

**Status of *Astragalus hyalinus* M.E. Jones var. *glabratus* Evert ex Dorn
(Smooth Summer Milkvetch)
Park and Hot Springs Counties, Wyoming**



Prepared for the Bureau of Land Management
Cody and Worland Field Offices and State Office

By Bonnie Heidel
Wyoming Natural Diversity Database
University of Wyoming
1000 E. University Avenue, Laramie, WY 82071

May 2020
Agreement No. L1600389

Abstract

Smooth summer milkvetch (*Astragalus hyalinus* M.E. Jones var. *glabratus* Evert ex Dorn) was described as a new taxon by Robert Dorn (Dorn 2014). Pilot surveys were conducted for it in 2014 on Cedar and Sheep Mountains. Expanded surveys were conducted in 2019 in BLM Cody and BLM Worland Field Offices that incorporate new specimen information to produce core status information. This work provides the basis for retaining ranks of G5T1/S1 for this taxon as known from up to five discrete locations, and presents possible directions for further work.

Literature Citation:

Heidel, B. 2020. Status of *Astragalus hyalinus* M.E. Jones var. *glabratus* Evert ex Dorn (smooth summer milkvetch), Park and Hot Springs Counties, northwest Wyoming. Prepared for the USDI Bureau of Land Management Cody and Worland Field Offices and the State Office by the Wyoming Natural Diversity Database - University of Wyoming, Laramie, Wyoming.

Cover photo: *Astragalus hyalinus* var. *glabratus* closeup at Cedar Mountain¹

¹ All photographs in this report were taken by the author.

TABLE OF CONTENTS

FIGURES AND TABLES

- Figure 1. Map of *Astragalus hyalinus* var. *glabratus* specimen collection sites
- Figures 2-4. *Astragalus hyalinus* var. *glabratus* in flower
- Figures 5-6. *Astragalus hyalinus* var. *glabratus* at Gebo in what is inferred to be late flower
- Figures 7-8. Cedar Mountain summit and bench habitat of *Astragalus hyalinus* var. *glabratus*
- Figures 9-11. Gebo and Sand Draw ridge habitat of *Astragalus hyalinus* var. *glabratus*
-
- Table 1. Specimens of *Astragalus hyalinus* var. *glabratus* referenced in 2019 surveys
- Table 2. Distinguishing characteristics among tufted milkvetches in Wyoming
- Table 3. Location information for known occurrences of *Astragalus hyalinus* var. *glabratus*
- Table 4. Survey locations for *Astragalus hyalinus* var. *glabratus* where it was not found
- Table 5. Species frequently associated with *Astragalus hyalinus* var. *glabratus*
- Table 6. Size of *Astragalus hyalinus* var. *glabratus* populations

APPENDICES

- Appendix A. *Astragalus hyalinus* var. *glabratus* records used in 2019 surveys
- Appendix B. Updated state species abstract for *Astragalus hyalinus* var. *glabratus*

INTRODUCTION

Smooth summer milkvetch (*Astragalus hyalinus* M.E. Jones var. *glabratus* Evert ex Dorn) was recently described as new to science (Dorn 2014). Taxonomic work was pursued by Robert Dorn after the death of Erwin Evert, the person who discovered it and brought it to the attention of the state botanical community. It was known from two specimens collected on Cedar Mountain (*Evert 3012* in flower on 7 July 1981, and *Dorn 5023* in flower on 30 June 1989). It has been recognized for over a decade as an unpublished taxon (*Astragalus* sp. nov. – undescribed taxon) in the current state flora (Dorn 2001) and in the Greater Yellowstone checklist (Evert 2010).

In addition to Cedar Mountain, Evert (2010) reported “*Astragalus hyalinus* var. *glabratus* – undescribed variety” from Sheep Mountain but with no supporting voucher specimen or more location information. The federal lands on Cedar and Sheep Mountains are administered by the Bureau of Land Management (BLM) Cody Field Office and the state lands are State of Wyoming parcels administered by the Wyoming State Office of Lands and Investments. Pilot surveys for *A. h.* var. *glabratus* were conducted in 2014, to provide more detailed mapping of its distribution on Cedar Mountain and populate the state species abstract. The 2014 surveys on Sheep Mountain were unsuccessful.

After the species description was published, specimens of *Astragalus hyalinus* at the Rocky Mountain Herbarium were reviewed by B.E. Nelson, and additional specimens of *A. h.* var. *glabratus* were annotated. A total of five specimens were added. The collection record information was entered at Wyoming Natural Diversity Database as representing at least four more populations.

Expanded 2019 survey for smooth summer milkvetch was set as botany fieldwork priority by mutual agreement of BLM Cody Field Office and Wyoming Natural Diversity Database (WYNDD), expanding surveys in Cedar Mountain and Sheep Mountain areas, and initiating surveys in three new areas. The goals were to further document the taxon and its habitat requirements, map its local distribution at all BLM lands and proximal public lands, and address the core information addressed in state species status reports.

METHODS

Astragalus hyalinus var. *glabratus* specimen data were compiled prior to the start of fieldwork (Table 1) and a specimen map was prepared (Figure 1). Specimens included the type specimens in the taxonomic publication (Dorn 2014), collections made in 2014 surveys, and the five additional specimens that were annotated at the Rocky Mountain Herbarium since the publication. All five of the population records as used for 2019 surveys are printed out and accompanied by population maps, as presented in Appendix A.

Figure 1. Map of *Astragalus hyalinus* var. *glabratus* specimen collection sites, northwestern Wyoming

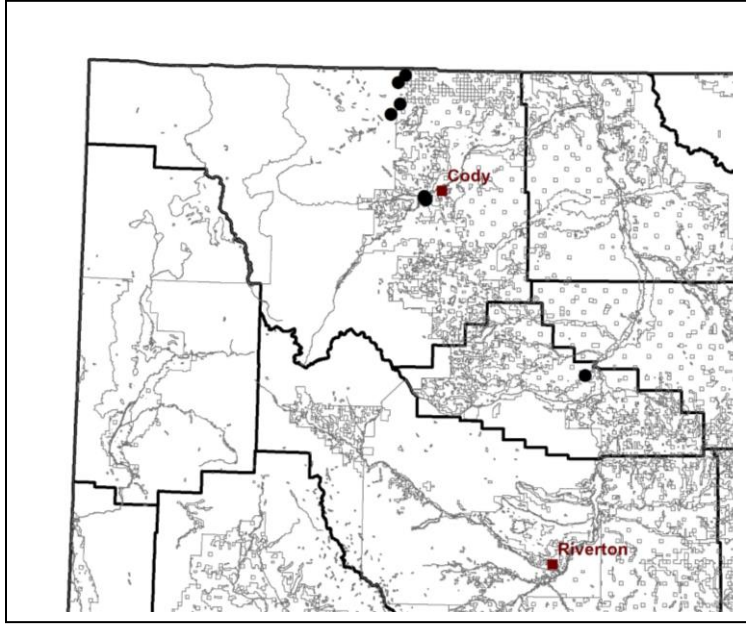


Table 1. Specimens of *Astragalus hyalinus* var. *glabratus* referenced in 2019 surveys

Population record	Specimen*	Date	County	Location
001	<i>Evert 3012; Dorn 5023; Heidel 3984, 3985, 3987</i>	7 July 1981; 30 June 1989; 30 June 2014	Park	Cedar Mountain
002	<i>Nelson 13539</i>	18 June 1987	Hot Springs	Gebo area
003	<i>Kademian 1551; Nelson 15671</i>	26 June 1988; 9 June 1988	Park	Line Creek
004	<i>Nelson 71151</i>	24 May 2007	Park	Clarks Fk Canyon mouth – upstream
005	<i>Nelson 71172</i>	24 May 2007	Park	Clarks Fk Canyon mouth – downstream

*All specimens are deposited at the Rocky Mountain Herbarium except that the earliest collection by Evert (paratype) was deposited at Harvard, and a duplicate of the collection by Dorn (holotype) was deposited at Missouri Botanical Garden.

Surveys were conducted on 7-10 July 2019 to coincide with flowering phenology. The growing season was relatively late in the cool 2019 growing season.

All of the population records on or near BLM lands were surveyed (all but population record 004, above on Shoshone National Forest) for work that included relocating the earlier collection site, expanding population boundaries using NAIP digital orthophotographs, and

filling in local gaps from the 2014 surveys and expanding surveys to nearby landforms. The aerial images were printed out at the same scale as USGS topographic maps to discern outcrops as a focus for surveys and to aid in navigation.

When smooth summer milkvetch was found, GPS coordinates were recorded, local extent was determined, and the approximate number of plants and associated species were recorded. A voucher specimen was collected at each new location. Photographs were taken of the taxon and its habitat.

RESULTS - SPECIES INFORMATION

A. Classification

1. Scientific name: *Astragals hyalinus* M.E. Jones var. *glabratus* Evert ex Dorn
2. Synonyms: none
3. Common name: Smooth summer milkvetch
4. Family: Fabaceae (Bean Family)
5. Size of genus: There are 62 species of *Astragalus* in Wyoming (Dorn 2001). There are 354 species in North America (Welsh and Spellenberg. In preparation).
6. Phylogenetic relationships: The species was recognized by D. Isely (1998) as a member of the sect. *Orophaca*, a tuft-forming group of milkvetches in the Great Plains and Rocky Mountain flanks, with trifoliolate leaves, and base chromosome number of $x = 12$. Note: Wyoming is the only state with all six species in this section.

B. Present legal or other formal status

1. National legal status:
2. Global Heritage rank: G4T1 (The “T” rank pertains to the taxonomic level below the species, and the “1” indicates that the variety is critically imperiled throughout its range.)
3. State Legal status: none
4. State Heritage rank: S1 (The “S” rank pertains to the particular taxon and the “1” indicates that the variety is critically imperiled throughout Wyoming.)
5. Wyoming Contribution rank: Very high (endemic to Wyoming)

C. Description

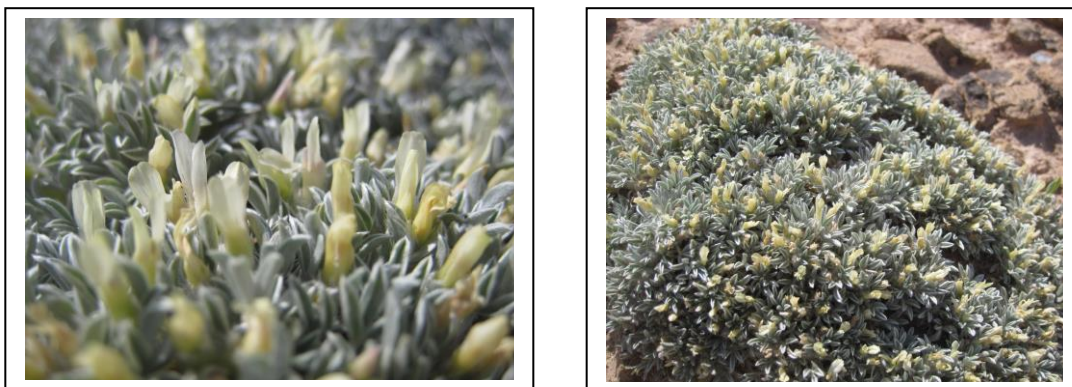
1. General non-technical description: Smooth summer milkvetch is a densely-matted perennial herb with a branching caudex forming discrete circular mounds up to 20 cm radius. Leaves are divided into three leaflets that are oblanceolate to ovate, and silvery pubescent with pick-shaped hairs. The leaf stalk is 3.5 cm or less, with overlapping stipules at the base obscured by long hairs. The calyx tube is over 5.5 mm long. Petal color is described as predominantly white (Dorn 2014) but lavender is reported in fresh petals, often drying yellowish (Heidel 2015). The pea-like flowers are sessile or on short stalks bearing 1-2 flowers. The upper petal (banner) is fiddle-shaped and 12 mm or longer. The petals are glabrous dorsally, sometimes with a short tuft of hairs at the very base. The fruits are upright, elliptical pods that are become overtopped by the leaves and are often hidden

among the leaf bases. Fruits have 6-8 ovules, though often only one or two seeds are produced (Dorn 2001, 2014, Heidel 2015) (Figures 2-4).

Figures 2-4: *Astragalus hyalinus* var. *glabratus*



Figures 5-6: Older flowers of *Astragalus hyalinus* var. *glabratus* may fade to creamy white



2. Technical description: *Astragalus hyalinus* var. *glabratus* is distinguished from the type variety by glabrous dorsal surface of the banner petal, and generally fewer ovules (6-8).

3. Local field characters: There are two local field characters that warrant closer examination. The timing of flowering is said to distinguish both varieties from other species in sect. *Orophaca*. However, two of the annotated specimens of *Astragalus hyalinus* var. *glabratus* were collected in flower in May (Nelson 71151, 71172). In addition, it is described as predominantly white, like the type variety (see Dorn 2014). However, I found lavender flower colors predominated at Cedar Mountain in both 2014 and 2019 surveys with a few plants in the harshest settings all white; and that whitish or cream colored flowers predominated at Gebo in 2019 surveys, with the more sheltered Sand Draw population segment maintaining some individuals with lavender flowers. I previously suggesting that they change from lavender to white as flowers age (Heidel 2015). If true, then this is a coloration change that is not known from other members of the sect. *Orophaca* and it confounds interpretation of the simplest field character, i.e., flower color. In fresh flowers, the banner tip and keel tip have the deepest color, and the banner veins and base of wing petals were usually also colored. It seemed that in older flowers, all coloration disappeared and was replaced by creamy white.
4. Similar species: *Astragalus hyalinus* var. *hyalinus* has petals villous on the back, and generally more ovules (8-9). The type variety also usually has solid white petals, rather than lined or tinged with lavender at the onset of flowering. It is not an identification trait but Dorn (2014) reported that the type variety does not overlap in distribution, located at about 75 km to the east in the eastern Big Horn Basin. *A. hyalinus* (both varieties) differs from other 3-leaflet species of *Astragalus* that grow in mats or tufts by either the long calyx tube, 5.5 mm or more long, or the fiddle-shaped banner. It generally blooms later than the other species (Dorn 2014). *Astragalus gilviflorus* is the most widespread of tufted milkvetches in the Big Horn Basin and it differs from *A. hyalinus* in having a banner that is oblanceolate to spatulate, and leaves that are often longer (1-10 cm).

There is one milkvetch that usually forms small clumps rather than mats and which is found with *Astragalus hyalinus* var. *glabratus*: *A. spatulatus*. There are four other *Astragalus* species on other Cedar Mountain habitats, but they do not form dense mats. They include *A. kentrophyta* var. *tegetarius* and (in or near occupied habitat), and *A. gracilis*, *A. miser* var. *decumbens* and *A. purshii* in other habitats (as noted in 2014 surveys and from RM on-line database 2015).

A table of distinguishing characteristics among tufted milkvetches in Wyoming has been developed (Heidel 2011a), based on Dorn (2001), Isely (1998) and Barneby (1989). It is printed on the following pages, replacing “undescribed taxon” in Dorn (2001) with *Astragalus hyalinus* var. *glabratus*.

Table 2 Distinguishing characteristics among tufted milkvetches in Wyoming (expanded from Heidel 2011a, 2015)

Species	Leaves	Growth form	No. of flowers	stipule pubescence	peduncle length	calyx length (mm)	banner length (mm)	banner color	banner pubescence	banner shape	wing length (mm)	keel length (mm)	ovules	pod	Phenology (WY)
<i>A. barrii</i>	compound, 3 lflets	dense cushion	2-5	ciliate on margins, sometimes glabrous dorsally	7-24 mm	3.6-6.5	10-16	purple with light purple veins*	very sparse dorsally to glabrous*	spathulate	9-13	7.5-10.5	(1-3)	lanceoloid w/ long beak, compressed, turgid	late April-early June
<i>A. calycosus</i>	compound (5 lflets present)	tufted or cushion	1-17	glabrous dorsally	(pedicel)	3.6-6.5	9.5-15	variable; whitish, pale blue or pink, bright purple	glabrous	spathulate	7-11.6	67.5-10.5	13-28	oblong-ellipsoid, trigonously compressed	late May-early June
<i>A. drabelliformis</i>	Simple	loose mat	1-5	glabrous	(pedicel)	2.5-5	5-7	pink-purple	glabrous dorsally	spathulate	gap	gap	7-10	trigonous, turgid, grooved dorsally	June
<i>A. gilviflorus</i> var. <i>gilviflorus</i>	compound, 3 lflets	loose mat	2 (rarely 1 or 3)	glabrous dorsally except at base	obsolete or nearly so	9.3-20 (10-15)	16-28	white or ochroleucus; sometimes tipped with purple	glabrous dorsally	oblanceolate to spatulate; tapering evenly to base	12.2-24.2	10.4-21.8	gap	ovoid-ellipsoid, 6-10 x 2.5-5.	May-early June
<i>A. gilviflorus</i> var. <i>purpureus</i>	compound, 3 lflets	loose mat	2	ciliate, nearly glabrous	obsolete or nearly so	9-14.5 (7-11)	12-22	purple	glabrous dorsally	oblanceolate to spatulate; tapering evenly to base	18.7-22	16-19	15-19	ovoid-ellipsoid, 6.8-11.5 x 2.8-4.	(late May) June-early July (Fremont Co.)
<i>A. hyalinus</i> var. <i>hyalinus</i>	compound; 3 lflets	dense mat	1-2 (3)	ciliate on margins	none - 3.5 mm	5.5-7	12-18	whitish corolla with purplish tips	villous dorsally	fiddle-shape	10-17 mm	10-13 mm	8-9	ovoid-ellipsoid, 5-6	late June-early Aug
<i>A. hyalinus</i> var. <i>glabratus</i> ["Undescribed taxon" in Dorn 2001]	compound, 3 lflets	dense mat	1-2	gap	gap	5.5+	12+	white, usually lined or tinged w/ lavender, drying yellowish	glabrous dorsally	fiddle-shape	gap	gap	6-8	gap	late June – early July
<i>A. proimanthus</i>	compound; 3 lflets	dense mat	gap	glabrous	obsolete or nearly so	8-10.5	gap	predom. yellow; sometimes white w/ purplish markings	glabrous dorsally	fiddle-shape	11.1-16	11.1-12.8	11-14	narrowly ellipsoid, straight or slightly decurved, ~laterally compressed	late April-early June

<i>A. serioleucus</i> var. <i>aretioides</i>	compound; 3 lflets	dense cushion	(2) 3-5	glabrous dorsally except upper margin	(pedicel)	2.5- 4.2	5-8	vivid pink, magenta, reddish violet	glabrous dorsally	spatulate	(5-7)	4-4.5	6-11	Ovoid- ellipsoid, slightly compressed	June
<i>A. serioleucus</i> var. <i>serioleucus</i>	compound; 3 lflets	stems often elongate- creeping	2	pilose dorsally	1-2.5, gen exserted above lvs	2.5- 4.2	5-8	dark purple	Gap	spatulate	5-6	5-5.8		ovoid- acuminate to lanceolate, laterally compressed but turgid, 4-6.5	June
<i>A.</i> <i>simplicifolius</i>	Simple	dense cushion	1-4	ciliate on margins	0.5-1.8	4.5-7	10.5- 16	pink-purple	Gap	spatulate	9.8-11.6	7-9.6	11-14	laterally compressed, 6-13 mm long	May-mid June
<i>A. spatulatus</i>	Simple	variable	1-11	gap		2.5-5	6-9.5	pink-purple	gap	spatulate	6-8	4.5-6	gap	laterally compressed	May-June
<i>A.</i> <i>tridactylicus</i>	compound; 3 lflets	tufted or prostrate cushion	2-4	lower stipules pilose dorsally	2-10	1.5- 3.8	7-9	pink-purple	glabrous dorsally	1.8-3.5	gap	4.5-7.2	gap	ellipsoid and turgid	June
Marriott 11545 (reported in Heidel and Marriott 1996)	compound; 3 lflets	gap	gap	ciliate on margins	none to very short	5	10.5	yellowish- cream with purple veins	strigose dorsally	gap	slightly <10 mm	8.5 mm	gap	gap	gap

D. Geographical distribution

1. Range: Distribution of *Astragalus hyalinus* var. *glabratus* spans almost 90 miles (145 km) from the middle of Hot Springs County in the Kirby area to the north end of Park County (Figure 1), in foothills of the Absaroka and Beartooth Mountains.
2. Extant sites: All five records are presumed to be extant. Two of the four population were mapped in greater detail and extent at Cedar Mountain and at Gebo. Two of the populations could not be relocated even though vegetative plants were noted (possibly past flowering), the populations located upstream and downstream from the Clarks Fork Canyon mouth. These two correspond to the specimens that had been collected in May, six weeks earlier than the type collections. It is inferred that all original collections represent extant populations. The unsuccessful 2019 surveys are basis for determining that any given population has narrower phenology than the variety as a whole.

Table 3. Location information for known occurrences of *Astragalus hyalinus* var. *glabratus*

EO#	Site Name	Agency	County	Legal Description	Elevation (ft)	USGS 7.5' Quad	Location
001	Cedar Mtn	BLM	Park	T52N R102W Sec 7 summit in the NE ¼ of the SE ¼ of the NE ¼; downslope in Sec 8 (SE ¼ of NW ¼ of SW ¼; SW ¼ of SE ¼ of SE ¼; NW ¼ of SW ¼ of SE ¼; and S ½ of NW4) and in Section 17 (SW ¼ of NE ¼ of NE ¼). Plus	6300-7600	Irma Flats	Cedar Mountain; expanded 1 mile to east in 2019
002	Gebo	BLM	Hot Springs	Within T44N R95W Sec 9, 10, 11, or 15	Kirby, Little Sand Draw	4500-	Gebo area; expanded 2 miles to Sand Draw in 2019
003	Line Cr	USFS	Park	Within T57N R103W Sec 3, 4, 5, 8, 9, or 10; and T58N R103W Sec 22, 23, 24,25, 26, 27, 32, 33,34,or 35		~5600-7600	Line Creek area
004	Clarks Fk canyon mouth	USFS (near BLM)	Park	T56N R104W Sec 23 NE ¼		4640	Upper
005	Clarks Fk canyon mouth	BLM	Park	T56N R103W Sec 5 W ½		4520	Lower

3. Historical sites: None known.
4. Unverified/Undocumented reports: None.
5. Sites where present status not known: Unable to confirm Clarks Fork Canyon mouth populations.
6. Additional Areas surveyed but species not located: Negative survey results are highlighted in Table 4, representing both 2014 and 2019 surveys.

Table 4. Survey locations for *Astragalus hyalinus* var. *glabratus* where it was not found

Site Name	County	Legal Description	Elevation (ft)	USGS 7.5' Quad
Sheep Mountain	Park	T52NR104W Sec 19, 30, 31; T52N R104W Sec 22, 23, 24	6000-7800	Castle Rock Creek
East of Clarks Fork mouth	Park	T56NR102W Sec 9	4300-4600	Bald Peak
Rattlesnake Ridge	Park	T52NR102W Sec4; T52NR103W Sec 2; T53N \$102W Sec 31, 32, 33	5200-8640	Shoshone Canyon

In 2019, my original plans were to survey the length of Rattlesnake Ridge and lands to the north of it via the Monument Hill Road. This road provides the only public access and was closed in 2019, so survey was limited to the lower 3.5 miles of Rattlesnake Ridge as accessed on foot from the southeastern corner. This surveyed segment is the portion that is closest to the Cedar Mountain population, though there is more potential habitat to the north and northwest that was not surveyed.

E. Habitat

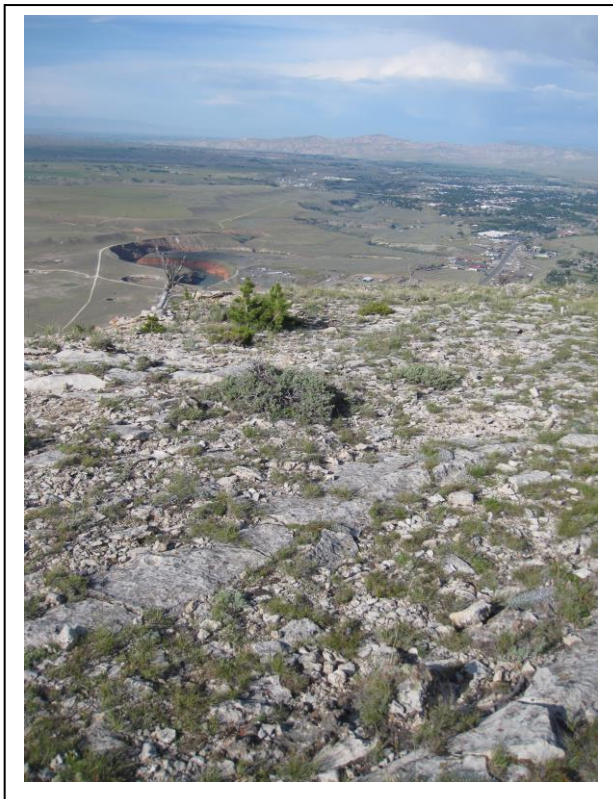
1. Associated vegetation: *Astragalus hyalinus* var. *glabratus* occupies cushion plant community and sparsely-vegetated barrens. The setting and associated vegetation were described by Evert (2010) as limestone outcroppings and pavements in limber pine-juniper woodlands from 6500-7500 ft, and described by Dorn (2014) as rocky calcareous ridge at 7600 ft.
2. Frequently associated species: The species associated with *Astragalus hyalinus* var. *glabratus* and overall composition of the two population sites both had a preponderance of cushion plants. There were composition overlaps but, in general, the species that were most common at one site were not common at the other if present at all. The general composition of occupied habitat at the two surveyed population sites is presented in Table 5.

Table 5. Species frequently associated with *Astragalus hyalinus* var. *glabratus*

Scientific name	Common name	Cedar Mtn	Gebo
<i>Achnatherum hymenoides</i>	Indian ricegrass	X	X
<i>Astragalus laxmannii</i> var. <i>robustior</i>	Prairie milkvetch		X
<i>Astragalus spathulatus</i>	Tufted milkvetch	X	X
<i>Carex filifolia</i>	Threadleaf sedge	X	X
<i>Elymus spicatus</i>	Bluebunch wheatgrass		X
<i>Eremogone hookeri</i>	Hooker's nailwort	X	
<i>Eriogonum brevicaule</i> var. <i>brevicaule</i>	Shortstem buckwheat		X
<i>Eriogonum flavum</i> var. <i>flavum</i>	Alpine golden buchweat	X	
<i>Hesperostipa comata</i>	Needle-and-thread		X
<i>Koeleria macrantha</i>	Junegrass	X	X
<i>Musineon divaricatum</i>	Leafy wildparsley	X	
<i>Packera cana</i>	Wooly groundsel	X	
<i>Phlox hoodii</i>	Hood's phlox		X
<i>Pinus flexilis</i>	Limber pine	X	
<i>Poa secunda</i>	Sandberg's bluegrass	X	
<i>Shoshonea pulvinata</i>	Shoshonea	X	

On Cedar Mountain it occupies the same habitat as another rare species, *Shoshonea pulvinata* (Shoshonea), and status reports on the latter may be relevant to the milkvetch (e.g., Lesica and Shelly 1988, Dorn 1989, Heidel 2011b). No noxious weeds were detected. There were almost no non-native species present in occupied habitat, though present at nearest roads and elsewhere in surrounding landscapes.

Figures 7-8. Cedar Mountain summit (the photo above, with a view to west) and bench habitat (the photo below, with an east view to Cody) of *Astragalus hyalinus* var. *glabratus*



Figures 9-11. Gebo and Sand Draw ridge habitat of *Astragalus hyalinus* var. *glabratus*



3. Topography: Summits, ridges and benches
4. Soil relationships: Occupies shallow soils and gravel pavement overlying bedrock of sedimentary Mesozoic and Paleozoic formations including dolomite of the Amsden Formation (Cedar Mountain); and sandstone and sandy siltstone in both the Mesa Verde Formation (Gebo) and the Lance Formation (north of Gebo, on Sand Draw).
5. Regional climate: The annual precipitation at Cody nearest Cedar Mountain is 10.53 in (26.75 cm), mean annual maximum temperature is 58.9° F (14.94 °C) and mean annual minimum temperature is 34.7° F (1.5 °C)(1981-2010). This represents a possibly wetter and warmer trend compared to the full period of climate data with 9.92 in (25.20 cm) mean annual precipitation, 58.9 °F (14.94 °C) mean annual maximum temperature and 34.7 °F (1.5 °C) mean annual minimum temperature (1915-2016). The annual precipitation at Thermopolis (nearest Gebo) is 12.35 in (31.37 cm), with an average monthly maximum temperature of 63.6 °F (17.56 °C), average monthly minimum temperature of 33.8 °F (1 °C) (1981-2010). This represents a possibly wetter and warmer trend compared to the full period of climate data, with 11.5 in (29.21) annual precipitation, 62.6 °F (17.00 °C) maximum monthly annual temperature and 30.0 °F (-1.1 °C) annual minimum monthly temperature (1899-2016).

6. Local microclimate: The settings are extremely exposed to wind. The largest Cedar Mountain subpopulations are on north-facing rims. The largest Gebo subpopulations are on gentle ridgetops and include south-facing slopes.

F. Population size and condition: Only two populations have size estimates. Their combined totals are between ~5000-11,000 plants. The Cedar Mountain population is the largest of the two that have been surveyed. It has high density so that, even though it may occupy less surface area than at the Gebo population, it has high density and numbers that are probably at least 5X greater.

Table 6. Size of *Astragalus hyalinus* var. *glabratus* populations

Site name	Population size
Cedar Mtns	4000-9000
Gebo	650-2100
Line Creek	Unknown
Clarks Fork Canyon mouth, upper	Unknown
Clarks Fork Canyon mouth, lower	Unknown

1. Reproductive biology
 - a. Type of reproduction: Reproduces by seed.
 - b. Pollination biology: Pollinated by bees.
 - c. Seed dispersal and biology: It is not known if seeds are edible. It is possible that they do not have specialized dispersal mechanisms because the pods are at about ground level tucked in a leaf bases. Unopened pods were found buried by soil in the root crown of individual plants collected as voucher specimens.

G. Population ecology

1. General summary: Populations exhibit patchy distribution pattern with highest numbers and density in the most suitable habitat found at high points, and with outliers on finger ridges and at lower slopes.
2. Competition: None noted.
3. Herbivory: None noted. The hairy leaves and low growth form are not conducive to grazing or browsing.
4. Hybridization: None noted.

H. Land ownership: Three of the five populations are on lands administered by the Bureau of Land Management, including the Cody Field Office (two) and Worland Field Office (one).

CONSERVATION CONSIDERATIONS

A. **Potential threats to currently known populations:** One of the two main subpopulations of *Astragalus hyalinus* var. *glabratus* on Cedar Mountain is a highly accessible overlook above the Shoshone Canyon. It appears that it may be heavily used. There, the outcrop habitat rises less than 10 m above the Cedar Mountain Road, and vehicles have been driven up its slopes for panoramic views. Placement of boulders along the road to separate the road from the overlook are a potential deterrent.

The other large subpopulation on Cedar Mountain is at the summit, besides radio towers that are closed to public access. It is inferred that the original radio tower construction that took place prior to discovery of the taxon may have been reduced occupied habitat. In 2014, it was noted that parts of the population had significant numbers of dead individuals present, as though they had died from drought in recent years.

The townsite of Gebo, now abandoned, was established in 1907 and associated with local coal-mining. Coal veins outcrop in the area, and small abandoned mines lie below ridges with occupied habitat, but there are no active mining operations.

The collection site on BLM land near the Clarks Fork canyon mouth adjoins private property and a house constructed on it, perhaps since the 2007 collection, may affect adjoining public land management.

Livestock grazing is the prevalent land use in the settings overall. There were no signs of grazing or trampling of the taxon or its habitat observed in 2014 or 2019 surveys.

B. **Present considerations:**

1. Notification of BLM personnel of locations on BLM lands: This report is submitted to three BLM offices as framework for status review.
2. Status notes: The majority of known *Astragalus hyalinus* var. *glabratus* populations are on BLM lands, including the largest known ones, and the ones with immediately-discernible threats.
3. Summary: This status survey project did not significantly expand known distribution of *Astragalus hyalinus* var. *glabratus* but it documented local distribution, provided synthesis of the new specimen information, and highlighted important information coming out of these specimen records. The specimen collection label data greatly expand the range of elevations, originally described as 6500-7500 feet, to as low as 4500 feet. This signifies elevation overlap if not geographic proximity with the type variety in at least the Gebo area. The specimen data further document that different populations may have different, and presumably nonoverlapping, phenology with some populations of this summer milkvetch flowering as early as May. Furthermore, it lays out the hypothesis that flower color, one of the simplest characteristics to observe, may change significantly during the course of flowering from a lavender color as consistently on the banner tip and veins when fresh, to a creamy white color.

DISCUSSION

There may be a need for more collecting and specimen review of the two varieties and among tufted milkvetches in the Big Horn Basin and adjoining mountain flanks. The two varieties of *Astragalus hyalinus* are not geographically separated at the south end of the Big Horn Basin, and there are collections of *Astragalus hyalinus* var. *hyalinus* at similar or higher elevations compared to the new variety, e.g., one collected at 8000 ft from the Owl Creek Mountains (*Lichvar* 5379). The geographic and elevation range limits of tufted milkvetches may hold clues to the taxonomic relationships of *A. h.* var. *glabratus* and other tufted milkvetches.

At the north end of the Big Horn Basin and adjoining Pryor Mountains are collections of *Astragalus aretioides* as reported from Montana (Lesica 2012). This lavender-colored species of milkvetch is documented in southern Wyoming but not northern Wyoming. Its presence in Montana may or may not hold clues to the taxonomic relations of *Astragalus hyalinus* var. *glabratus* to other tufted milkvetches.

The information presented in this report represents the data available to date and a working interpretation. It provides a reminder of the challenges and dynamics of understanding of the flora and conservation priorities within it.

LITERATURE CITED

- Barneby, R.C. 1989. Fabales, Vol. 3 Part B. IN: A. Cronquist, A. H. Holmgren, N.H. Holmgren, J.L. Reveal, and P.K. Holmgren. *Vascular Plants of the Intermountain West, USA*. New York Botanical Garden, Bronx, NY. 279 pp.
- Dorn, R. D. 1989. Report on the status of *Shoshonea pulvinata*, a Candidate Threatened species. Unpublished report prepared for the U.S. Fish and Wildlife Service by Mountain West Environmental Services, Cheyenne, WY.
- Dorn, R.D. 2001. *Vascular Plants of Wyoming*, third edition. Mountain West Publishing, Cheyenne, WY.
- Dorn, R.D. 2014. A new variety of *Astragalus hyalinus* (Fabaceae) from Wyoming. *Phytologia* 96(1):26-27.
- Evert, E.F. 2010. *Vascular Plants of the Greater Yellowstone Area: Annotated Catalog and Atlas*. Published by Author, Park Ridge, IL.
- Heidel, B. 2011a. Surveys for *Astragalus gilviflorus* var. *purpureus* in the Big Horn Basin, Wyoming. Unpublished report prepared for the Bureau of Land Management Worland Field Office by the Wyoming Natural Diversity Database, Laramie, WY.
- Heidel, B. 2011b. Status of *Shoshonea pulvinata* (*Shoshonea*), Park County, Wyoming. Prepared for the Bureau of Land Management – Cody Field Office. Wyoming Natural Diversity Database, Laramie, WY.
- Heidel, B. 2015. Survey for *Astragalus hyalinus* M.E. Jones var. *glabratus* Evert ex Dorn

(smooth summer milkvetch) in northwestern Wyoming. Prepared for the USDI Bureau of Land Management – State Office and Cody Field Office by the Wyoming Natural Diversity Database - University of Wyoming, Laramie, Wyoming.

Isely, D. 1998. Native and Naturalized Leguminosae (Fabaceae) of the United States (exclusive of Alaska and Hawaii). MLBM Press, Monte L. Bean Life Science Museum, Brigham Young University, Provo, UT.

Lesica, P. and J.S. Shelly. 1988. Report on the conservation status of *Shoshonea pulvinata*, a candidate Threatened species. Report prepared for the U.S. Fish and Wildlife Service by the Montana Natural Heritage Program, Helena, MT.

Lesica, P. 2012. *Manual of Montana Vascular Plants*. Botanical Research Institute of Texas. Fort Worth, TX.

New York Botanical Garden. 2015. C.V. Starr Virtual Herbarium Database. Searched online. <http://sciweb.nybg.org/science2/vii2.asp.html>.

Rocky Mountain Herbarium. 2015. RM Herbarium Specimen Database. Searched online. <http://www.rmh.uwyo.edu/data/search.php>.

Welsh, S. and R. Spellenberg. In preparation. *Astragalus*. For: Flora of North America Editorial Committee; 1993+. *Flora of North America North of Mexico*; 12+ vols; New York and Oxford.