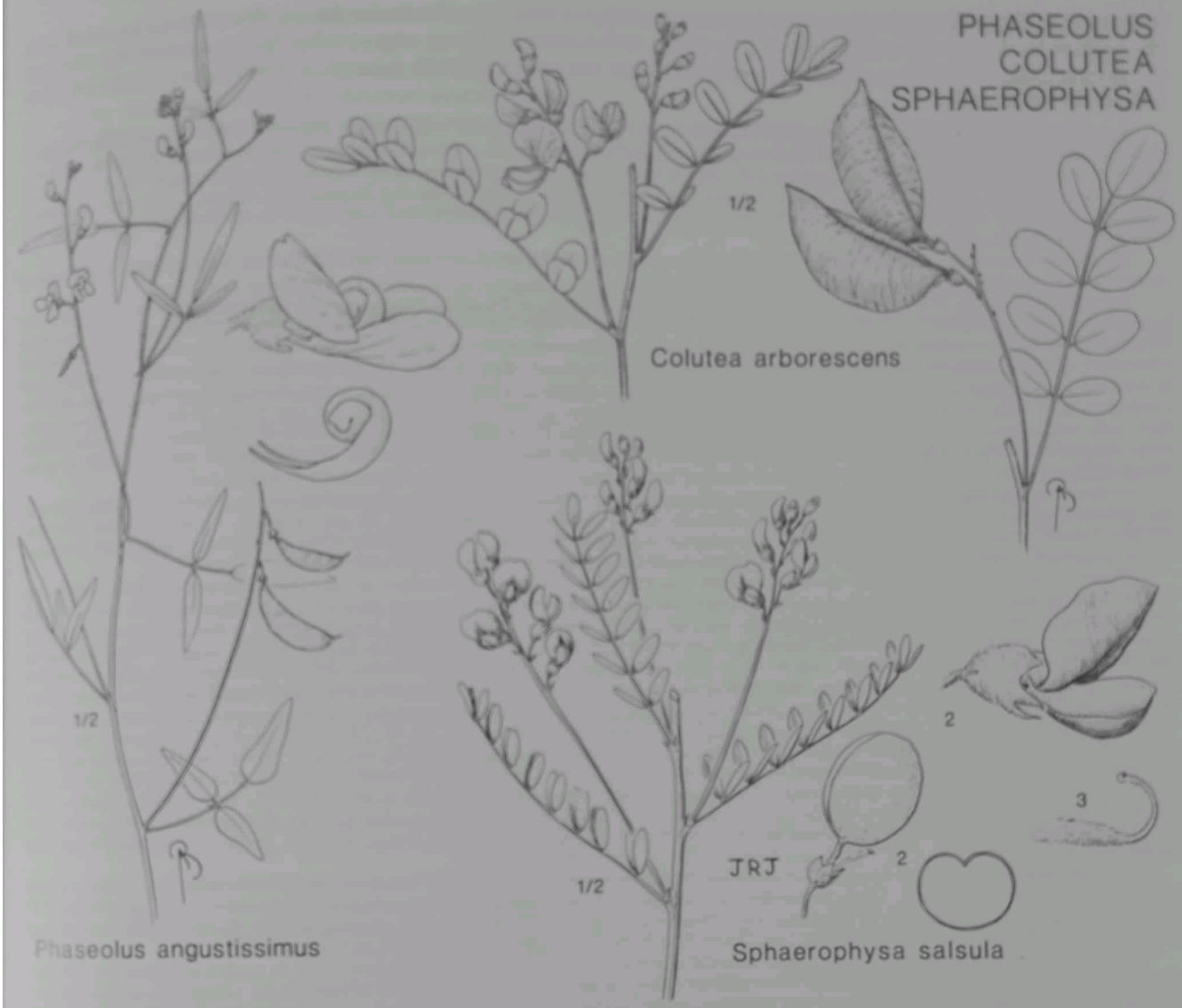

13. ASTRAGALUS L. Milkvetch, Locoweed

Ours annual and perennial, caulescent or acaulescent, sometimes weakly suffrutescent herbs, the stems arising directly from the root-crown or from a caudex, this aerial, superficial, or subterranean, in the latter case sometimes rhizomatous and adventitiously rooting at nodes; pubescence of simple basifixed or of dolabriform hairs, these attached laterally above their base and consisting of an ascending and a shorter descending arm; stipules either cauline, or cauline and adnate to petiole, or amplexicaul and connate opposite and rarely also behind the petiole into a sheath; leaves basically imparipinnate with 3 to many petiolulate leaflets, rarely palmately 3-foliolate or 1-foliolate, the lateral leaflets sometimes reduced in number, or confluent into the rachis, or absent, the leaf then reduced to its stalk, sometimes dilated into a grasslike phyllode; inflorescence of axillary, pedunculate or rarely sessile, sometimes spiciform or capituliform, bracteate racemes, exceptionally reduced to 1 or 2 subsessile flowers; bracteoles 0–2, small when present; calyx-tube campanulate (less than twice) or cylindric (at least twice as long as diameter), 5-toothed; flowers papilionaceous, the white, ochroleucous, pale yellowish, pink, purple, or violet petals usually conventionally graduated, the keel sometimes weakly exserted from the wings or equaling the banner, this often pale-eyed; androecium 10-merous, diadelphous (9 + 1), the anthers nearly uniform; style glabrous; stigma terminal, minute, glabrous or puberulent; ovary sessile or stipitate, unilocular; pod highly diverse in orientation, size, shape, compression, texture, and dehiscence: either 1) sessile in the calyx and then either continuous with or disjointing from the receptacle, or 2) elevated on and disjointing from a stipelike gynophore, or 3) differentiated into a sterile stipe and fertile body, then firmly attached to receptacle and either deciduous with the pedicel or dehiscent in situ; body of pod varying in profile from linear to globose, from straight to curved or coiled, and in compression from terete to compressed either dorsiventrally, laterally, trigonously, or rarely 4-gonously, often longitudinally sulcate dorsally, the cavity either filled with seeds sometimes embedded in pulpy filaments, or variably tumescent or bladdery-inflated; valves of pod varying when fresh from thin and dry to thick and pulpy, when ripe varying from papery-membranous and translucent to chartaceous, leathery, pithy, or woody, the endocarp often intruded across the cavity as a recessive fold issuing from the dorsal (abaxial) suture to form a partial or complete longitudinal septum; ovules 2 to many,

biseriate, the funicles sometimes united by a web of tissue forming a funicular flange, this sometimes fused with the septum to divide the cavity into 2 chambers, dehiscence either in situ or after falling, commonly through the gaping beak, sometimes also basal, rarely through the length of both sutures; $x = 8, 10, 11, 12, 13, 14$, with infrequent polyploidy.

A genus of perhaps 1600 species, in number of taxa but not in biomass the largest of Leguminosae, dispersed primarily around the Northern Hemisphere, most highly diversified in arid continental, desert, and Medit. climates, most numerous in c. Asia, the Iranian Highland, Anatolia, the Medit. Basin, w. N. Amer. between Alaska and Honduras, and disjunct along the Andes between Ecuador and Patagonia, about 375 species in N. Amer., including 156 (+ 122 vars.) in the Intermountain region, 100 in S. Amer., the rest Eurasian and African. (Name from the Greek *astragalos*, anklebone, early applied to some leguminous plant, perhaps analogous to rattleweed; bones, used by the Greeks as dice, rattle when shaken, like seeds in an inflated pod.)

The generic description of *Astragalus* given above refers exclusively to the genus as represented in our range. It incorporates definitions of some special terms that will be encountered in the descriptive text.

The size and diversity of *Astragalus* has repeatedly suggested the division of the genus into more easily comprehensible, smaller, and more homogeneous units. Attempts by C. Steven in Russia and by Rydberg in North America to define segregate genera by features of the pod were frustrated by pervasive parallelism. While differentiation has taken independent paths in mutually distant centers of speciation, one encounters everywhere similar modifications of growth-patterns, leaves, stipules, and individual flowers. Texture, inflation, compression of the pod, and development of a septum within it are particularly sensitive indicators of genetic disturbance and therefore ill suited to serve as generic criteria. Cytologists have discovered that Palearctic *Astragalus*, which contributes to our flora species nos. 1–4 and 87–91 of the following account, have, with insignificant exceptions, chromosomes in sets of eight, whereas the numbers in endemic American *Astragalus* form an aneuploid series ranging from ten to fifteen. This promising division of *Astragalus* into two main branches is unfortunately not supported by gross morphology; it shows, however, that the astragalus floras of Eurasia and the Americas have long independent histories.

Astragalus is believed to be a primitively mesophytic genus of the Northern Hemisphere. Its proliferation by adaptive radiation into arid and otherwise hostile microhabitats appears to be a relatively recent phenomenon that has not yet run its course. An ability to colonize new unstable habitats in progressively dry climates has hastened evolution of the genus and incidentally given rise to many sharply differentiated but geographically restricted genotypes, a pattern also exemplified in our region by *Eriogonum* and *Phacelia*.

Numerous Intermountain astragali are stock poisons and therefore of concern to ranchers in our region. They are of three types. Our relatively few primary selenophytes (nos. 43–51 and 80–86) concentrate the element selenium in their tissues and return it to the soil in soluble form that can be taken up by cereal grasses and other innocuous herbs. Ingestion of selenium by cattle gives rise in due course to the so-called alkali disease, of which painfully deformed hooves are symptomatic, and a nervous degeneration known as blind staggers. When bruised or heated by the sun, seleniferous astragali, which are conveniently distinguished as poison-vetches, exhale a characteristic odor sometimes described as snakelike. More serious because more widespread in lands grazed in spring and early summer are nitrotoxins synthesized by many astragali. Williams and Barneby (1977) found significantly high concentrations in leaf samples of 64 species native to our area and lower concentrations in many more. Especially high ones occurred in our species nos. 6–8, 10, 18, 19, 28–30, 63, 68, 87. Ruminants in particular are susceptible to nitrotoxins, which may disrupt the central nervous system, leading to paralysis and death. Severe losses are caused annually in Nevada and Utah by nitrotoxin poisoning of sheep and cattle. Locoism, to which horses are particularly susceptible, is caused by an alkaloid found in foliage of *A. mollissimus*, some forms of *A. lentiginosus* and numerous species of *Oxytropis*. A healthy animal will normally avoid locoweeds when palatable and wholesome forage is within reach, but having sampled them quickly becomes addicted and actively seeks them out. The alkaloidal substance identified as locoine affects the brain, causing stumbling gait, defective vision, weight loss, delirious locomotor ataxia, and death.

The systematic sequence and nomenclature adopted for Intermountain *Astragalus* are based on the last comprehensive revision of the genus in North America (Barneby, 1964), modified in detail by new data accumulated in course of general botanical exploration in the past 20 years. In this respect the collections of Welsh and his colleagues and students (BRY), N. and P. Holmgren (NY), Beatley (NTS), Packard and students (CIC), Williams and Tiehm (RENO), and Tiehm (NY) have been particularly numerous and critical.

The key that follows unavoidably uses some technical characters that require close observation. Care is needed to distinguish between *cauline* stipules symmetrically attached to the stem, stipules *adnate* to the petiole or, toward base of stem, to the vestige of a suppressed leaf-stalk, and *connate* stipules, fully amplexicaul and united on the side of stem further from the petiole into a more or less deeply bidentate sheath. Dolabriform hairs, when touched with a dissecting needle, pivot on the point of attachment. A dry leaflet broken in half appears ciliate along both lines of fracture when the pubescence is dolabriform and ciliate along the broken edge of only the proximal half when the pubescence is basifixed. A *stipe* is a sterile stalk formed of ovarian tissue and continuous with the fertile body of the pod; a *gynophore*, which may raise the body of the pod out of the calyx and simulate a stipe, is of receptacular origin and separated from the pod itself by a joint. Either stipe or gynophore may be quite short and concealed by the marcescent calyx.

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Key to the Species-Groups and some Species

1 Leaflets 3–9, linear-elliptic, continuous with rachis and mucronate or spinulose at apex, becoming stiff and prickly in age; racemes subsessile or shortly pedunculate, 1–3-flowered, the banner only 4–10 mm long; pod in profile ovate, oblong, or lanceolate, 3–10 mm long, laterally compressed, unilocular, 1–4-seeded ..... 36. *A. kentrophyta*

1 Leaflets not at once continuous with rachis and mucronate-spinulose, never prickly in age.

2 Pubescence of leaflets composed of dolabriform hairs, these attached above their base, with a shorter descending and a longer ascending arm ..... GROUP I, p. 41
2 Pubescence of leaflets composed of basifixed hairs, these (straight, incumbent, or curly) affixed by their base; plants sometimes almost hairless.
3 Plants perennial, either caulescent or stemless (if duration doubtful, take either choice).
4 Leaves all modified into a simple, subsessile, broadly ovate-suborbicular, leathery blade ± 15–55 mm diameter; pod ascending, stipitate, the body tumidly ellipsoid, stiffly leathery, unilocular; badlands of Uinta Basin, Canyonlands, and middle Sevier valley in Utah ..... 79. *A. asclepiadoides*
4 Leaves not so modified.
5 Terminal leaflet of at least some upper (sometimes of all) leaves confluent with the rachis, or the distal or even all leaves reduced to a linear leaf-stalk or somewhat dilated phyllode ..... GROUP II, p. 43
5 Terminal leaflet present in all leaves and either petiolulate or manifestly jointed to rachis.
6 Stipules at early leafless or at lowermost leafy nodes connate opposite the (sometimes rudimentary) petiole into a papery-membranous sheath.
7 Pod stipitate, the stipe (of fertilized flowers apparent soon after anthesis) 1–16 mm long ..... GROUP III, p. 45
7 Pod sessile or almost so, the stipe, if perceptible, either less than 1 mm long or shorter than hypanthial cup, or both ..... GROUP IV, p. 46
6 Stipules free from one another opposite the petiole, even though sometimes fully amplexicaul.
8 Pod either stipitate or elevated on a gynophore, the stipe or gynophore either exserted from or concealed by calyx, but always longer than the hypanthial cup (if any doubt, follow either choice) ..... GROUP V, p. 48
8 Pod sessile or almost so, the stipe (or gynophore) if any less than 1 mm long, no longer than diameter, and no longer than the hypanthial cup.
9 Stems arising from widely creeping horizontal rhizomes, the aerial axis usually shorter, never longer, than the longest leaves or longest inflorescences; foliage hirsute; pod sessile, deciduous from receptacle, crescentic or subannular, ± 30–65 × 4–8 mm, sulcate dorsally, subbilocular; marginally entering our area in ne. corner of Inyo Co., Calif. and adj. Esmeralda Co., Nev. ..... 119. *A. layneae*
9 Stems arising together from a single taproot, when partly subterranean the aerial axis much longer than the longest leaves or inflorescences.
10 Plants acaulescent or subacaulescent, the internodes all concealed by stipules or, if a few short internodes developed, the cauline axis of current year shorter than the longest leaf or the longest inflorescence (or both) ..... GROUP VI, p. 50
10 Plants evidently caulescent, the primary cauline axis well developed and longer than either longest leaf or inflorescence ..... GROUP VII, p. 52
3 Plants obviously or apparently annual ..... GROUP VIII, p. 55

GROUP I

Pubescence of leaves dolabriform.

1 Leaves all palmately 3-foliolate and the leaflets sessile; stipules both connate opposite the petiole and united behind the petiole, hyaline in texture; racemes 1–3-flowered, radical or shortly pedunculate; acaulescent tufted or shortly caulescent matted-pulvinate plants densely silky-canescent throughout; entering our region in extreme se. Idaho, adj. Wyo., and extreme n. Utah.
2 Racemes shortly pedunculate, 2-flowered, the flowers very small, the abruptly recurved banner 6–8 mm long, normally pink-purple ..... 155. *A. aretioides*
2 Racemes sessile among leaves, 1–3-flowered, the flowers long and narrow, the erect white banner 16–28 mm long ..... 156. *A. gilviflorus*
1 Leaves pinnate or reduced to a phyllode, or if a few of them 3-foliolate the leaflets petiolulate or stipules free (or both).
3 Leaves all modified into simple linear, oblanceolate, or spatulate phyllodes; cespitose acaulescent plants with connate stipules and small pink-purple flowers.
4 Low, tufted or pulvinate, the longest leaves at most 8 cm and the raceme-axis less than 4 cm long; calyx-teeth remaining erect after anthesis; relatively common on dry barren slopes and hilltops in ne. Utah, se. Idaho, and adj. Wyo. ..... 23. *A. spatulatus*
4 Taller, tufted, the longest leaves mostly 10–17 cm and the raceme-axis 5–24 cm long; calyx-teeth commonly stellately spreading after anthesis; local along seams and ledges of white sandstone cliffs and outcrops in lowland Uintah Co., Utah ..... 24. *A. chloödes*
3 Leaves imparipinnate or exceptionally 3-foliolate, but if some or all reduced to the rachis then

20 Leaflets 9–21 and 1–30 (33) mm long, variable in outline but when linear less than 20 mm long; pod at first subterete, becoming sharply 4-angled when ripe, mostly 20–40 × (5.5) 6–10 mm and as wide as thick, incurved into sickle or ring ..... 126. *A. tetrapterus*

17 Plants of Uinta Basin and Canyonlands in Utah, one (*A. coltonii* var. *coltonii*) extending locally into the middle Sevier valley, one (*A. episcopus* var. *lancearius*) into the Dixie-Corridor.

21 Pod stipitate, the stipe 2.5–12 mm long.

22 Body of pod laterally compressed, both sutures salient and both faces flat or almost so; petals purple; var. *coltonii* of ..... 20. *A. coltonii*

22 Body of pod dorsiventrally more or less compressed, flattened or openly grooved dorsally, the valves convex.

23 Flowers nodding at full anthesis; petals white or cream-colored, the banner 16–24 mm long; body of pod strongly compressed dorsiventrally, long-stipitate, the stipe 8–12 mm long.

24 Broadest leaflets up to 1–2.5 (3.5) mm wide; species widespread s. of Tavaputs Escarpment ..... 21. *A. lonchocarpus*

24 Broadest leaflets 4–8 (9) mm wide; species local in lowlands of Uinta Basin ..... 22. *A. hamiltonii*

23 Flowers ascending at full anthesis; petals pink-purple, the banner 8–14 mm long; body of pod moderately depressed dorsally, its stipe 2.5–6 mm long.

25 Stems 1–3.5 dm tall; most leaves pinnate; calyx commonly 4.5–7 mm long and banner ± 11–14 mm long; raceme-axis (1.5) 4–20 cm long; San Juan, e. Garfield, and Wayne cos., Utah ..... 18. *A. nidularius*

25 Stems 4–7 dm tall; all but lowest leaves reduced to rachis; calyx ± 3–3.5 mm long and banner 8–9 mm long; raceme-axis (5) 10–40 cm long; very local in Wayne and Garfield cos., Utah ..... 19. *A. harrisonii*

21 Pod sessile or almost so.

26 Body of pod strongly compressed laterally its whole length, the ripe valves plane or low-convex; s. of Tavaputs Escarpment to Dixie-Corridor ..... 16. *A. episcopus*

26 Body of pod dorsiventrally compressed in proximal half but laterally compressed distally; Uinta Basin ..... 17. *A. duchesnensis*

Group III

Perennial; pubescence basifixed; terminal leaflet present and jointed to rachis; lower stipules connate-amplexicaul; pod stipitate.

1 Leaves and stems hirsute with widely spreading hairs minutely dilated at base; stout caulescent herbs with nodding whitish flowers; body of pod linear-oblanceolate, bluntly trigonous, bilocular, glabrous ..... 62. *A. drummondii*

1 Leaves and stems not hirsute as above; pod different in some respect.

2 Body of pod unilocular and bladdery-inflated, terete or shallowly sulcate along sutures but not laterally angulate.

3 Pod erect on the stipe (9) 10–22 mm long, the valves chartaceous, opaque; Dixie-Corridor in Utah and immediately adj. Ariz. ..... 78. *A. ampullarius*

3 Pod either pendulous or declined, the stipe only 2–9 mm long.

4 Valves of pod papery-membranous, translucent; Great Basin and s. Idaho.

5 Plants of Owyhee Desert Sect. below 1500 m; body of pod ± obliquely ovoid, obovoid, or ellipsoid, differentiated at the apex into a broad low-deltate beak ..... 32. *A. cusickii*

5 Plants widespread over se. Oregon, n. half of Nev., adj. Calif., and sw. Idaho; in Owyhee Desert Sect. mostly submontane or subalpine; body of pod subsymmetrically balloon-shaped, rounded at the broad apex, the beak obsolete ..... 33. *A. whitneyi*

4 Valves of pod firm, subcarnosulous, becoming stiffly papery, opaque; s. Utah Plateaus southward ..... 10. *A. hallii*

2 Body of uni- or bilocular pod not inflated or, if subtumescent then also angulate laterally.

6 Flowers at once nodding, retrorsely imbricate and relatively large, the banner (12.5) 14–23.5 mm long; stipe of pod 4–22 mm long.

7 Petals pale yellow; pod valves of fleshy lignescent texture, the body bicarinate by the sutures and at the middle transversely dilated, the cavity unilocular; w. periphery of our range in Nev. northward from Lake Tahoe and adj. Calif. ..... 30. *A. gibbsii*

7 Petals either ochroleucous or purple; pod valves chartaceous or submembranous; cavity either uni- or bilocular, but if unilocular the body of pod either trigonous, or dorsiventrally compressed and ventrally bisulcate.

8 Stems arising from subterranean root-crown; foliage scentless; pod trigonously compressed, dorsally sulcate, bilocular ..... 5. *A. scopulorum*

8 Stems arising together in clumps from superficial root-crown; foliage selenium-scented; pod unilocular.
9 Body of pod sharply trigonous, the 3 faces of subequal width; Uinta Basin in Utah and in sw. Wyo. ..... 46. *A. racemosus*
9 Body of pod depressed ventrally, rounded dorsally, the ventral suture lying between parallel grooves; c. Nev. eastward; widespread ..... 45. *A. bisulcatus*
6 Flowers variably oriented but if nodding then loosely and openly racemose and if retrorsely imbricate smaller.
10 Body of pod at once fully bilocular and sharply trigonous; rare xeromorphic species of Great Basin and Owyhee Desert.
11 Stems diffuse and incurved-ascending from root-crown, mostly 1–3 dm tall, some internodes well developed; caudex not thatched with stiff marcescent leaf-stalks.
12 Body of pod (9) 10–16 × 3–4.5 mm, 10–16-ovulate; below 1000 m in sw. Idaho and adj. Malheur Co., Oregon ..... 55. *A. mulfordiae*
12 Body of pod 6–10.5 × 2–3 mm, 6–11-ovulate; at ± 2100–2650 m in Mono Co., Calif. and adj. Nev. ..... 56. *A. johannis-howellii*
11 Stems densely tufted, 1–3 (5.5) cm tall; caudex thatched with persistent leaf-stalks; body of pod 4–7 × 2–3 mm, 6–8-ovulate; ec. Humboldt Co., Nev. and sw. corner of Idaho ..... 57. *A. yoder-williamsii*
10 Body of pod uni- or subunilocular, variously compressed, the septum when present narrow and incomplete; body of pod trigonous only in some mesophytic montane or alpine species.
13 Flowers nodding and retrorsely imbricate; body of pod depressed ventrally, the suture lying between parallel grooves; foliage selenium-scented; c. Nev. eastward; chiefly on badlands; small-flowered forms of ..... 45. *A. bisulcatus*
13 Flowers variably oriented, but if nodding then openly racemose; ventral face of pod not depressed; foliage scentless.
14 Body of pod laterally compressed, bifacial, the faces plane or low-convex, the cavity unilocular; plains, foothills, and up to middle elev. in the mts.
15 Pod incurved-ascending at wide angles from raceme-axis; leaflets 7–13, broadly obovate-flabellate; desert of Lahontan Basin, Nev. ..... 77. *A. porrectus*
15 Pod pendulous; leaflets either more numerous, or of narrower outline, or both; distribution and ecology other.
16 Stipules not blackening when dried; racemes solitary in leaf-axils; flowers relatively large, the banner (10) 11–15 mm long; body of pod 17–30 × 3–6.5 mm, stramineous when ripe ..... 31. *A. filipes*
16 Stipules and ripe valves of pod commonly nigrescent; racemes in some distal axils paired either with a branchlet or with a second shorter raceme; flowers small, the banner 5.5–10 mm long; body of pod 7–17 × 2.5–4.5 mm ..... 35. *A. tenellus*
14 Body of pod obtusely trigonous or if laterally compressed turgid, and the valves inflexed dorsally as a narrow partial septum; cool montane and alpine habitats; relictual in foothills of Franklin Co., Idaho and high mts. of e. Nev. and Utah Plateaus.
17 Stems arising from a subterranean root-crown or weak buried caudex; keel a trifle longer than the wings and ± equaling the banner; pod sulcate dorsally; lower stipules clearly and strongly connate ..... 1. *A. alpinus*
17 Stems from a superficial root-crown; keel shorter than the wings; pod depressed dorsally but not sulcate; lower stipules larger than the free upper ones and at times only obscurely united opposite the petiole.
18 Stipules amplexicaul but not united opposite the petiole; leaves subsessile, the proximal leaflets inserted close to the stipules; racemes (with us) compactly flowered; wing-petals bidentate at tip; high mts. of ne. Nev. and ne. and c. Utah ..... 3. *A. australis*
18 Stipules connate-amplexicaul; leaves slender-petiolate; racemes remotely few-flowered; wing-petals obtuse at tip; endemic to the Ruby Mts., Nev.; var. *occidentalis* of ..... 2. *A. robbinsii*

Group IV

Perennial; pubescence basifixed; terminal leaflet present and jointed to rachis; lower stipules connate-amplexicaul; pod sessile.

1 Flowers at once narrowly ascending or erect and crowded into heads or short spiciform racemes; stems arising from subterranean root-crown or rhizomelike caudex-branches.

15 Diffuse caulescent, from superficial or shallowly buried root-crown; only the lowest stipules connate, the rest free; peduncles mostly 5–20 mm long, shorter than the primary cauline axis; ovules 17–23; Utah Plateaus at 2250–3200 m ..... 130. *A. perianus*

14 Strongly caulescent plants, the stems 1–9 dm tall.

17 Habitat in moist meadows on Fremont–Sevier divide in c. Utah; pod obliquely ovoid, obtusely trigonous, 7–10 × 2.5–4 mm, tumid but scarcely bladdery, 5- or 6-ovulate; root-crown superficial or very shallowly subterranean ..... 37. *A. bodinii*

17 Habitat in dry places from desert to pine forest; pod either much broader and bladdery or if not broader then linear or linear-elliptic in profile and slightly dorsiventrally compressed (but never trigonous) and 10- to many-ovulate; root-crown deeply buried.

18 Pod linear-oblanceolate or -elliptic, 3–5 mm diameter.

19 Stems pubescent with appressed, incurved-ascending or curly hairs ..... 6. *A. flexuosus*

19 Stems pubescent with stiff, straight, spreading or subretrorse hairs ..... 8. *A. subcinereus*

18 Pod tumid or bladdery, 5–22 mm diameter.

20 Stems, calyces, and pods loosely strigulose-villosulous or spreading-hirsutulous; keel-tip obtusely deltate; pod varying from narrowly ellipsoid to globose, 5–13 mm in diameter, 10–20-ovulate; Utah and Grand Canyon plateaus in Ariz. and Utah, thence w. into se. Nev. and e. in Utah to the Henry Mts., where vicariant with the next; found in stony pinyon-juniper or pine forest ..... 8. *A. subcinereus*

20 Stems, calyces, and pods strigulose with appressed hairs; keel-tip triangular, beaklike; pod plumply ovoid or globose, 12–22 mm diameter, 20–32-ovulate; dunes and sandy valley floors in Utah Canyonlands ..... 7. *A. fucatus*

Group V

Perennial; pubescence basifixed; terminal leaflet present and jointed to rachis; lower stipules not connate opposite petiole; pod elevated on a stipe or gynophore.

1 Pod sessile on and jointed to a stipelike gynophore.

2 Stems from a deeply subterranean root-crown; leaflets (9) 15–27, subcontiguous on rachis; pod ellipsoid, bladdery-inflated, 15–38 × 8–17 mm, unilocular; rare on shale knolls and bluffs around periphery of Uinta Basin in Utah and nw. Colo. ..... 124. *A. lutosus*

2 Stems from a superficial root-crown or aerial caudex; leaflets either few or distant along rachis, or both; if sympatric with the last then the pod 40–70 mm long and the peduncles subradical.

3 Pod inflated but relatively small, 14–22 × 6–10 mm, unilocular, 9–13-ovulate, the valves papery; banner 7.5–10.5 mm long; local along Grand River in Grand Co., Utah ..... 137. *A. wetherillii*

3 Pod, if bladdery-inflated, 30–60 (75) mm long, if less than 30 mm long then the valves of leathery texture and the cavity subbilocular, the ovules in any case over 20; banner (11) 16–26 mm long; widespread.

4 Pod (2) 3–6 (7.5) cm long, bladdery-inflated, unilocular, the valves papery.

5 Plants subacaulescent, the stems 1–5 cm long, the internodes mostly concealed by stipules and the leaves tufted; peduncles subradical, mostly less than 3 cm long; racemes 3–5 (8)-flowered; discontinuously dispersed from c. Nev. to Utah Plateaus and Uinta Basin in Utah and to sw. Wyo. ..... 121. *A. megacarpus*

5 Plants normally caulescent, the stems mostly 5–20 cm tall, at least one and usually several internodes well developed; peduncles from median and upper leaf-axils 4–13 cm long; racemes 3–14-flowered; widespread over s. half of Intermountain region westward from Grand Canyon and Utah plateaus ..... 122. *A. oophorus*

4 Pod 1.5–3.7 cm long, solid or subturgescent but not bladdery, the fleshy valves becoming leathery, inflexed as a narrow partial septum; Great Basin in Nev. and Utah, n. to Snake River Plains and Owyhee Desert ..... 123. *A. beckwithii*

1 Body of pod continuous with the true stipe.

6 Body of pod laterally compressed, bicarinate by the sutures, bifacial, the faces plane or low-convex at maturity; septum 0 or vestigial.

7 Plants (with us) of subalpine or tundra habitats; dorsal suture of pod inflexed as a narrow membranous septum; wing-petals bidentate ..... 3. *A. australis*

7 Plants of lowland and foothill habitats; dorsal suture not inflexed; wing-petals entire.

8 Body of pod incurved into a hook, sickle, or coiled into a ring or spiral.
9 Flowers larger, the calyx-tube (marcescent around stipe of pod) 4.5–11.5 mm long; ovules 18–28.
10 Stems arising few together or solitary from slender cordlike rhizomes; petals pink-purple; local in Owyhee Co., Idaho ..... 28. *A. camptopus*
10 Stems several, incurved-ascending from crown of taproot; petals ochroleucous or whitish; widespread over se. Oregon, s. Idaho, n. Nev., and e. Calif. northward from Mono Co. ..... 29. *A. curvicarpus*
9 Flowers smaller, the calyx-tube (1.7) 2–2.6 mm long; stems from a deeply subterranean root-crown; ovules 10–16; se. Oregon and adj. Nev. ..... 26. *A. alvordensis*
8 Body of pod straight or slightly decurved from stipe.
11 Flowers small, the calyx-tube (marcescent around the stipe of the pod) 2.1–2.8 mm long; leaflets 5–11 (13); rare species of Harney and Malheur cos., Oregon and far n. Humboldt Co., Nev. ..... 27. *A. solitarius*
11 Flowers large, the calyx-tube 4–6.5 mm long; leaflets 9–19; common in Grand and San Juan cos., Utah; var. *moabensis* of ..... 20. *A. coltonii*
6 Body of pod either trigonously compressed, or dorsiventrally compressed, or subterete, rarely laterally compressed but then fully bilocular.
12 Pod at once strongly inflated or tumid and fully unilocular; plants selenium-scented.
13 Leaflets relatively few, (3) 5–11, and ample, 1–4 (5) cm long, mostly acuminate at apex; pod only obscurely stipitate, the stipe not over 1.5 mm long, the oblong or oblong-elliptic body 20–45 × 9–15 mm; petals white or ochroleucous; coarse diffuse plants of badlands in Grand and San Juan cos., Utah; turn to choices 22/22 in key to Group VII, p. 54.
13 Leaflets usually more numerous, always smaller, never acuminate; where sympatric with the last the stipe of pod (1.5) 2–7 mm long; petals purple.
14 Pod erect or narrowly ascending from the erect peduncle; stems erect and incurved-ascending, 1–3.5 (4) dm tall; Canyonlands and w. around our s. border into Nev. ..... 80. *A. preussii*
14 Pod horizontally spreading or declined, borne on the weakly ascending and reclining peduncle, commonly humistrate; relatively slender diffuse stems mostly 2–10 (14) cm tall; n. Canyonlands, in Grand, San Juan, Emery, and perhaps Wayne Co., Utah ..... 81. *A. eastwoodiae*
12 Pod either not inflated or, if inflated, at least incipiently bilocular; if foliage selenium-scented then the flowers nodding and the petals commonly whitish except for keel-tip.
15 Coarse selenium-scented plants of Utah Canyonlands (San Juan Co.); pod erect, succulent, becoming ligneous, narrowly septiferous; var. *lonchopus* of ..... 83. *A. praelongus*
15 Allopatric; scentless; pod otherwise.
16 Plants of mesic habitats above 2000 m in the Ruby Mts., Elko Co., Nev. and on upper Bear River in Summit Co., Utah; pod pendulous, obtusely trigonous, 7–10-ovulate, the papery-membranous valves inflexed as a very narrow hyaline septum ..... 2. *A. robbinsii*
16 Plants of xeric habitats in foothills and valleys.
17 Leaves and stems hirsute with widely spreading hairs minutely dilated at base; stout caulescent herbs with nodding whitish flowers; body of pod linear-oblanceolate, bluntly trigonous, bilocular, glabrous ..... 62. *A. drummondii*
17 Leaves and stems not hirsute as above; pod otherwise.
18 Stipe of pod 5–20 mm long.
19 Pod erect or incurved to erect from ascending or erect raceme-axis, neither pendulous nor humistrate, the body trigonous, grooved dorsally, 3.5–8 (12) mm diameter ..... 73. *A. eremiticus*
19 Pod either humistrately ascending from reclining peduncles or pendulous from ascending ones, the body either dorsiventrally compressed or subterete, 6–21 mm diameter.
20 Body of humistrate pod strongly compressed dorsiventrally below the laterally compressed beak, the ripe valves smooth; rare native species.
21 Foliage green; axis of the 5–9-flowered raceme up to 3 cm in fruit; canyon of Snake River on Oregon–Idaho boundary ... 67. *A. vallaris*
21 Foliage glaucescent; axis of the (6) 10–25-flowered raceme (1.5) 3–19 cm in fruit; s. Lahontan and Tonopah sections of Great Basin and southward ..... 68. *A. cimae*
20 Body of pendulous pod subterete, the ripe valves transversely rugulose; adventive in se. Idaho ..... 4. *A. chinensis*

18 Stipe of pod 1–4.5 (5) mm long.
22 Body of pod slightly arched downward, the ventral suture in profile appearing convex, or at least the beak declined from the body.
23 Pod 2.5–4 mm in diameter, and where sympatric with the following the septum not over 0.2 mm wide ..... 58. *A. atratus*
23 Pod (4) 4.5–6.5 mm in diameter, semibilocular, the septum 0.4–1 mm wide; n. Nev., sw. Idaho, and se. Oregon ..... 59. *A. salmonis*
22 Body of pod straight or commonly incurved, either the ventral suture appearing concave in profile, or the beak incurved.
24 Pod obliquely ovoid, bladdery-inflated, fully bilocular, the valves papery; very local in e. Tooele Co., Utah; var. *pohlii* of ... 139. *A. lentiginosus*
24 Pod linear-oblong or elliptic in profile, if at all tumid then the valves firm.
25 Valves of pod glabrous.
26 Body of pod 2.5–3 mm in diameter, the valves green, turning stramineous; se. Nev., sw. Utah, and nw. Ariz. ..... 54. *A. straturensis*
26 Body of pod 3.5–5 mm in diameter, the valves faintly mottled and glaucescent; n. Nye Co., Nev. ..... 53. *A. toquimanus*
25 Valves of pod strigulose, pilosulous, or hirsute.
27 Flowers relatively large, the banner mostly 10–21 mm long, or if slightly less then bright purple; pods 12–40 × (3.5) 4–9 (10) mm; widespread.
28 Pod shaggy-hirsute with lustrous spreading hairs up to 1–3 mm long ..... 69. *A. malacus*
28 Pod strigulose or pilosulous, the hairs appressed or incumbent and less than 1 mm long.
29 Body of pod dorsiventrally compressed below the beak, the cross-section at middle wider than high; septum narrow, incomplete, at most 1 mm wide.
30 Stipe of pod not over 2 mm long and body 16–32 × 7–10 mm; widespread over much of Great Basin and Snake River Plains, to sw. Wyo. and adj. Utah ..... 63. *A. cibarius*
30 Stipe of pod 2–5 mm long and body 12–16 × 3.5–5 mm; rare near our sw. border in Lincoln Co., Nev. and Inyo and Mono cos., Calif. ..... 61. *A. inyoensis*
29 Body of pod either compressed-trigonous or laterally compressed and biconvex, the cross-section at middle narrower or no wider than high; septum broad, complete, 3–6 mm wide.
31 Dorsal suture of pod prominent, the body biconvex, the cross-section elliptic; Dixie-Corridor and Canyonlands in Utah and Ariz.
32 Foliage appressed-strigulose; banner 11–15 mm long; Mohave Co., Ariz. and Washington Co., Utah ..... 64. *A. ensiformis*
32 Foliage loosely hirsutulous; banner 17–21.5 mm long; Garfield and e. Kane cos., Utah ..... 66. *A. malacoides*
31 Dorsal suture of pod recessive, the body trigonous, the cross-section deltate; Calcareous Mountains Sect. in ec. Nev. and adj. Utah ..... 70. *A. chamaemeniscus*
27 Flowers small, the banner 5–7.5 mm long, ochroleucous; pods 7–12 × 2–3.5 mm; local at n. edge of Snake River Plains ..... 52. *A. oniciformis*

Group VI

Perennial, acaulescent or subcaulescent, the cauline axis above ground none or, when present, shorter than leaves or inflorescence; pubescence basifixed; terminal leaflet present and jointed to rachis; lower stipules not connate opposite petiole; pod sessile or almost so, the stipe if present less than 1 mm long.

mineous, coriaceous, reticulate, not inflexed; dehiscence of *A. curvicarpus*.

Meadows and open parkland in ponderosa pine forest and foothills or valley floors in climax sagebrush, in porous sandy or sandy clay soils mostly of volcanic origin, 1250–1800 m; scattered along the piedmont of Sierra Nevada from se. Lassen to e. Sierra Co., Calif., more rarely s. through extreme s. Washoe and Ormsby cos., Nev. and thence reentering Calif. in Alpine and perhaps n. Mono Co., the s. limit not reliably documented. May–July.

Gibbs's milkvetch is closely related to *A. curvicarpus*, but in practice distinguished by connate stipules at the buried nodes, distinctly yellow rather than white or ochroleucous petals, and a broader, more tumid pod. The handsome flowers are sometimes heavily fragrant.

31. Astragalus filipes Torr. ex A. Gray

Astragalus filipes Torr. ex A. Gray, Proc. Amer. Acad. Arts 6: 226. 1864. *Tragacantha filipes* Kuntze, Revisio Gen. Pl. 2: 944. 1891. *Homalobus filipes* A. A. Heller, Muhlenbergia 9: 67. 1913. *A. stenophyllus* var. *filipes* Tidestrom, Proc. Biol. Soc. Wash. 50: 20. 1937. (*Pickering s.n.*, "between Fort Okanagan and the Grand Coulee, Washington Territory," in 1841; holotype at NY!; isotype at GH!)

Homalobus stenophyllus sensu Rydb. Mem. New York Bot. Gard. 1: 249. 1900; N. Amer. Fl. 24(5): 273. 1929. *A. stenophyllus* sensu Tidestrom, Contr. U.S. Natl. Herb. 25: 331. 1925; ? not *A. stenophyllus* Torr. & Gray, 1838, nomen dubium (Barneby, 1964, pp. 323, 1157, 1158).

Basalt milkvetch.

Perennial from stout taproot, strigulose with appressed, basifixed hairs or almost glabrous below the calyces, the thin, narrow foliage green or cinereous, the leaflets either glabrous or cinereous-canescent above; stems of mature plants numerous, erect and ascending in clumps or (with us only exceptionally) diffuse, (2) 2.5–6 (9) dm tall, arising from superficial or shallowly buried root-crown, leafless at base, usually strictly branched or spurred upward; stipules dimorphic, the lower ones amplexicaul and connate into a papery-membranous sheath, 2–5 mm long, the upper ones smaller, herbaceous, deltate or triangular-acuminate, semi- or fully amplexicaul but free or essentially so; leaves 2.5–12 cm long; leaflets (5) 9–21 (23), distant and often scattered, linear, linear-oblong, or filiform, obtuse, emarginate, or subacute, 3–24 (30) mm long, all petiolulate; peduncles stiffly ascending, (4.5) 6–22 cm long; racemes loosely (3) 8–30-flowered, the flowers declined in age, the axis becoming (3) 5–34 cm long; calyx 4–6.5 (7.5) mm long, either black- or white-strigulose, the campanulate tube 3–5.5 (6.5) mm long, the deltate or triangular-subulate teeth 0.5–1.5 mm long; petals whitish or cream-colored, the moderately recurved banner (10) 11–15 mm long, the wings nearly as long, the obtuse or triangular-subacute keel 7–10 (12) mm long; ovary glabrous above the strigulose stipe or rarely strigulose overall; ovules 12–20 (22); pod pendulous, stipitate, the straight or downwardly arched, always puberulent stipe (6) 8–16 mm long, the body in profile narrowly oblong or linear-elliptic, 17–30 × (3) 3.5–6 (6.5) mm, straight or almost so, cuneate at both ends or tapering backward into the stipe, the planocompressed body bicarinate by the filiform sutures, the thin, pale-green, ultimately low-convex valves becoming papery, stramineous, finely reticulate, not inflexed; dehiscence tardy, the pod often shed unopened with the calyx and pedicel, sometimes inertly dehiscent through apex and the stipe; $2n = 22, 24$.

Plains, hillsides, and valley floors, almost always in sagebrush, mostly below 2000, southward rarely up to 2400 m; widespread and locally abundant throughout the Columbia Basin and the Great Basin westward from the w. margin of Bonneville Basin; very common with us in the Lake, Owyhee Desert, and Snake River Plains sections, extending e. in Idaho to Bonneville Co., to Box Elder Co., Utah and copiously s. in Nev. and adj. Calif. around the margins of Lahontan Basin and through the Humboldt River valley to n. Mineral, n. Nye and White Pine cos.; n. to s. B.C. and s. to remotely disjunct localities in mountainous s. Calif. and adj. Baja Calif. May–July.

32. Astragalus cusickii A. Gray

Astragalus cusickii A. Gray, Proc. Amer. Acad. Arts 13: 370. 1878. *Phaca cusickii* Rydb. Bull. Torrey Bot. Club 40: 47. 1913. (*Cusick 68*, Union Co., Oregon, in 1877; holotype at GH!; isotypes at K!, P!)

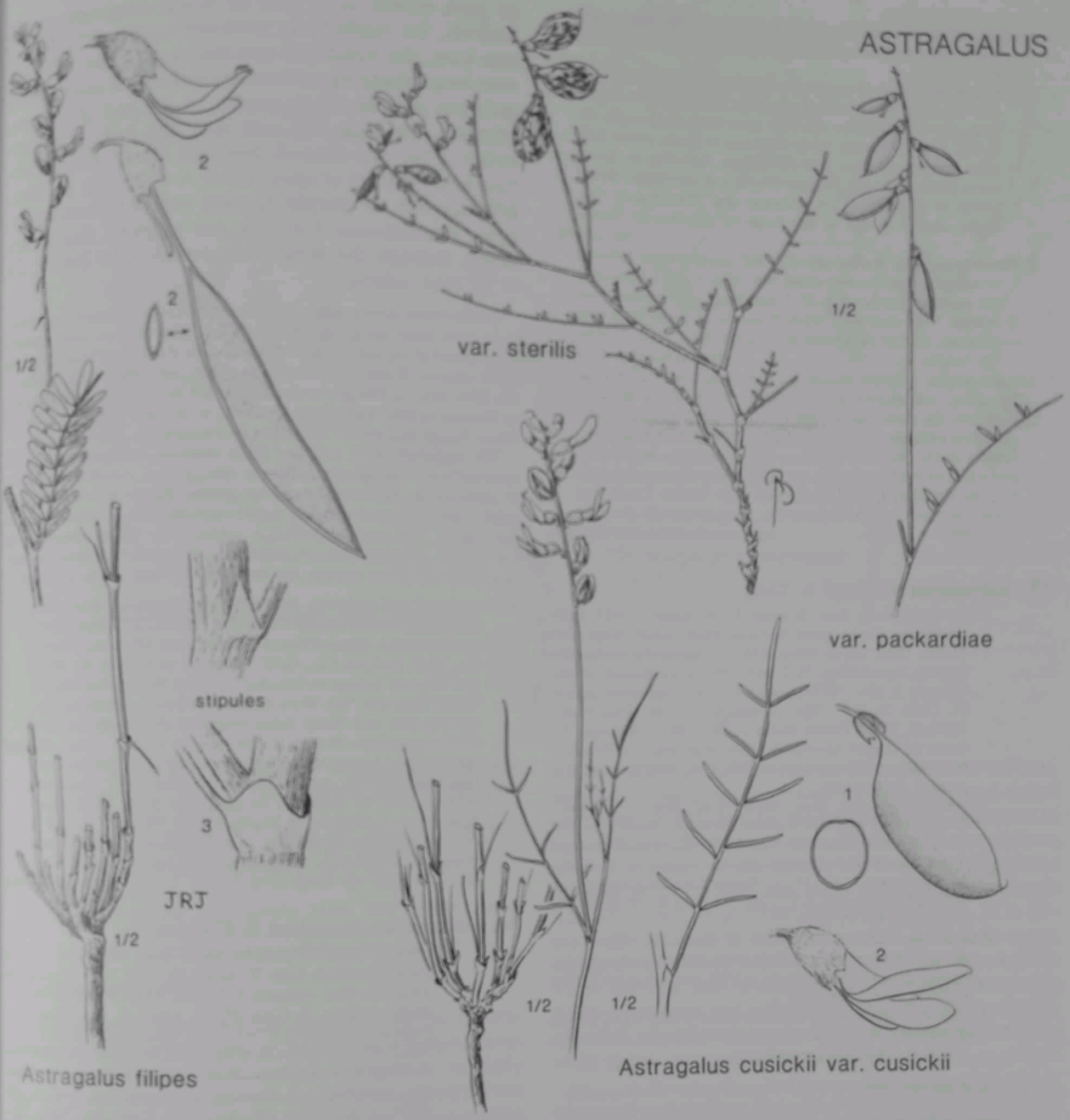
Astragalus cusickii var. **sterilis** (Barneby) Barneby, comb. nov. *A. sterilis* Barneby, Leafl. W. Bot. 5: 193. 1949. (*Ripley & Barneby 9415*, 24 mi sw. of Marsing, Owyhee Co., Idaho; holotype at CAS!; isotypes at GH!, IDS!, NY!, POM!, RSA, US!, UTC!)

A. cusickii var. *flexilipes* Barneby, Amer. Midl. Naturalist 55: 485. 1956. (*Ripley & Barneby 10709*, Little Salmon River canyon, 3 mi n. of Pollock, Idaho Co., Idaho; holotype at CAS!; isotypes at NY!, WS!) = var. *flexilipes*, extralimital.

Astragalus cusickii var. **packardiae** Barneby, var. nov. Inter speciei formas hucusque descriptas foliis summis in rachin simplicem reductis, floribus parvis, calycis tubo 3.1–3.6 mm, dentibus 0.5–0.7 mm, vexillo 8.5–10.5 mm, carina 6.5–7 mm longis, necnon legumine ellipsoideo parum inflato 18–26 mm longo, applanato 7–10 mm tantum lato praestans. TYPE: UNITED STATES. IDAHO. Payette Co., on a small tributary of Dry Creek, T9N, R2W, S27, ca 850 m, 18 May 1980, *J. Grimes & P. L. Packard 1583* (HOLOTYPE NY!)

Cusick's milkvetch, barren milkvetch, Packard's milkvetch.

Slender, sparsely leafy and subjunceous, perennial herbs (0.5) 1–7 dm tall, thinly strigulose with appressed, basifixed hairs, green or subcinereous; stems arising either from a multicipital root-crown at level of the soil, or from a short, branched caudex, or from subterranean, sometimes adventitious, rhizomelike caudex-branches, freely branched or spurred upward, flexuous or zigzag distally; stipules 1–5 mm long, the lowest aerial and all subterranean ones connate into a (sometimes early ruptured) papery-membranous sheath, the distal ones progressively smaller, firmer and less connate or only semiamplexicaul and free, their herbaceous blades deltate or triangular-subulate, erect or deflexed; leaves (2) 3–11 (14) cm long; leaflets distant, (5) 7–15 (17), linear, linear-oblong or -elliptic, acute or subobtuse, or in some early leaves linear-oblanceolate, emarginate, (1) 2–22 (27) mm long, sometimes fewer, smaller or obsolete in some distal leaves, the lateral ones petiolulate though sometimes obscurely so, the terminal one either petiolulate or decurrent into the rachis; peduncles erect or incurved-ascending, (1) 2–16 cm long; racemes loosely (1) 2–14 (18)-flowered, the flowers declined in age, the axis 1–8.5 cm long in fruit; calyx either black- or white-strigulose, 3.5–7 mm long, the campanulate tube 3–6 mm long, the deltate or broadly triangular-subulate teeth 0.4–1 mm long; petals clear white, creamy-white or suffused with pink-purple, the moderately recurved banner 8–15 (17.5) mm long, the wings ± 1–2 (5) mm shorter, the obtuse keel 8–12 mm long; ovary glabrous; ovules 10–20; pod pendulous, stipitate, the stipe 2–5 mm long, the body either symmetrically or obliquely obovoid, ellipsoid or semi-ellipsoid, bladdery-inflated, (18) 20–48 × (6) 7–16 (when flattened up to 22 mm wide), contracted at



apex into a low-deltate, sometimes obscure, laterally compressed beak, elsewhere terete or a trifle dorsiventrally compressed, the filiform sutures either equally convex as viewed in profile or the ventral one less so, straight, or sometimes shallowly concave, the pale green or sometimes brightly red-mottled, subdiaphanous valves becoming papery-membranous, lustrously stramineous, not inflexed; dehiscence primarily through the stipe, often only after fall of the pod with its marcescent calyx and pedicel; $2n = 22$ (var. *cusickii*).

Rocky hillsides, bluffs, talus-slopes, and barren hilltops below 1500 m; scattered along the Snake River and its affluents from the s. and w. in the Owyhee Desert Sect., n. through the canyons of Snake and lower Salmon rivers to extreme se. Wash. May–July.

Cusick's milkvetch is closely related to *A. whitneyi*, from which it differs chiefly in the sparse, narrow foliage. It is a polymorphic species varying from one population to the next in stature, size and color of flowers, position of root-crown or caudex, and in the pod, which varies in length of stipe, degree of inflation, and overall length and girth. Modern collections from the Owyhee Desert made by Dr. Patricia Packard and her students have recently expanded our knowledge of this diversity and there are now grave obstacles to recognition of *A. sterilis* as a discrete species. When first described, this appeared strongly characterized by its rhizomatous, subterranean caudex (resembling that of *A. ceramicus*) which gave rise to colonies of solitary or paired, short, and densely branched stems. This now emerges as a more or less sharply marked ecotype of shallow clay soils on exposed hilltops which is apparently replaced in talus and in rubble under cliffs along the Owyhee River by a taller plant (to ca 4 dm) with several stems arising together from a pluricipital root-crown. These seem distinguishable collectively from typical *A. cusickii* by the sometimes only shallowly buried points of renewal, by the uniformly very short leaflets, and by the bright mottling of the pod, a syndrome too weak to support specific status. Outside our range, on the lower Salmon and Little Salmon rivers, *A. cusickii* is represented by the weakly differentiated var. *flexilipes* Barneby, characterized by small, purplish flowers and oblique, half-ellipsoid pods; and just within our borders by the highly localized var. *packardiae*, which resembles var. *flexilipes* in the flower but differs in the loss of leaflets from upper leaves and in the narrowly but symmetrically ellipsoid pod.

recurved banner (11) 12–16.5 mm, the wings ± 1–4 mm shorter, the obtuse keel (8) 8.5–10.5 mm long; ovary glabrous; ovules 24–36; pod erect, sessile, continuous with receptacle, in profile narrowly oblong or ovate-oblong, 12–17 × 3–6.5 mm, straight or slightly incurved, obtuse at base, abruptly contracted into a short, laterally compressed beak, otherwise dorsiventrally compressed, carinate ventrally by the cordlike suture, flattened or openly sulcate dorsally, the lateral angles rounded, the green, fleshy valves becoming coriaceous, stramineous, inflexed as an almost complete or complete septum ± 1 mm wide; dehiscence through the narrowly gaping beak while pod yet attached to raceme-axis; $2n = 22$.

Open stony hillsides and benches along rivers, commonly associated with low sagebrush and calcareous bedrock, ± 1600–3100 m; locally plentiful on the sources of the Missouri, Snake, and Salmon rivers in c. Idaho, sw. Mont., and immediately adj. Wyo.; collected once (in 1936) ostensibly near Pocatello, Bannock Co., Idaho, the station requiring confirmation, and to be looked for around the e. periphery of Snake River Plains. June–Aug.

In its range of dispersal *A. terminalis* is the only astragalus in which dolabriform pubescence coincides with erect, sessile, persistent, toughly leathery, glabrous, bilocular pods.

73. Astragalus eremiticus E. Sheldon

Astragalus eremiticus E. Sheldon, Minnesota Bot. Stud. 1: 161. 1894. *A. arrectus* var. *eremiticus* M. E. Jones, Proc. Calif. Acad. Sci. II. 5: 665. 1895. *Tium eremiticum* Rydb. Bull. Torrey Bot. Club 40: 49. 1913. (*Parry 45*, Beaver Dam Mts., s. Utah, in 1874; lectotype by Barneby, 1964, p. 535, at MIN!; isolectotypes at GH!, MO!, NY!, P!)

A. cusickii Rydb. Bull. Torrey Bot. Club 26: 541. 1899; not A. Gray, 1878. *A. malheurensis* A. A. Heller, Cat. N. Amer. Pl. ed. 2. 7. 1900. *Tium malheurense* Rydb. N. Amer. Fl. 24(7): 391. 1929. *A. eremiticus* var. *malheurensis* Barneby, Amer. Midl. Naturalist 41: 501. 1949. (*Cusick 1238*, "Malheur [Oregon]"; holotype at GH!)

A. eremiticus var. *spencianus* M. E. Jones, Contr. W. Bot. 10: 60. 1902. (*Jones s.n.*, "Spencemont [? Sprucemont, Elko Co.]," Nev., in 1891; lectotype by Barneby, Proc. Calif. Acad. Sci. IV. 25: 155. 1944, at POM!)

A. boiseanus A. Nels. Bot. Gaz. 53: 223. 1912. *Cystium boiseanum* Rydb. Bull. Torrey Bot. Club 40: 50. 1913. (*Macbride 112*, "Big Willow [Canyon Co., Idaho]"; holotype at RM!; isotypes at GH!, MO!, NY!, US!, WIS!)

A. eremiticus var. *ampullarioides* Welsh, Great Basin Naturalist 46: 262. 1986. (*Welsh & Atwood 21049*, n. of Highway 91 at Shivwits, 1050 m elev., Washington Co., Utah, 21 Apr 1982; holotype at BRY!; isotype at NY!)

Hermit milkvetch.

Perennial herbs with multicipital root-crown or short caudex at or just below soil-level, strigulose nearly throughout with basifixed hairs, the foliage cinereous or green, the leaflets often glabrous above; stems several or many, erect-ascending or less often diffuse-assurgent, 1–5 dm tall, simple or proximally spurred; stipules 3–11 mm long, the lowest papery, ovate, approximate or imbricate, semi- or fully decurrent-amplexicaul but free, the upper ones narrower, triangular-lanceolate, subherbaceous; leaves (3) 4–18 cm long; leaflets 11–23, ovate, oblong, elliptic, or linear, obtuse or retuse, 5–26 mm long; peduncles erect, (1.5) 2.5–17 (24) cm long; racemes ± 10–25-flowered, at anthesis either loose or compact, the flowers ascending, spreading, or rarely declined, the axis becoming (1.5) 2–18 cm long; calyx partly or wholly black-strigulose, 5.5–9.5 mm long, the deeply campanulate tube 4.5–8 mm long, at base either subsymmetric or strongly oblique, the subulate teeth ± 1–2.5 mm long; petals variable in color, either ochroleucous or pale yellow with or without maculate keel-tip or all pale dull to vivid purple with contrasting pallid wing-tips, the moderately recurved banner 12–20 mm long, the wings ± 1–2 mm shorter, the obtuse keel 9.5–14.5 mm long; ovary glabrous; ovules 17–32; pod stipitate, in our region incurved to erect, the stipe 6–15 mm long, the narrowly oblong-ellipsoid body 15–28 × 3.5–8 (9, exceptionally in "var. *ampullarioides*" to 12) mm, cuneately tapering into the stipe, abruptly short-beaked at apex, trigonously and sometimes a trifle dorsiventrally compressed, keeled ventrally by the suture, the lateral faces low-convex, the dorsal face openly sulcate, the green or purple-tinged or -speckled valves becoming stiffly chartaceous or subcoriaceous, inflexed as a complete or partial septum 0.5–1.2 mm wide; dehiscence apical and downward, the beak gaping to release the seeds; $2n = 24$.

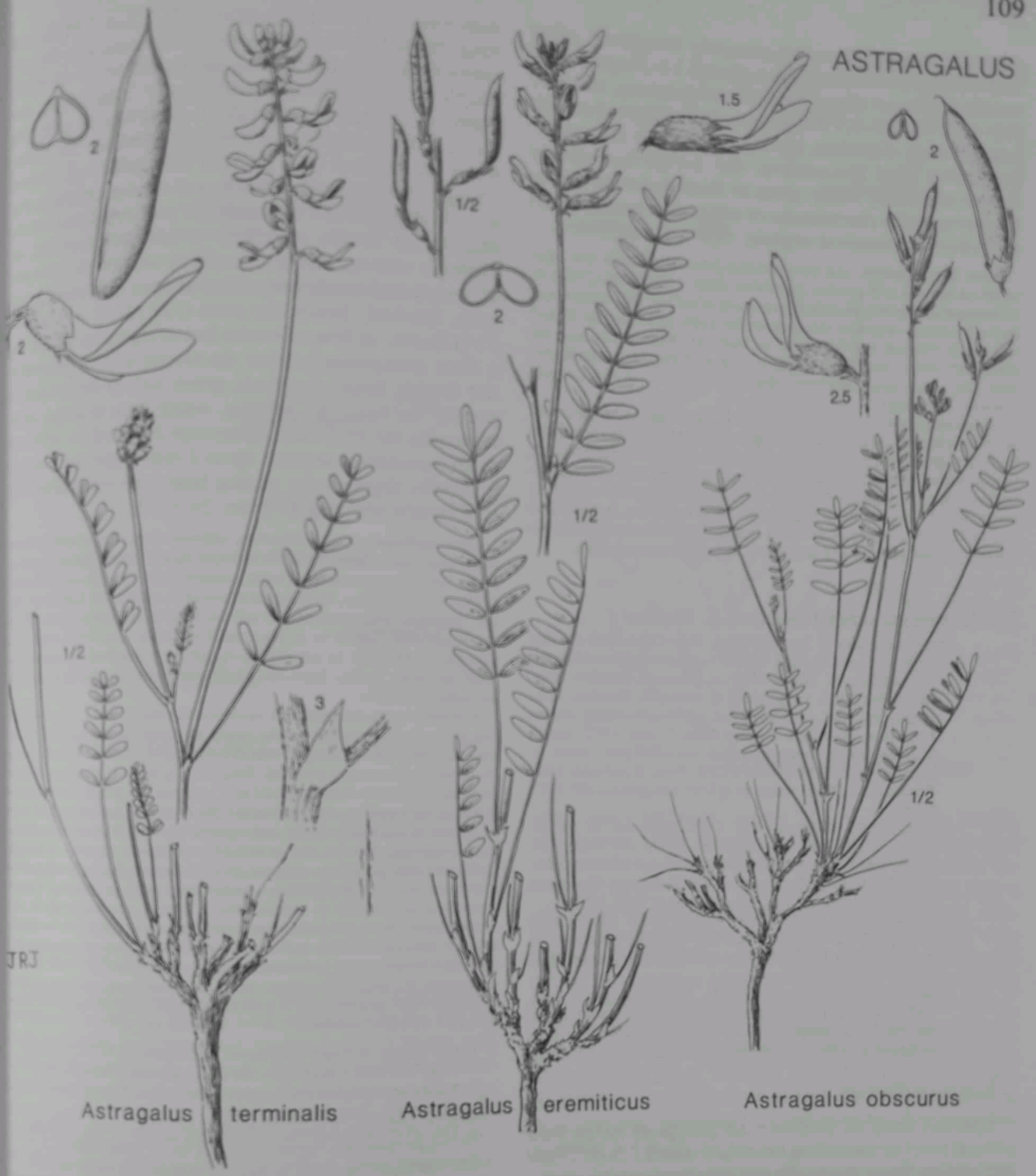
Plains and foothills, both in sagebrush climax and more barren habitats such as gullied clay knolls, tuffaceous or sandy bluffs, talus-slopes, and gravelly outwash alluvia, southward mostly in pinyon-juniper woodland, on a variety of eruptive and sedimentary substrates, 650–2100 m; scattered but forming populous colonies in the Owyhee Desert, nw. Snake River Plains, n. Central Great Basin, and Calcareous Mountains sections of the Great Basin in se. Oregon (Malheur Co.), sw. Idaho (e. to Cassia Co.), and the ne. third of Nev. (w. to e. Pershing Co.), thence interruptedly s. through se. Nev. and closely adj. Utah to the Grand Canyon Plateaus Sect. in Mohave and far nw. Coconino cos., Ariz.; extending shortly beyond our borders, n. in Oregon to Burnt River in Baker Co., and s. in Ariz. to the sources of Verde River in n. Yavapai Co.; remotely disjunct on bluffs of the Gila River in sw. N.M. Apr–June (southward), May–July (northward).

The range of *A. eremiticus*, as described above, is a rather unusual one, spanning almost ten degrees of latitude between eastern Oregon and northern Arizona but much less extended east and west, and distantly isolated in southwest New Mexico. It is a pattern that sets the stage for progressive differentiation of mutually remote populations. These indeed have long been known to differ in width of leaflets, length of raceme-axis, diameter and obliquity of the calyx-tube, color of petals, and diameter of the pod. In our range purple or purplish flowers occur in two distantly remote areas: a) in southeast Nevada, adjoining Utah, and northwest Arizona, commonly on limestone substrates, and associated with relatively broad leaflets and lax racemes (*A. eremiticus* sensu stricto); and b) in the Owyhee Desert in southwest Oregon and southwestern Idaho south of the Snake River, commonly on volcanic substrates, and associated with linear-oblong leaflets and relatively compact racemes. Immediately to the north of the last, astride the Snake River just within our border in Oregon and Idaho, the same narrow leaflets and short racemes coincide with a smaller narrower flower, ochroleucous except for the purple keel-tip (*A. cusickii* Rydb.; not A. Gray). In northeast Nevada the common syndrome is broad leaflets, compact raceme, large broad flowers, and uniformly ochroleucous flowers (var. *spencianus*). A robust but diffuse form, growing on clays of the Chinle formation in western Washington Co., Utah, and having pods potentially up to 12 mm diameter, has been segregated as var. *ampullarioides*. While perceptibly different, these forms evade exact definition and appear taxonomically inconsequential.

Two rare relatives of *A. eremiticus* that occur near our southwest border must be mentioned here in passing. *Astragalus remotus* (M. E. Jones) Barneby, known only from the foothills of the Spring and Charleston ranges in Clark Co., Nevada, has small ochroleucous flowers and more emphatically laterally compressed-triquetrous pods that stand erect, parallel and approximate to the raceme-axis, not incurved to vertical at a distance from the axis on a long, upwardly arching stipe. *Astragalus ackermanii* Barneby is apparently endemic to the Sheep and Pintwater ranges just outside our border in southwest Lincoln and adjoining Clark cos., Nevada, where it inhabits rock-ledges and crevices of limestone cliffs in box-canyons. Its pod differs from that of *A. eremiticus* in the short stipe (1.5–2, not 6–15 mm), and the 4–6 pairs of broad, emarginate leaflets remotely inserted on a wiry, persistent leaf-stalk are further distinctive.

74. Astragalus obscurus S. Wats.

Astragalus obscurus S. Wats. in King, Rep. Geol. Explor. 40th Parallel 5: 69. 1871. *Tragacantha obscura* Kuntze, Revisio



Gen. Pl. 2: 946. 1891. *Tium obscurum* Rydb. Fl. Rocky Mts. 498, 1063. 1917 [1918]. (*Watson 266*, foothills near Truckee Pass, Washoe Co., Nev.; holotype at US!; isotypes at GH!, NY!, YU!)

Tium miserum sensu Rydb. N. Amer. Fl. 24(7): 394. 1929, and Bull. Torrey Bot. Club 57: 403. 1930, as to description; not *A. miser* Douglas ex Hook. 1831.

Arcane milkvetch.

Slender, diffusely caulescent or subacaulescent, tufted, perennial herbs with superficial root-crown or short, suffruticulose caudex, strigulose with basifixed hairs, the foliage greenish or cinereous; stems 5–15 cm tall, when well developed radiating and prostrate or weakly assurgent, when short forming a subradical cluster of leaves and pseudoscapose peduncles; stipules 1.5–5.5 mm long, the lowest papery, often loosely imbricate, strongly decurrent-amplexicaul, free or obscurely connate, the upper ones narrower, subherbaceous; leaves (2.5) 3.5–10 cm long, the leaf-stalk slender but stiff; leaflets (5) 7–13 (15), openly or remotely inserted on rachis, varying from broadly oblong-elliptic to linear, 2–12 (15) mm long, mostly obtuse, rarely acutish, emarginate only when very broad, tending to be narrower in distal than in early leaves; racemes (3) 5–15-flowered, the flowers ascending, the axis becoming 1–6 (8) cm long; calyx (3) 3.5–5.5 mm long, black- and white-strigulose, the campanulate tube (2.3) 2.5–4 mm long, the broadly or narrowly subulate teeth 0.4–1.6 mm long; petals ochroleucous, dirty white or tinged with dull lilac, little graduated in length, the moderately recurved banner 7–10.5 mm long, the wings ± 1 mm shorter, the keel as long or slightly longer than wings,