. comm.). Because of its narrow habitat requirements and generally small numbers of individuals, this rare fern is inherently vulnerable to extinction at the population level. Site-specific threats are as-yet undocumented.

Threat comments from G. Yastkievych: "As for threats, the two things that come to mind, generally, are: 1) on the one hand drying out of seeps following lowering of the water table; and 2) in areas where the habitat is not drying out, but fires are infrequent, the microhabitats might get overgrown and thus shade out the plants."

Threat comments from J. Andre: "That 20 or so occurrences are on private land is concerning from a threats standpoint, especially given the recent sprawl of ranchettes and such in the Lake Moreno/Campo area."

Threat comments from J. Rebman: It really seems to specialize on wetter, shaded areas of granitic boulders or larger granite outcrops with just enough moisture but those microhabitats can be a little tough to find and are not always cohesive in their spatial arrangement. I am little worried about this microhabitat if things start drying out and getting hotter with clomate change because I do think it will become rarer in time; much like what we are finding with Asplenium vespertinum which sometimes shares the same microhabitat with this species.

Threat comments from S. Fawcett: " I have not studied ferns much in this part of California, but have studied ecology of rock ferns in the northeast, and based on my work with Asplenium viride along the southern edge of its global distribution in eastern North America,

climate change seems to have impacted the southernmost sites. The plants had apparently disappeared from historic localities that had dried up over the past 100 years, and some rocky habitats of the niagara escarpment no longer support the same species they had 50 or more years earlier. Like these Pentagrammas, the Asplenium depend on rare habitats associated with rock formations and unique climate and moisture availability. Changes to the water table or seasonal variation in moisture (in our case, snow-depth) can have a negative impact, so I would consider climate change to be a threat given the narrow range and specialized moisture-dependent habitat. The good news is that the spores of Pteridaceae of dry climates are especially well-adapted to survive prolonged periods of dormancy. I attach a paper that discusses hydrologic refugia, and one with some data from my study on Asplenium microclimates."

Summary

Based on the limited habitat preferences of this species and its low numbers where found, CNPS and CNDDB recommend adding *Pentagramma rebmanii* to California Rare Plant Rank 1B.3 of the CNPS Inventory. If knowledge on the distribution, threats, or rarity status of *P. rebmanii* changes in future, then we will re-evaluate its status at that time.

Recommended Actions

CNPS: Add *Pentagramma rebmanii* to CRPR 1B.3
CNDDB: Add *Pentagramma rebmanii* to G3 / S3

Draft CNPS Inventory Record

Pentagramma rebmanii (Winner & M.G. Simpson) Schuettp. & Windham
Rebman's silverback fern
Pteridaceae
USDA Plants Symbol: none
CRPR 1B.3
Counties: Imperial, San Diego
States: Baja California, California
Quad name (code): Barrett Lake (3211666), Cameron Corners (3211664), Campo (3211654), Descanso (3211675), Dulzura (3211667), El Cajon Mtn. (3211687), In-Ko-Pah Gorge (3211661), Jacumba (3211662), Julian (3311615), Morena Reservoir (3211665), Mount Laguna (3211674), Otay Mountain (3211657), Potrero (3211655), Ramona (3311617), Santa Ysabel (3311616), Tecate (3211656), Tierra Del Sol (3211653), Tule Springs (3211686), Viejas Mountain (3211676)
General Habitat: Chaparral, cismontane woodland, riparian woodland
Microhabitat Details: seeps and other seasonally moist sites on ± shaded, generally north-facing, rocky slopes or canyon bottoms
Microhabitat: clay (sometimes), decomposed granitic (sometimes), gabbroic (sometimes), granitic (mostly), mesic, rock crevices (sometimes), rocky (mostly), seeps, slopes, streambanks
Elevation: 175–1760 meters
Life form: perennial rhizomatous herb
Blooms: no data
Threats: ~~no data.~~ Potentially threatened by development.

Taxonomy: ~~The species-name *glandulosiscida* is in reference to the upper leaf surfaces, which are viscid (sticky) and have conspicuously stalked glands.~~ Rare, unnamed polyploids resemble this diploid species. *Pentagramma rebmanii* has a dense, white farina (powdery-waxy secretion) on the lower leaf surface but differs from other *Pentagramma* taxa in having sparse, white farina on the upper leaf surface as well. ~~Co-occurs with *Pentagramma triangularis* and *P. viscosa*. Unlike *P. triangularis* in having lower leaf surfaces white-farinose (vs. yellow). Most similar to *P. maxonii* which occurs on the desert side of the mountains.~~

Selected References:

- CNPS Status Review: *Pentagramma rebmanii*: Proposed Addition to CRPR 1B.3 (2024)
- Original Description: *Madroño* 54(4): 345 (2008)
- Revised Nomenclature: *Systematic Botany* 40(3): 641 (2015), *Journal of the Botanical Research Institute of Texas* 17(1): 28 (2023)

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Personal Communications

Rebman, Jon P. 2023. Curator, Department of Botany, San Diego Natural History Museum. Email correspondence on the limited distribution and microhabitat of *Pentagramma rebmanii*, the difficulty of verifying some iNaturalist observations attributed to this species, and transmitting his curated subset of iNaturalist observations. Personal communications 31 May and 17 November 2023.

Schuettpelz, Eric. 2023. Research Botanist and Chair, Dept. of Botany, U.S. National Museum of Natural History. Email correspondence regarding rarity of unnamed polyploids resembling *Pentagramma glanduloviscida* and *P. rebmanii*. Personal communication 11 May 2023.