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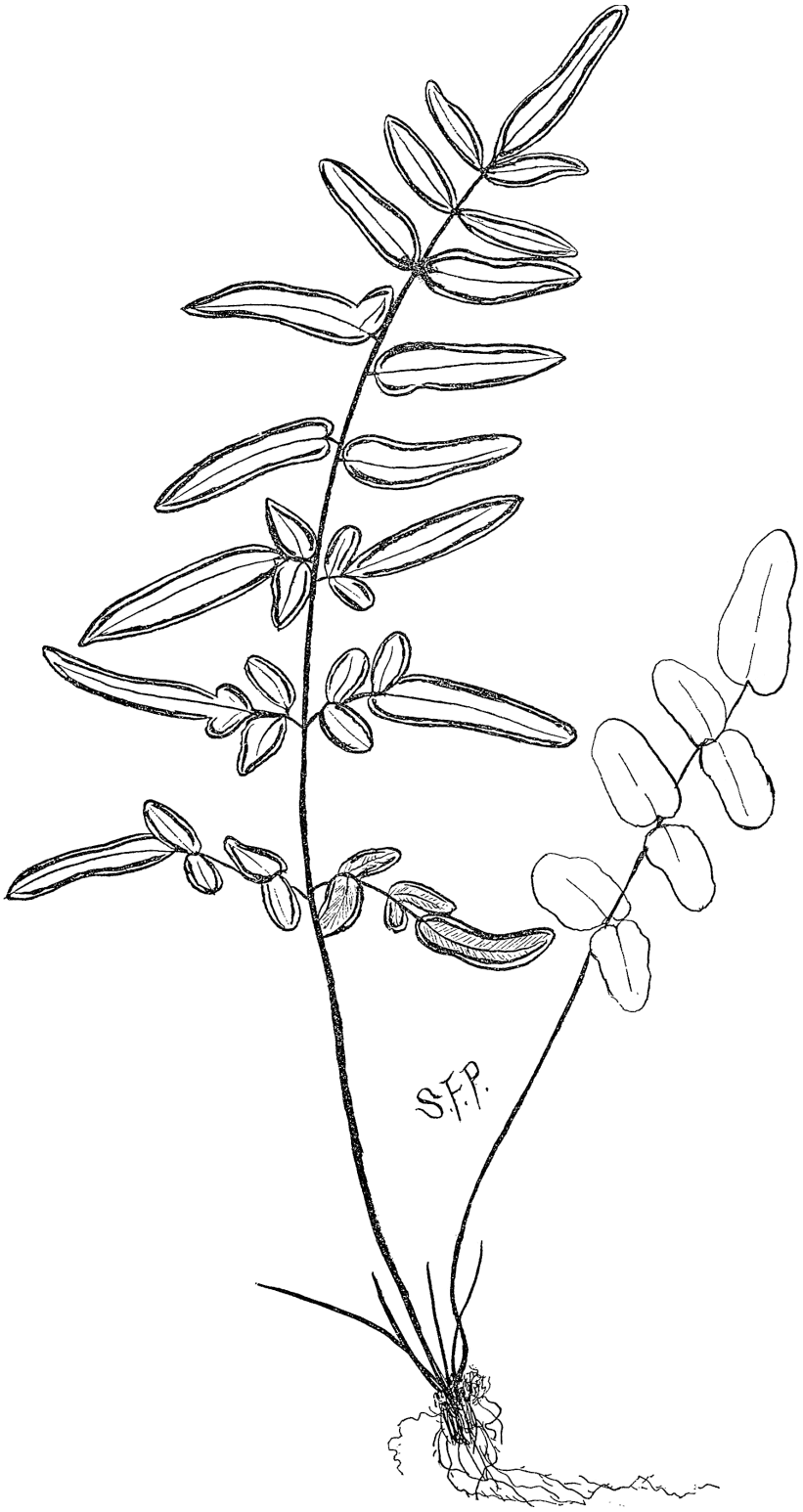

Paronychia leucochthonicola (Caryophyllaceae: Paronychieae), a new species of the San Luis Valley, north-central New Mexico and adjacent Colorado

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Paronychia leucochthonicola (Caryophyllaceae: Paronychieae), a new species of the San Luis Valley, north-central New Mexico and adjacent Colorado.

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Abstract—*Paronychia leucochthonicola* C.E.V.Alexander sp. nov. is described from two population complexes in the San Luis Valley, one along the Rio Grande Gorge west of Taos (New Mexico), the other centered on Flat Top in the San Luis Hills (Colorado). This is a rare species, occurring in narrow bands of habitat along rimrock. These plants have previously been identified as either *Paronychia pulvinata* or *Paronychia sessiliflora*. *Paronychia leucochthonicola* differs from both in having fringed stipules that conceal the leaves. It is more similar to the alpine *Paronychia pulvinata*, which is found at high elevations in the surrounding mountains. Additional distinguishing features are discussed and a key to the *Paronychia* of Colorado, New Mexico, and Wyoming is provided.

In early 2021 I found myself confused by the distinction between *Paronychia depressa* and *Paronychia jamesii* in New Mexico. What began as a narrowly defined question snowballed into a broader interest in *Paronychia*. To answer my original question, I did not see a coherent distinction because only *Paronychia jamesii* occurs in the state. Reports of *Paronychia depressa* in New Mexico are erroneous, resulting from a relatively simplistic habit / height cutoff that works most but not all of the time. Low, mat-forming populations of *Paronychia jamesii* can be found throughout much of its range, especially in harsher habitats. At the end of this paper I provide an identification key—based on Chaudri (1968) and Hartman et al. (2005) along with my observations from visiting numerous populations of these plants—that may help resolve similar confusions for others. The distinction between *Paronychia depressa* and *Paronychia jamesii* remains difficult where their ranges truly overlap—northeastern Colorado and adjacent Wyoming & Nebraska.

In answering that question, I discovered another. I noticed that four herbarium specimens and two observations on iNaturalist, all from the San Luis Valley, were unusual cushion-forming, grayish-green plants that had been identified as either *Paronychia pulvinata* or *Paronychia sessiliflora*. However, these plants appeared distinct from both. Thinking this might be a new species, I visited known and potential sites for these plants over nine days in 2021 and 2022, collecting specimens and taking photographs to investigate further. It became clear that this is a new species readily distinguished from other *Paronychia* in the area—most notably by having the leaves concealed by fringed stipules. After being distracted by life events[1] I return to publish this species as *Paronychia leucochthonicola*.

Paronychia leucochthonicola C.E.V.Alexander, sp. nov. (Figs. 1–3) Type: New Mexico. Taos County: Rim on the east side of the Rio de los Pueblos 0.8 miles northeast of its confluence with the Rio Grande, 36.34532°N 105.71943°W[2], elev. 6700 ft., 19 June 2021, *Alexander 1689* (holotype: UNM; isotypes: COLO, KHD).

Perennial, pulvinate, forming dense mounds 8–40 cm in diameter, to 15 cm high; caudex woody, branched, from a woody tap root. Stems ascending to erect, much-branched, 5-20 cm, obscured by leaves & stipules, hirtellous (hairs widely spreading, blunt, ± 0.2 mm) below each node, otherwise glabrous; internodes 0.5–1.5 mm. Leaves closely imbricate, persistent for a few years, tan with age; mostly or entirely obscured by stipules; narrowly elliptic to broadly lanceolate (occasionally narrowly lanceolate), apices broadly rounded, 1–2.5(–3.1) × 0.5–0.6 mm; midrib prominent and raised abaxially, obscure adaxially; glabrous on the surfaces, margins scabrous on the basal 1/4–2/3. Stipules appressed, persistent for several years, each covering a leaf of the next distal node; hyaline; keeled & ± cymbiform, lanceolate, gradually tapering to acute apices, 1.7–4.1 × 0.7–0.8 mm; margins prominently fringed with fragile, wavy cilia 0.1–0.3(–0.4) mm, cilia becoming shorter on the distal margins, usually absent in the distal fifth or so, and gradually lost with age. Flowers pentamerous, solitary (rarely paired), sessile, terminating stems, subtended by ordinary leaves; yellow at anthesis (greenish when immature, tan with age); when closed, narrowly ellipsoidal-oblong in outline, 2.5–3.3 × 1.1–1.3 mm (excluding sepal awns); hypanthium 0.9–1.2 mm long, hirtellous externally (trichomes ± 0.2 mm, sharp, ascending to loosely appressed). Sepals yellow; abaxially scabrous, hirtellous near the hypanthium, adaxially

[1] At the beginning of this project, my name was Patrick James Alexander. Now it is Cecelia Ember Victoria Alexander. I use feminine pronouns.

[2] All coordinates in WGS84 decimal degrees.

glabrous, midvein inconspicuous; excluding the hyaline margins & awns, broadly lanceolate, 1.5–2.2 × 0.7–0.8 mm; hyaline margins yellowish, translucent, 0.2–0.3 mm at their widest, usually curved inward; hoods small, cupping inward 0.2–0.3 mm, rounded; awns erect, conic, 0.3–0.4 mm long, ± 0.2 mm diameter at the base, yellow except for a minute, whitish, weakly spinose tip. STAMENS yellow; filaments 0.7–1.1 mm; anthers oblong, ± 0.5 mm long. STAMINODES thinner & slightly shorter than the filaments; yellow; 0.6–0.8 mm. OVARIES yellowish-green, ovoid, ± round in cross-section, apex conical, tapering gradually into the style; 0.7–0.8 × 0.5–0.6 mm; usually glabrous, sometimes hirtellous in the distal third around the base of the style (trichomes 0.1–0.2 mm, ascending, sharp). STYLES filiform, 1.0–1.5 mm, obscurely bifid. UTRICLES tan, ovoid-oblong, plump distally but deflated basally around the seed, 1.0–1.1 × 0.8 mm, glabrous (or distally hirtellous); style persistent. SEEDS reddish-brown, reniform, 0.4 mm long; funicle robust, persistent.

PARATYPES—U.S.A. COLORADO. CONEJOS COUNTY: San Luis Valley, San Luis Hills, northwest rim of Flat Top, 7.6 miles west-southwest of Music Mesa and 3.3 miles south-southeast of Saddleback Mountain, 37.21737°N 105.81260°W, elev. 9110 ft., 28 May 2022, *Alexander 1737* (KHD, UNM); basalt ridge above La Jara Creek E of the Gonzalez-Martinez Ranches [estimated: 37.260°N 106.144°W; the label T/R/S should be corrected to T35N R8E Sec. 30 NW], elev. 8020 ft., 10 July 1984, *Bye 12909* (ALAM, COLO); Flat Top Mountain, at the middle of the top, 37.208°N 105.800°W, elev. 9000 ft., 10 July 1986, *Dixon 4765* (ALAM); top of Flat Top, San Luis Hills [estimated: 37.209°N 105.794°W], elev. 9160 ft., 10 July 1986, *O'Kane 2502* (CS). COSTILLA COUNTY: San Luis Hills, just south of Trinchera Creek, on rocky, barren sagebrush plateau reminiscent of an alpine "felsenmeer" at the supposed site of ancient Lake Alamosa [converted from NAD27 UTM: 37.3662°N 105.6354°W], elev. 7800 ft., 19 June 2005, *Erdman 111* (COLO). NEW MEXICO. TAOS COUNTY: west rim of the Rio Grande Gorge, 4.8 miles east-northeast of Tres Oreja and 6.4 miles north of the confluence with the Rio Pueblo de los Taos, 36.42968°N 105.72310°W, elev. 6970 ft., 19 June 2021, *Alexander 1690* (ARIZ, COLO, KHD, UNM); west rim of the Rio Grande Gorge, 5.1 miles east-southeast of Tres Orejas and 3.4 miles north of the confluence with the Rio Pueblo de los Taos, 36.38736°N 105.72603°W, elev. 6820 ft., 3 September 2021, *Alexander 1717* (ARIZ, COLO, KHD, UNM); edge of Rio Grande Rim, 36.38590°N 105.72729°W, elev. 6800 ft., 10 June 2021, *Call s.n.* (BLM:NM); western rim of Rio Grande Gorge SW of Taos [estimated: 36.386°N 105.727°W], elev. 6800 ft., 31 May 1978, *Spellenberg 4987* (NMC, NY).

ADDITIONAL RECORDS—Photographic records from iNaturalist are listed below. Five are duplicates of specimens listed above. Observations are cited as [username] [iNaturalist observation ID].

U.S.A. COLORADO. CONEJOS COUNTY: San Luis Hills, Flat Top: 37.2174°N 105.8126°W, 28 May 2022, *aspidoscelis 334665135* [*Alexander 1737*]; 37.2166°N 105.8259°W, 28 May 2022, *aspidoscelis 119114553*; 37.2104°N 105.8188°W, 28 May 2022, *aspidoscelis 119127212;* 37.2083°N 105.8127°W, 28 May 2022, *aspidoscelis 119127292;* 37.2125°N 105.7959°W, 28 May 2022, *aspidoscelis 119142923*; 37.2127°N 105.8161°W, 28 May 2022, *aspidoscelis 119164844*. NEW MEXICO. TAOS COUNTY: Rio Grande Gorge: 36.3584°N 105.7338°W, 18 June 2020, *ashlee_wolfberry 59060349*; 36.3452°N 105.7196°W, 19 June 2021, *aspidoscelis 83716313* [*Alexander 1689*]; 36.4296°N 105.7234°W, 19 June 2021, *aspidoscelis 83730717* [*Alexander 1690*]; 36.3874°N 105.7260°W, 3 September 2021, *aspidoscelis 109744478* [*Alexander 1717*]; 36.4420°N 105.7309°W, 10 June 2021, *erincall 82475146* [*Call s.n.*]; 36.3455°N 105.7174°W, 1 June 2016, *janmarnm 47722427*; 36.3453°N 105.7194°W, 31 May 2020, *kirbz 48057300*; 36.3461°N 105.7178°W, 28 June 2024, *kmwilliamso 241606580*; 36.3450°N 105.7192°W, 21 April 2018, *lukev 11365154*; 36.3486°N 105.7140°W, 2 June 2024, *maryadams 220113642*; 36.3461°N 105.7176°W, 6 November 2022, *nmacphee 141291807*; 36.3461°N 105.7178°W, 18 May 2022, *rbarber 117608218*; 36.3866°N 105.7266°W, 15 August 2022, *ryanbailey 130993275*; 36.4719°N 105.7346°W, 13 June 2025, *slvbarrett 289907743*; 36.3867°N 105.7270°W, 14 June 2023, *tadaryvolamarez 195085836*; 36.3452°N 105.7192°W, 18 April 2022, *zachbehrens 112005040*.

ETYMOLOGY—The epithet refers to the habitat on the rim of the Rio Grande Gorge: bands of whitish calcareous soil, conspicuous on aerial imagery against the adjacent basalts.

COMMON NAME—I recommend "San Luis Valley nailwort".

PHENOLOGY—Flowering late May to mid-September. The largest number of flowering records is in June.

ECOLOGY—All but one record of *Paronychia leucochthonicola* is on shallow soils over basaltic bedrock, mostly on rimrock (at Flat Top, I found it along the rim but prior collections—*O'Kane 2502* and *Dixon 4765*—were apparently on the flat top of the mountain). The largest populations are along the Rio Grande Gorge, where it grows along the rim in pale, whitish, calcareous soil with rounded gravels and cobbles of mixed origin. Apparently wind scour has removed surface soils to reveal underlying calcic horizons. These whitish soils are also home to the Taos County populations of the rare plant *Eriogonum lachnogynum* var. *colobum*. The lone record off basalt (*Erdman 111*) is on Conejos Formation dacite or andesite (Thompson et al. 2008), on a low bedrock scarp above the adjacent floodplain.

Paronychia leucochthonicola is found in perennial grasslands (or, occasionally, savanna with sparse *Juniperus monosperma*). I recorded coöccurring plants within a 10m radius at six sites, three at Rio Grande Gorge and there at Flat Top. At these sites, the most frequent grasses are: *Hesperostipa comata* (Trin. & Rupr.) Barkworth, *Bouteloua gracilis* (Kunth) Lag. ex Griffiths, *Eriocoma hymenoides* (Roem. & Schult.) Rydb., and *Aristida purpurea* Nutt. Shrubs & subshrubs are sparse in these habitats. The most frequent are: *Chrysothamnus greenei* (A.Gray) Greene, *Artemisia tridentata* Nutt., *Gutierrezia sarothrae* (Pursh) Britton & Rusby, *Artemisia bigelovii* A.Gray, *Krascheninnikovia lanata* (Pursh) A.Meeuse & A.Smit, and *Symphoricarpos rotundifolius* A.Gray. The perennial forb *Tetraneuris acaulis* (Pursh) Greene was present at all six sites. All plants I recorded with *Paronychia leucochthonicola*, and at 37 additional sites visited searching for it, are provided in the supplementary data (see Data Access, below).

STATUS AND THREATS—*Paronychia leucochthonicola* is a rare plant. It is narrowly distributed and found within narrow strips of suitable habitat, although it is sometimes locally abundant. It is known from 10 specimen collections and 22 photographic records on iNaturalist, a total of 27 records after removing duplicates (mapped in Fig. 4). Most of these (20) are from 2020 to present, reflecting both the recent increase in photographic records in and my interest in the species. Our understanding of its abundance remains limited and we have no information on trends.

There are primitive roads along the rim of the Rio Grande Gorge, adjacent to or crossing suitable habitat. The area has a rest stop and a recreation site adjacent to suitable habitat and receives a fair amount of recreational visitation given the scenic value of the gorge. A major powerline also passes through suitable habitat—the earliest record of *Paronychia leucochthonicola* in New Mexico (*Spellenberg 4987*) was collected during surveys for this powerline. These all have local impacts on habitat.

The sites in Colorado are more remote, less visited. The Flat Top area is heavily grazed by horses, causing ecological degradation. The rim habitats where I found *Paronychia leucochthonicola* are somewhat protected by their rocky nature. I saw no evidence that the plants themselves were consumed. I tried to relocate the population documented by *Bye 12909,* without success. Although it is difficult to be certain, I believe I revisited the same site. I found no *Paronychia leucochthonicola*, though the habitat looked suitable. I have not attempted to relocate *Erdman 111*.

The two population clusters are separated by ± 80 km and there may be additional populations to be found in the gap. In 2021 and 2022 I spent a few days checking areas that looked promising based on aerial imagery (Fig. 4) without any luck. The core habitat, basaltic rims, is relatively easy to target. However, *Paronychia leucochthonicola* is not limited to that habitat and populations in other habitats may be unpredictable. In the Rio Grande Gorge area, much of the habitat is on Taos Pueblo lands on the east rim. It likely occurs there.

DISCUSSION—*Paronychia leucochthonicola* has been identified as either *Paronychia pulvinata* or *Paronychia sessiliflora*. The fringed stipules concealing the leaves distinguish it from both. It is more similar to *Paronychia pulvinata* in a number of features that parallel those Chaudri (1968: 195) mentions separating *Paronychia pulvinata* from *Paronychia sessiliflora*. For both *Paronychia leucochthonicola* and *Paronychia pulvinata*: leaves are rounded apically; stipules are never bifurcate; closed flowers are ellipsoidal-oblong in outline (more narrowly so in *Paronychia leucochthonicola*); sepal awns are erect and short (0.3–0.4 and 0.3–0.6, respectively); ovaries are conic apically, tapering gradually into the style; also—and this is a character Chaudri omits but becomes apparent with good photographs of live plants—ovaries are ± round in cross-section.

In *Paronychia sessiliflora*, by contrast, leaves are cuspidate; stipules are often deeply bifurcate; closed flowers are somewhat flask-shaped in outline (narrowing above the hypanthium); sepal awns are usually ± spreading and longer (0.5–)1–1.5(–2) mm); ovaries are rounded apically, the style arising more abruptly; ovaries are ellipsoidal in cross-section, the long axis about twice the short. These additional features give ample distinction between *Paronychia leucochthonicola* and *Paronychia sessiliflora*. The two also occur together on Flat Top[3] and remain distinct.

In addition to the fringed, sheathing stipules, *Paronychia leucochthonicola* is distinguished from *Paronychia pulvinata* by: narrower leaves (0.5–0.6 vs. 1.25–1.75(–2) mm); leaves with midribs conspicuous, raised abaxially (vs. obscure, flush with the abaxial surface); a deeper hypanthium with the top of the ovary about equalling the rim of the nectary in live flowers at anthesis (vs. the ovary more exposed, the rim of the nectary around its base). The two also occupy different habitats. *Paronychia pulvinata* is found in rocky alpine areas high in the mountains around the San Luis Valley (there is only one definite record[4] in the area below 11,000 ft.: *Douglas 1876*, CS.

KEY TO *PARONYCHIA* OF COLORADO, NEW MEXICO, AND WYOMING—Though written for these three states, this key should work in adjacent states so long as one does not wander into the ranges of additional species of *Paronychia*.

1 Awns, hoods, and margins of the sepals white; awns conspicuous, widely spreading ..... *Paronychia wilkinsonii* S.Watson
Trans-Pecos Texas, one site in New Mexico (west base of the Guadalupe Mountains, Otero Co., 4800–4900 ft.).

1 Awns & hoods of the sepals yellowish or greenish; awns relatively inconspicuous, erect to weakly spreading

2 Leaves mostly obscured by the stipules; stipules fringed ..... *Paronychia leucochthonicola* C.E.V.Alexander
Endemic to the San Luis Valley, 6700–9200 ft. The fringes are gradually lost with age; the leaves also become more visible on older growth.

2 Leaves clearly visible, not obscured by the stipules; margins of the stipules entire to serrulate

3 Leaves elliptic to oblong, glabrous, not apiculate or mucronate .....*Paronychia pulvinata* A.Gray
Colorado, New Mexico (Sangre de Cristo Mountains), Utah (Uinta Mountains), and Wyoming (Snowy Range).

[3] *Alexander 1737 / aspidoscelis 334665135* (*leucochthonicola*) and *Alexander 1738 / aspidoscelis 119156623* (UNM; *sessiliflora*) were growing together, as were *Alexander 1689 / aspidoscelis 83716313* (*leucochthonicola*) and *Alexander 1689.5* (UNM; *sessiliflora*).

[4] *Hartman 65088* (RM) is identified as *Paronychia pulvinata* at 8600 feet. The elevation & habitat would be very unusual for *Paronychia pulvinata*. More likely it is *Paronychia sessiliflora* or, more interestingly, *Paronychia leucochthonicola*. Resolving this is too deep a rabbithole at present.

Alpine and occasionally subalpine habitats, rarely below 10,000 ft.

3 Leaves linear to subulate, scabrous (at least on the margins) to puberulent with minute, sharp, ascending trichomes, usually apiculate to mucronate (at least on the longer, more distal leaves)

4 Plants pulvinate to mat-forming; flowers solitary or in cymose clusters of 2–7, sessile; sepals at anthesis usually yellowish throughout their lengths; sepal awns usually > 1 mm; ovaries & utricles pubescent ..... *Paronychia sessiliflora* Nutt.
Alberta, Arizona, Colorado, Idaho, Montana, Nebraska, North Dakota, New Mexico, Oklahoma, Saskatchewan, South Dakota, Texas, Utah, and Wyoming. 3000–9500 ft. Taller, looser plants, especially in Texas, may be confusing and seem at first to be some other species.

4 Plants of varying habit, sometimes pulvinate or mat-forming; flowers usually in open cymes, sometimes in congested cymes of 3–7, branches or pedicels very short but visible without dissection; sepals at anthesis yellowish basally, greenish distally; sepal awns usually < 1 mm; ovaries & utricles glabrous

5 Plants pulvinate to mat-forming, sometimes caespitose, stems prostrate to ascending, usually < 10 cm tall; cymes usually with < 10 flowers, never corymbose; flowers usually equalled or exceeded by the subtending leaves
..... *Paronychia depressa* (Torr. & A.Gray) Nutt. ex A.Nelson
Central and eastern Wyoming, northeastern Colorado (south to 40°N), western Nebraska, and southwestern South Dakota. 3500–9000 ft. Pulvinate forms are sometimes misidentified as *Paronychia sessiliflora* but are reliably distinguished by the characters in the couplet. Taller forms apparently grade into *Paronychia jamesii*. Chaudri says the sepals are distinctive relative to *Paronychia jamesii*. I can find no consistent difference.

5 Plants caespitose or sometimes mat-forming, stems ascending to erect, usually > 10 cm tall; cymes usually with > 15 flowers, often corymbose; flowers usually exceeding the subtending leaves ..... *Paronychia jamesii* Torr. & A.Gray
Eastern Colorado, Kansas, Oklahoma, New Mexico, and Texas. Peripheral in southeastern Wyoming, southwestern Nebraska, and southeastern Arizona. One population in northern Arizona (Meteor Crater). 1500–8000 ft. Short, mat-forming plants occur throughout its range and are sometimes misidentified as *Paronychia depressa*. A height cutoff alone is not reliable. Where the ranges of *Paronychia jamesii* and *Paronychia depressa* overlap, some plants are intermediate and may not be identifiable even with additional characters.

ACKNOWLEDGEMENTS—I would like to thank Mat Sharples, with apologies for losing touch; Meg Dudley, for assistance with specimens at ALAM; Sam Reiss, for periodic nudging to continue this project; and my three cats: Carphochaete, Dyschoriste, and Uncifer. Online specimen data portals are invaluable & greatly appreciated. I used data and images provided through SEINet (https://swbiodiversity.org/seinet/), a Symbiota portal, from the following herbaria:

Herbarium (ALAM) at Adams State University, Alamosa, Colorado.

Herbarium (COLO) at the University of Colorado Museum of Natural History, Boulder, Colorado.

Charles Maurer Herbarium (CS) at Colorado State University, Fort Collins, Colorado.

NMSU Biology Herbarium (NMC) at New Mexico State University, Las Cruces, New Mexico.

William and Lynda Steere Herbarium (NY) at the New York Botanical Garden, New York.

UNM Herbarium (UNM) at the University of New Mexico, Alburquerque, New Mexico.

DATA ACCESS—All of my photographs of *Paronychia leucochthonicola* and its habitat, as well as coordinates and plant lists for sites mapped in FIG. 4, are on Dryad: https://doi.org/10.5061/dryad.gfvhhn3m.

This article presents the understanding of the author, which may diverge from that of her employer, the Bureau of Land Management.

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FIGURE 1. *Paronychia leucochthonicola*, Rio Grande Gorge, 19 June 2021, *Alexander 1689*. Focus-stacked images (using Zerene Stacker, Zerene Systems 2024) of 23 and 15 photographs, respectively, taken with a Canon 6D and Laowa 100mm f2.8 macro lens at 2:1.

FIGURE 2. *Paronychia leucochthonicola*, habit, east rim of the Rio Grande Gorge, 19 June 2021, *Alexander 1689*. Photographs taken with a Canon 6D and a Laowa 100mm f2.8 macro lens.

FIGURE 3. Habitat of *Paronychia leucochthonicola*: **A** west rim of the Rio Grande Gorge, site of *Alexander 1690*; **B** north rim of Flat Top, site of *Alexander 1737*. Photographs taken with a Canon 6D and Canon 17-40 mm f4L lens.

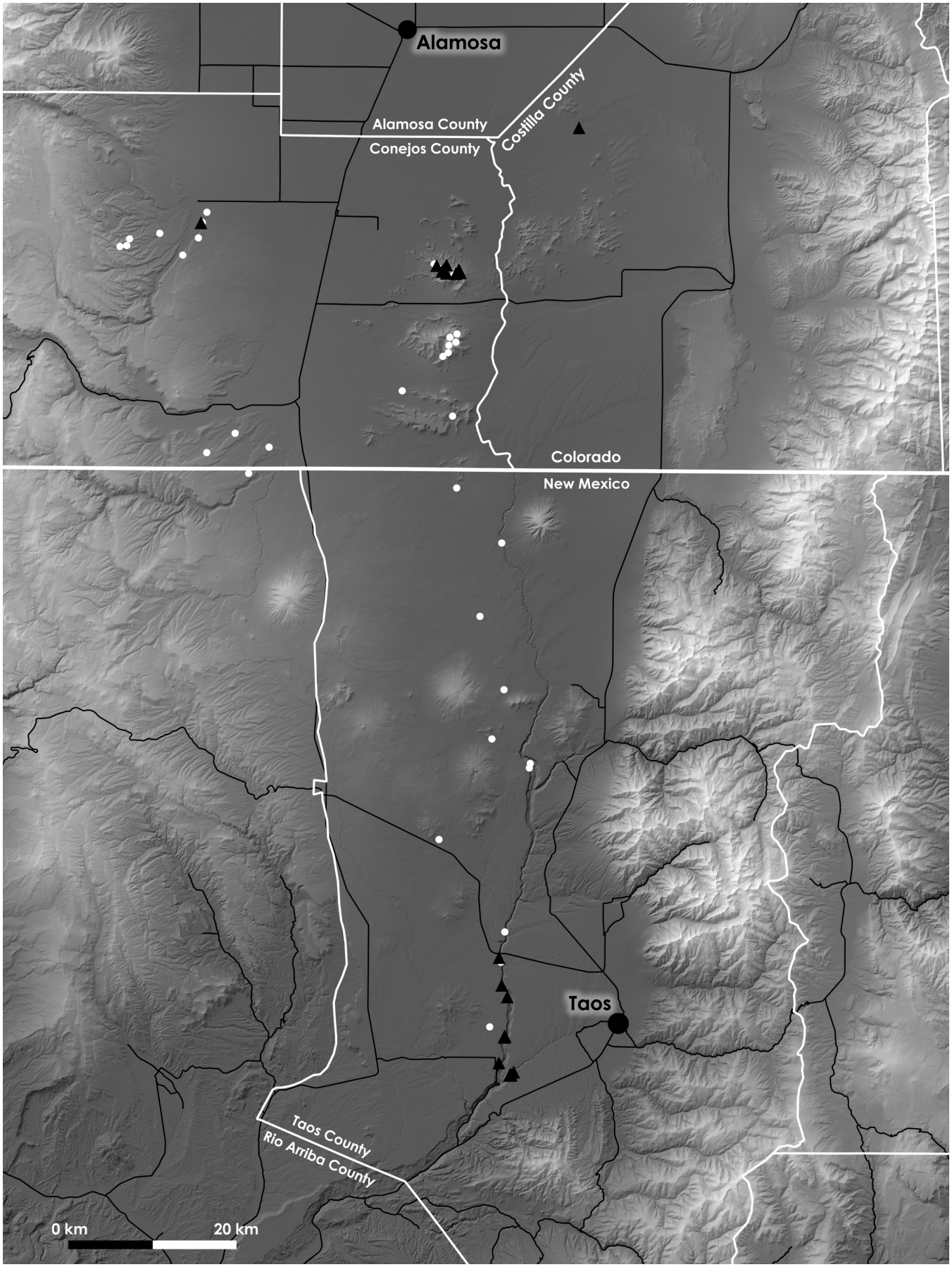

FIGURE 4. Distribution of *Paronychia leucochthonicola* (black triangles) with additional sites visited searching for this species (white circles). Map produced in QGIS (QGIS Development Team 2025).

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>
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>
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>
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The cover illustration was drawn by S.F. Price and depicts *Pellaea atropurpurea* (L.) Link, a fern that occurs in semiarid environments. It was first published in:

S.F. Price, 1897. *The fern-collectors handbook and herbarium: an aid in the study and preservation of the ferns of the northern United States, including the district east of the Mississippi and north of North Carolina and Tennessee.* Henry Holt and Company, New York, NY.

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