

Purple milkvetch (*Astragalus agrestis*)

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Nomenclature

Purple milkvetch (*Astragalus agrestis* Douglas ex G. Don) belongs to the Euastragalus group (Hermann 1966) and Hypoglottioidei section (Barneby 1989) of the Fabaceae or pea family (USDA NRCS 2023).

Family

Fabaceae – Pea family

Genus

Astragalus

Species

agrestis

NRCS Plant Code

ASAG2 (USDA NRCS 2023)

Synonyms

Astragalus dasyglottis Fisch. ex DC, *A. danicus* Retz. var. *dasyglottis* (Fisch. ex DC) B. Boivin, *A. goniatus* Nutt., *A. hypoglottis* Hook. (USDA NRCS 2023).

Common Names

Purple milkvetch, field milkvetch, Cock’s head, Don meadow-milkvetch, nickleaf vetch, purple loco (Barneby 1989; Smreciu et al. 2013; Welsh et al. 2016; Stubbendieck and Milby 2021).

Chromosome Number

2n = 16 (Welsh et al. 2016).

Distribution

Purple milkvetch occupies a broad range in western North America. It occurs from Alaska and Yukon east to Manitoba or Ontario and south to California, Nevada, New Mexico, Nebraska, and Iowa (Welsh et al. 2016; Hitchcock and Cronquist 2018; SOS SM 2023).

Habitat And Plant Associations

Purple milkvetch occurs in a variety of grassland, shrubland, and forest vegetation types (Fig. 1). It is often associated with depressional or poorly drained areas where water collects or persists at least early in the growing season (Barr 2015). Throughout its range, it is found in partially moist, shady sites (Hermann 1966) such as meadows, water edges, and cool, brushy slopes (Barneby 1989; Spellenberg 2001; Fox et al. 2010). It is considered infrequent to locally common in prairies, meadows, thickets, open woodlands, and along roadsides and lake and stream margins (Stubbendieck and Milby 2021).

In Canada, purple milkvetch occurs in prairies and along shores. In a botanical survey of the Yellowknife Highway in the Northwest Territories, purple milkvetch grew in grasslands and along gravelly lake or stream shores (Thieret 1963). In Kinsella, Alberta, cover of purple milkvetch was 5% in native plains rough fescue (*Festuca*

hallii) grasslands and cover dropped to 1% when these grasslands had greater than 40% cover of nonnative smooth brome (*Bromus inermis*) (Carrigy et al. 2016). Frequency of purple milkvetch was high in both Altai fescue (*F. altaica*) dominated and shortbristle needle and thread-thickspike wheatgrass (*Hesperostipa curtisetula*–*Elymus lanceolatus*) dominated grasslands at Kern Prairie northeast of Saskatoon, Saskatchewan (Redmann et al. 1993).

Various habitats are occupied by purple milkvetch in the United States. In Montana, plants are reported in grasslands, meadows, sagebrush (*Artemisia* spp.) steppe, open forests, and in thickets near streams (Lesica 2012). Plants occurred in ponderosa pine-juniper (*Pinus ponderosa*–*Juniperus* spp.) woodlands, thickets and wooded coulees, mixed-grass prairies, sagebrush steppe communities, and moist coulee bottoms and swales in Phillips and Valley Counties in Montana (Charboneau et al. 2013). At the Central Grasslands Research Center northeast of Streeter, North Dakota, purple milkvetch was associated with northern mixed-grass prairie occupying well-drained soils with moderately fine textures where the climate was continental with an average January temperature of 9 °F (-13 °C) and July temperature of 70 °F (21 °C). The average frost-free period was 132 days, and annual precipitation averaged 18 in (446 mm). The north mixed-grass prairie was dominated by Kentucky bluegrass (*Poa pratensis*), western wheatgrass (*Agropyron smithii*), green needlegrass (*Nassella viridula*), and sedge species (*Carex* spp.) (Biondini et al. 1998). In Teton County, northwestern Wyoming, purple milkvetch occurred in willow (*Salix* spp.) bottomland, sagebrush, and montane meadow, mixed-conifer, and shrubland vegetation types (Kesonie and Hartman 2011). In the Medicine Bow National Forest in southeastern Wyoming, it occurred in dry montane meadows, in northern mixed-grass prairie, in sagebrush, and along roadsides (Lukas et al. 2012). In the Rocky Mountains of the Colorado Front Range, plants formed patches on plains and mesas (Hermann 1966) and grew in open ponderosa pine-Douglas-fir (*Pseudotsuga menziesii*) stands in the montane zone (Johnson and Cline 1965). In Utah, plants were common in meadows and in the openings of sagebrush shrublands and quaking aspen (*Populus tremuloides*) woodlands (Welsh et al. 2016). In northeastern California, plants occurred in sagebrush vegetation at about 5,400 ft (1,650 m) in elevation (Hickman 1993).

Elevation

Purple milkvetch commonly occurs at low to mid-elevations, but plants are found at elevations of up to 10,500 ft (3,200 m) in the Rocky Mountains (Barneby 1989) and 15,000 ft (4,600 m) in New Mexico (Fox et al. 2010). In its limited distribution of Lassen County, California, plants occur at about 5,500 ft (1,700 m) (Munz and Keck 1973). In Utah, the elevation range of this species is 6,070 to 10,000 ft (1,850–3,050 m) (Welsh et al. 2016), and in New Mexico it is 7,000 to 15,000 ft (2,100–4,600 m) (Fox et al. 2010).

Soils

The soils associated with purple milkvetch habitats are often described as seasonally moist and alkaline. Soil texture descriptions range from gravelly to sandy clay loams to stiff clays (Smith 1960; Thieret 1963; Munz and Keck 1973).

In floras of California and Utah, purple milkvetch was described in association with sites that were moist in spring or early summer (Hickman 1993; Welsh et al. 2016). In a study of montane wetland vegetation near Grays Lake in southeastern Idaho, vegetation was compared along a moisture gradient from semi-permanently flooded to dry. Purple milkvetch occurred in dry upland meadows and temporarily flooded mesic meadows. This region experiences severe prolonged winters with temperatures as low as -49 °F (-45 °C) and freezing temperatures are possible in any month. Summer temperatures can reach 95 °F (35 °C). Annual precipitation averages 14 in (535 mm), and snow accumulation averages 86 in (219 cm) (Austin et al. 2007).

Alkaline soils were described in association with purple milkvetch habitats in the Intermountain West (Barneby 1989) and in eastern Washington where it occasionally grows on the margins of vernal pools (Björk and Dunwiddie 2004). In the Athabasca River Valley in Alberta, purple milkvetch was a significant indicator of the Richardson's needlegrass (*Achnatherum richardsonii*) type with subxeric to mesic soils with a pH level above 7 (Gould 2007).

In California, purple milkvetch grows in stiff clay soils that are moist in the spring (Munz and Keck 1973). In the Jackson Hole area of Wyoming, it grows in big sagebrush/Sandberg bluegrass (*Artemisia tridentata*/ *Poa secunda*) communities occupying north slopes with slightly alkaline, sandy clay loam soils with very low phosphorus levels (Smith 1960).



Figure 1. Typical forest margin habitat for purple milkvetch in Alaska. Photo: U.S. Department of the Interior, Bureau of Land Management (BLM) AK930 Seeds of Success (SOS).

Description

Purple milkvetch is a decumbent to ascending perennial (Fig. 2) with weak stems that arise from a buried caudex or from long rhizomatous caudex branches (Barneby 1989; Hickman 1993; Welsh et al. 2016; Hitchcock and Cronquist 2018). Munz and Keck (1973) described purple milkvetch as having a deeply buried caudex, but plants growing in Idaho fescue-bluebunch wheatgrass (*Festuca idahoensis*–*Pseudoroegneria spicata*) grasslands in southwestern Montana were considered shallowly rooted with roots averaging 4 in (10 cm) deep (Pokorny et al. 2004).



Figure 2. Purple milkvetch plant growing in a tangle with other plants in Wyoming. Photo: BLM WY090 SOS.

Plants are diffuse to loosely tufted, and often clambering, ranging from 1.5 to 17 in (4–43 cm) tall (Barneby 1989; Hickman 1993; Spellenberg 2001; Welsh et al. 2016; Hitchcock and Cronquist 2018; Stubbendieck and Milby 2021). They grow in patches and have even been called sod-forming (Hickman 1993; Welsh et al. 2016; Stubbendieck and Milby 2021).

Leaves are alternate, odd pinnately compound, and 0.8 to 4 in (2–10 cm) long with 9 to 23 leaflets (Fig. 3) (Barneby 1989; Hickman 1993; Welsh et al. 2016; Hitchcock and Cronquist 2018). The narrowly elliptic- to oval- or lance-shaped leaflets are 0.2 to 0.8 in (4–20 mm) long and 2 to 5 mm wide with mostly obtuse or retuse, but sometimes acute, apices (Munz and Keck 1973; Hickman 1993; Spellenberg 2001; Lesica 2012; Welsh et al. 2016). Leaflet size typically decreases upward along the rachis with terminal leaflets joined to the rachis (Barneby 1989). Foliage is sparsely strigulose to pilosulose with basifixed hairs (Barneby 1989; Lesica 2012; Welsh et al. 2016). Stipules are 2 to 11 mm long, and at least the lower papery ones are sheathed or united around the stem. Upper stipules are larger and fully or distally herbaceous (Munz and Keck 1973; Barneby 1989; Hickman 1993; Lesica 2012; Welsh et al. 2016).

Perfect, erect flowers are densely clustered in groups of 3 to 15 in axillary racemes that resemble the globose inflorescences of clover but with larger, more loosely arranged, individual flowers (Fig. 3) (Weber 1976; Barneby 1989; Hickman 1993; Lesica 2012; Barr 2015; Welsh et al. 2016; Hitchcock and Cronquist 2018; Stubbendieck and Milby 2021). Individual flowers are papilionaceous and 0.7 to 1 in (1.7–2.4 cm) long (Hitchcock and Cronquist 2018). The calyx (7–12.5 mm long) is campanulate to tubular with

long spreading black or white hairs, and the corolla has five purple petals with pale wing tips and barely reflexed banners (Hermann 1966; Weber 1976; Spellenberg 2001; Lesica 2012; Welsh et al. 2016). The keel is shorter than the wings (Welsh et al. 2016). Purple milkvetch produces seed in short, erect to spreading pods that are generally ovoid, 4 to 14 mm long, and up to 4.5 mm thick (Fig. 4) (Hickman 1993; Lesica 2012; Welsh et al. 2016; Hitchcock and Cronquist 2018). Pods are pointed at the tip and three-sided with the lowest side deeply grooved (Munz and Keck 1973; Hickman 1993; Spellenberg 2001). They are leathery, rigid, and densely, silky, white villous (Hermann 1966; Hickman 1993; Hitchcock and Cronquist 2018). Pods have two cells that are divided by a partition running the full length (Hermann 1966; Munz and Keck 1973). Pods contain 14 to 26 seeds that are hard, kidney-shaped (1.5–2 mm long), and brown to black (Welsh et al. 2016; Stubbendieck and Milby 2021).



Figure 3. Purple milkvetch in flower growing in Alaska. Photo: BLM AK930 SOS.



Figure 4. Purple milkvetch producing pods. Photo: ©2012 Jean Pawek from CalPhotos.

Belowground Relationships And Interactions

Purple milkvetch is associated with nitrogen-fixing bacteria (Smreciu et al. 2013).

Reproduction

Purple milkvetch reproduces by seed and rhizomes that become detached from the parent plant (Stubbendieck and Milby 2021). Seed production by *Astragalus* spp. is limited by seed predation (Youtie and Miller 1986; Cane et al. 2013).

Plants have a long flowering window, typically from May to August (Spellenberg 2001; Stubbendieck and Milby 2021). Flowering duration was lengthened with moisture in the Great Plains (Barr 2015). Initiation of flowering was earlier (April) in southern plant populations in New Mexico (Fox et al. 2010) and later (mid-June) in northern populations in the Northwest Territories, Canada, where flowering lasted about 2 months and fruit production began in mid-August (Thieret 1963).

Pollination

Flowers are insect-pollinated. In a comparison of common eastern bumble bee (*Bombus impatiens*) colonies at organic and conventional farms at Big Sandy, Montana, purple milkvetch pollen was recovered from the bee colonies (Adhikari et al. 2019). Other researchers note that purple milkvetch flowers are visited by butterflies (Stubbendieck and Milby 2021) and consider it a pollinator-friendly plant (Arathi and Hardin 2021).

Ecology

Studies comparing disturbed and undisturbed sites suggest that purple milkvetch tolerates and is even associated with disturbance, but plant abundance can be reduced by growing-season burning and heavy grazing. In a guide to milkvetch (*Astragalus* spp.) plants of New Mexico, Fox et al. (2010) indicate that although purple milkvetch is perennial, plants sometime persist just one season.

Disturbance Ecology

Fire.

Purple milkvetch is quite fire tolerant. At Kernen Prairie northeast of Saskatoon, Saskatchewan, frequency of purple milkvetch was high in Altai fescue and shortbristle needle and thread-thickspike wheatgrass communities across spring and fall prescribed fire treatments and in the first and second post-fire years (Redmann et al. 1993). In the same Prairie, purple milkvetch seedlings emerged from soil collected immediately following spring prescribed fires. More purple milkvetch seedlings emerged from soil collected from burned prairie than mowed prairie, although not significantly more (Ren and Bai 2017). Density of purple milkvetch was greatest on fall-burned plots when unburned, spring-, summer-, and fall-burned plots were compared at plains rough fescue-dominated Kernan Prairie. Density of purple milkvetch was 1.3 stems/ft² (13.7 stems/m²) on fall-burned, 0.2 stem/ft² (2.3 stems/m²) on spring-burned, and 0 stems/m² on unburned and summer-burned plots. Plant density was evaluated in the second post-fire growing season, and the summer fire produced the highest temperatures in the soil and above ground (Gucker 2005). In the Athabasca River Valley of Alberta, cover of purple milkvetch was significantly lower in burned ($P < 0.05$) than in unburned areas after a spring prescribed fire. The fire on May 6 was a low-intensity, slow-moving surface fire. Differences between pre- and second year post-fire coverages were greatest outside of exclosures designed to keep out elk (*Cervus canadensis*) (Amiro et al. 2004).

Grazing.

Purple milkvetch is nontoxic (Spellenberg 2001; Braun et al. 2003; Fox et al. 2010) and eaten by livestock and native ungulates (Smith 1967). Plant abundance increases and decreases were reported with grazing, but rarely were abundance differences large between protected and grazed plots or among plots with increasing levels of use. In comparisons of exclosures and unprotected areas near Jackson Hole, Wyoming, Smith (1960) found that purple milkvetch increased with elk use of big sagebrush/Sandberg bluegrass vegetation on north slopes. A study at the Central Grasslands Research Center northeast of Streeter, North Dakota, compared the relative density of purple milkvetch in ungrazed (protected 9+ yrs), moderately grazed (158 g/m² aboveground biomass remaining), and heavily grazed (32 g/m² aboveground biomass remaining) northern mixed-grass prairie. In any year of evaluation (1988 to 1995), the differences between the highest and lowest relative densities were less than 4% (Biondini et al. 1998).

In ponderosa pine-bunchgrass range on the Manitou Experimental Forest in central Colorado, purple milkvetch was not impacted by different grazing intensities but increased with protection from cattle. The grazing intensities were light: 10 to 20% herbage removal, moderate: 30 to 40% removal, and heavy > 50% removal. Plants were highly palatable to cattle, and estimated use of purple milkvetch was 45 to 88% from 1942 to 1947 (Smith 1967).

In several studies, purple milkvetch occurred on disturbed sites associated with black-tailed prairie dog (*Cynomys ludovicianus*) and badger (*Taxidea taxus*) activities. In northern mixed-grass prairies at Sun Prairie in Phillips County, Montana, cover of purple milkvetch was 0.2% on plots in active prairie dog colonies, 0.4% on plots in inactive colonies (abandoned 1–11 yrs), and 0% on uncolonized plots (Gervin et al. 2019). In Badlands National Park, South Dakota, plants were associated with prairie dog colonies ($P < 0.05$) in a comparison of sites supporting and without colonies (Fahnestock et al. 2003). On badger mounds in tallgrass prairie at Cayler Prairie Preserve, Dickinson County, Iowa, purple milkvetch was ranked among the 20 most successful flowering plants in 4 years of observations (Platt 1975).

Nutrient Addition.

The addition of nutrients did not increase abundance of purple milkvetch in an early- to mid-seral needle and thread (*Hesperostipa comata*) grassland on a working ranch near Jesmond, British Columbia. The study was conducted on an area rested from livestock grazing and treated with biosolids (20 dry Mg/ha) 14 years earlier. Frequency (31%) and cover (3%) of purple milkvetch were lower on treated than on control plots (frequency 69%, cover 4%) (Avery et al. 2019).

Wildlife And Livestock Use

Native ungulates, small mammals, birds, pollinators, and livestock feed on purple milkvetch or milkvetch species. Although some related species are known to be toxic, purple milkvetch is not (Spellenberg 2001; Braun et al. 2003; Fox et al. 2010).

Purple milkvetch was noted as an important summer food for pronghorn (*Antilocarpa americana*) in Petroleum County, Montana (Cole 1955). A guide to American wildlife and plants reported that milkvetches are eaten by pronghorn and bighorn sheep (*Ovis canadensis*) (Martin et al. 1951).

Seeds of purple milkvetch and other milkvetches are eaten by western game birds (quail [*Coturnix* spp.] and wild turkeys [*Meleagris gallopavo*]), other ground-foraging birds, and small mammals (Martin et al. 1951; Stubbendieck and Milby 2021). Frequency of milkvetches (purple milkvetch, Missouri milkvetch [*Astragalus missouriensis*], or groundplum milkvetch [*A. crassiocarpus*]) was up to 60% in the diets of Merriam's wild turkeys (*M. g. merriami*) in southeastern Montana. Diets were determined from the analysis of crops from turkeys harvested in ponderosa pine forests in the fall or winter. Leaves made up less than 1% of crops by volume (Jonas 1966).

Purple milkvetch is considered pollinator friendly (Arathi and Hardin 2021), and flowers are visited by butterflies (Stubbendieck and Milby 2021). Milkvetches are used as host plants by clouded sulphur (*Colias philodice*), orange sulphur (*C. eurytheme*), western tailed-blue (*Cupido amyntula*), eastern tailed-blue (*C. comyntus*), Anna's blue (*Plebejus anna*), and Melissa blue (*P. melissa*) in the

Cascadia region, which includes the state of Washington and the adjacent areas of British Columbia, Idaho, and Oregon (James and Nunnallee 2011).

Many land managers reported that purple milkvetch is highly palatable to livestock (Hermann 1966). Based on utilization and species composition observations in ponderosa pine-bunchgrass ranges in central Colorado, purple milkvetch was considered one of the most palatable forbs by yearling heifers (Johnson and Reid 1958). In the same general area, Smith (1967) noted that it was highly palatable to cattle with an estimated use of 45 to 88%.

Ethnobotany

Thompson Indians considered many milkvetches to be good forage and identified them as rich horse and deer food (Turner et al. 1990).

Horticulture

Purple milkvetch is an attractive low-growing plant used in rock gardens. The spread of plants by rhizomes may be undesirable when using this species for landscaping (Stubbendieck and Milby 2021).

Revegetation Use

Purple milkvetch is a nitrogen-fixer (Smreciu et al. 2013), considered pollinator friendly (Arathi and Hardin 2021), and described as a sod former (Welsh et al. 2016), all useful traits in revegetation.

Developing A Seed Supply

For restoration to be successful, the right seed needs to be planted in the right place at the right time. Coordinated planning and cooperation is required among all partners to select appropriate species and seed sources; these are determined by current or projected revegetation requirements and goals (PCA 2015).

Developing a seed supply begins with seed collection from native stands. Collection sites are determined by current or projected revegetation requirements and goals as well as through consultation with land managers and stakeholders. Collected seed is distributed for restoration or first increased in seed fields to provide a larger supply of seed (PCA 2015). Production of nursery stock requires less seed than large-scale seeding operations. Regardless of the size and complexity of any revegetation effort, seed certification is essential for tracking seed origin from collection through use (UCIA 2015).

Seed Sourcing

Because empirical seed zones are not currently available for purple milkvetch, generalized provisional seed zones developed by Bower et al. (2014) may be used to select and deploy seed sources. These provisional seed zones identify areas of climatic similarity with comparable winter minimum temperature and aridity (annual heat to moisture index). In Figure 5, Omernik Level III Ecoregions (Omernik 1987) overlay the provisional seed zones to identify climatically similar but ecologically different areas. For site-specific disturbance regimes and restoration objectives, seed collection locations within a seed zone and ecoregion may be further limited by elevation, soil type, or other factors.

The Western Wildland Environmental Threat Assessment Center's (USDA FS WWETAC 2017) Threat and Resource Mapping (TRM) Seed Zone application provides links to interactive mapping features useful for seed collection and deployment planning. The Climate Smart Restoration Tool (Richardson et al. 2020) can also guide revegetation planning, seed collection, and seed deployment, particularly when addressing climate change considerations.

Occurrence Map

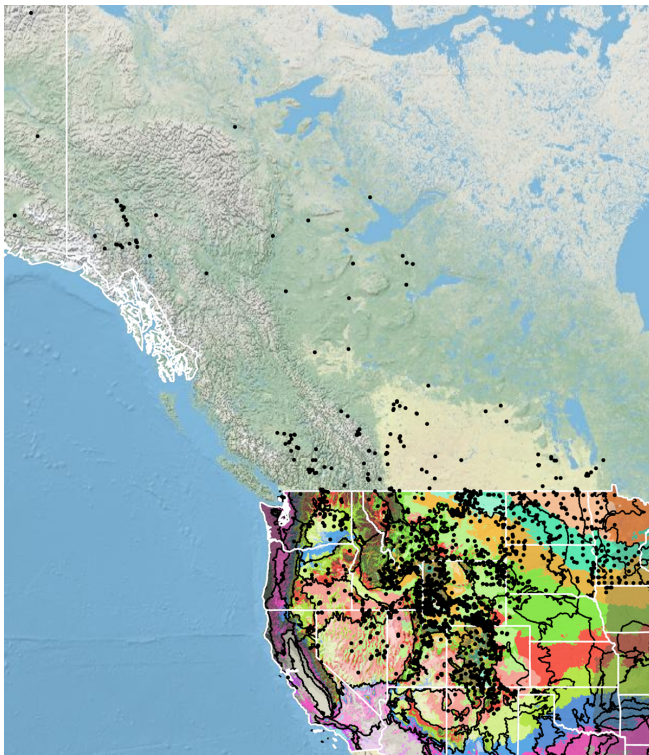


Figure 5. Distribution of purple milkvetch (black circles) based on geo-referenced herbarium specimens and observational data from 1868–2022 (CPNWH 2020; SEINet 2020; USDI USGS 2020). Generalized provisional seed zones (colored regions) (Bower et al. 2014) are overlain by Omernik Level III Ecoregions (black outlines) (Omernik 1987; USDI EPA 2018). Interactive maps, legends, and a mobile app are available (USDA FS WWETAC 2017; research.fs.usda.gov/pnw/products/dataandtools/seed-zone-webmap). Map prepared by S. Barga and B. Bautch-Breitung, USDA Forest Service, RMRS.

Releases

As of 2023, there were no purple milkvetch germplasm releases.

Wildland Seed Collection

Detailed descriptions of the pods and seeds for collection timing were lacking in the reviewed literature. Based on a few harvests made by BLM Seeds of Success collection crews, seed is typically ready for harvest in summer (June–August) (BLM SOS 2017). See other milkvetch species at WesternForbs.org for guidance related to seed collection for related species.

Wildland Seed Certification

Verification of species and tracking of geographic source is necessary whether wildland seed is collected for immediate project use or as stock seed for cultivated increase. This official Source Identification process can be accomplished by following procedures established by the Association of Official Seed Certifying Agencies (AOSCA) Pre-Variety Germplasm Program (UCIA 2015; Young et al. 2020). Wildland seed collectors should become acquainted with state certification agency procedures, regulations, and deadlines in the states where they collect.

If wildland-collected seed is to be sold for direct use in ecological restoration projects, collectors must apply for Source-Identified certification prior to making collections. Pre-collection applications, site inspections, and species and seed amount verification are handled by the AOSCA member state agency where seed collections will be made (see listings at AOSCA.org).

If wildland seed collected by a grower or private collector is to be used as stock seed for planting cultivated seed fields or for nursery propagation (See Agricultural Seed Field Certification section), detailed information regarding the collection site and collecting procedures must be provided when applying for certification. Photos and herbarium specimens may be required. Germplasm accessions acquired within established protocols of recognized public agencies, however, are normally eligible to enter the certification process as stock seed without routine certification agency site inspections. For contract grow-outs, however, this collection site information must be provided to the grower to enable certification.

Collection Timing

There were only three seed collections made by the BLM SOS collection crews as of 2022. The first was made on June 19, 2010, in Jefferson County, Colorado, at 5,920 ft (1,800 m) in elevation. The next was made on July 20, 2010, in Lincoln County, Wyoming, at 7,400 ft (2,260 m) elevation. The final collection was made from the same Wyoming sites on August 11, 2010 (BLM SOS 2017).

Collection Methods

Whole pods are collected into a breathable container (Smreciu et al. 2013). Milkvetch pods are plucked or clipped.

Several collection guidelines and methods should be followed to maximize the genetic diversity of wildland collections: 1) collect seed from a minimum of 50 randomly selected plants; 2) collect from widely separated individuals throughout a population without favoring the most robust or avoiding small stature plants; and 3) collect from all microsites including habitat edges (Basey et al. 2015). General collecting recommendations and guidelines are provided in online manuals (e.g., ENSCONET 2009; USDI BLM SOS 2021).

It is critical that wildland seed collection does not impact the sustainability of native plant populations. Collectors should take no more than 20% of the viable seed available at the time of harvest (USDI BLM SOS 2021). Additionally, care must be taken to avoid the inadvertent collection of weedy species, particularly those that produce seeds similar in shape and size to those of purple milkvetch.

Post-Collection Management

Although specific post-collection management was not described in the reviewed literature, seed collections should be kept cool and dry until they can be cleaned. Because seed predation is common for *Astragalus* spp. (Youtie and Miller 1986; Cane et al. 2013), collections should be treated by freezing or with no-pest strips to prevent insect damage.

Seed Cleaning

Seed can be cleaned by first crushing the pods, then winnowing the seed, which is followed by screening off the remaining chaff (Smreciu et al. 2013).

Seed Storage

Seed is likely orthodox, but best practices for storage or seed longevity under storage conditions were not provided in the reviewed literature.

Seed Testing

There are no AOSA guidelines or methods provided for tetrazolium chloride (TZ) testing of milkvetch seed.

Germination Biology

The following procedure was used to test germination of seed collected from soil immediately following burning and mowing treatments in Kernen Prairie northeast of Saskatoon, Saskatchewan. Soil samples collected at up to 2 in (5 cm) deep were air dried for 1 week and then spread over sterile sand. Flats were put in the greenhouse (81 °F [27 °C] day, 70 °F [21 °C] night, with an 18-hr photoperiod). Emergence was monitored for 14 weeks. Purple milkvetch emerged in both mowed and burned soils, but more seedlings emerged from the burned soils (Ren and Bai 2017).

Wildland Seed Yield And Quality

Post-cleaning seed yield and quality of two seed lots collected in the Intermountain region are provided in Table 1 (USDA FS BSE 2017). The results below come from only two seed lots.

Table 1. Seed yield and quality of purple milkvetch seed lots collected in the Intermountain region, cleaned by the Bend Seed Extractory, and tested by the Oregon State Seed Laboratory or the USDA Forest Service National Seed Laboratory (USDA FS BSE 2017).

Seed lot characteristic	Mean	Range	Samples (no.)
Bulk weight (lbs)	0.52	0.16–0.88	2
Clean weight (lbs)	0.05	0.013–0.08	2
Clean-out ratio	0.09	0.08–0.09	2
Purity (%)	98	98–99	2
Fill (%)¹	87	85–90	2
Viability (%)²	86	84–88	2
Seeds/lb	306,201	268,402–344,000	2
Pure live seeds/lb	258,506	233,832–283,181	2

¹ 100 seed X-ray test

² Tetrazolium chloride test

Marketing Standards

Acceptable seed purity, viability, and germination specifications vary with revegetation plans. Purity needs are highest for precision seeding equipment used in nurseries, while some rangeland seeding equipment handles less clean seed quite well.

Agricultural Seed Production

There was no experience reported for growing purple milkvetch for seed increase. Although this species produces rhizomes, use of these vegetative structures to establish stands was not reported in the literature but could be explored for agricultural seed production.

Please see other *Astragalus* spp. reviews at WesternForbs.org for information that might prove useful to initiation of agricultural production of purple milkvetch seed.

Agricultural Seed Certification

In order to minimize genetic changes in specific accessions of native species when increased in cultivated fields, it is essential to track the geographic source and prevent inadvertent hybridization or selection pressure. This is accomplished by following third party seed certification protocols for Pre-Variety Germplasm (PVG) as established by the Association of Official Seed Certification Agencies (AOSCA). AOSCA members in the U.S., Canada, and other countries administer PVG requirements and standards that track the source and generation of planting stock. Field and cleaning facility inspections then monitor stand establishment, proper isolation distances, control of prohibited weeds, seed harvesting, cleaning, sampling, testing, and labeling for commercial sales (UCIA 2015; Young et al. 2020).

Seed growers apply for certification of their production fields prior to planting and plant only certified stock seed of an allowed generation (usually less than four). The systematic and sequential tracking through the certification process requires preplanning, knowing state regulations and deadlines, and is most smoothly navigated by working closely with state certification agency personnel. See the Wildland Seed Certification section for more information on stock seed sourcing.

Nursery Practice

There were no reports (as of 2023) of growing purple milkvetch nursery stock.

Wildland Seeding And Planting

Use of purple milkvetch in wildland revegetation was not reported in the reviewed literature (2023).

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