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# IOWA STATE JOURNAL OF RESEARCH 

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## FROM THE EDITORS

It is not unusual for the statistical treatment of a manuscript to be questioned by reviewers and editors. One reason may be that the authors do not fully understand what the reviewers are looking for. On the other hand, reviewers may disagree among themselves on the correct way to handle a given set of data. Thus an author may try to follow the same pattern of data analysis and presentation that was successful in a previous publication only to find it does not work the second time. The author might then wonder if the new manuscript just appears to be similar in structure to the old but really presents a new situation that requires a different methodology.

Another difficulty authors face is that journals may have differing policies on how data should be analyzed. For example, multiple range tests, such as Duncan's, are often used to compare means. This may not necessarily be the best methodology, but many authors are of the opinion that reviewers and editors will demand this approach. The practice persists despite the fact that articles highly critical of the general use of multiple range tests have appeared in many different journals. Indeed, some plant science journals have attempted to replace the dogma of multiple range tests with alternative policies designed to force authors to make more meaningful analyses of means. These intentions are good and the new policies are definite improvements. However if the new policies are rigidly administered without an understanding of when exceptions are desirable and needed, there will be undesirable effects on author's presentations. The policy will be viewed as just another obstacle in the path toward publication. One then wonders if statistical review makes any difference other than to satisfy cranky reviewers and editors.

It would be reasonable to ask if the Journal has a statistical "policy." The answer is that there is no formal policy, but we can offer some guidelines. This editor feels that it is important for an author to inform the reader of how data were collected. This is necessary to allow the reader to judge whether the experimental evidence supports the author's conclusions. If the data were collected from an experiment, the author should describe the experimental design, the experimental units, the treatments, how the units were assigned to treatments, and how experimental error is estimated. Summary statistics such as means, standard deviations, and regression coefficients should be skillfully presented in tables, graphs, and in the text.

A clear connection between the statistics and the conclusions is imperative. Similar guidelines apply when data come from observational studies.

Authors should not view the statistical treatment of a manuscript in terms of a hurdle to clear or a law to follow. Rather, the statistics should be used as the author's ally in clarifying and documenting strength of evidence.
P. N. H.

The Iowa State Journal of Science was established in 1926. Now presently in Volume 60, threescore years, we have reached a venerable age for a journal of this type.

In the initial issue, the famed bacteriologist, R. E. Buchanan, editor, listed some five reasons for establishment of the Journal. Of these the first was:


#### Abstract

First, to furnish a medium for the prompt publication of the results of research. Experience has shown that many of the technical and scientific journals are at present overcrowded, and it is frequently impossible to secure publication of an article for many months or even a year or more after acceptance.


For this and the other stated reasons, the Journal was supported entirely by the College (later University) for some 52 years in that there were no page charges.

A "Journal of Science.." In an age of increasing disciplinary specialization, the Journal was truly interdisciplinary in science, the first volumes containing important contributions in Biology, Home Economics, Chemistry, Economics, Agriculture, etc. It included a number of classic publications that because of length would have been difficult to publish elsewhere; e.g., Gilman, J. C. and W. A. Archer. 1929. "The fungi of Iowa parasitic on plants" in volume 3: 299-507; Jacobs Anderson's "Flora of Alaska," published in sections in the late forties and early fifties, after revision appearing as a book, the now standard floristic reference for that state. Abstracts of doctoral theses were published. The inclusion of major symposia was then, as now, a regular feature; e.g., "Six decades of the modern era in botanical science" in 1935, volume 9: (2-3) 219-565 that included contributions from twenty authors.

Some seven individuals have served as editor of the Journal. The founder, R. E. Buchanan, resigned in 1940. Following brief stewardship of J. W. Woodrow, J. C. Gilman (Botany) assumed the editor's post, which he held until 1948 when he was briefly succeeded by W. H. Bragonier and G. F. Stewart. Then, now Emeritus Professor, Buchanan again assumed the post of Editor-in-Chief, and so continued until his death in 1972. Ellis Hicks (Entomology) followed, and upon his retirement in 1979 was succeded by the present editor, Duane Isely (Botany).

In 1972, consistent with the broadening of the university thrust, the pages of the Journal were opened to humanities faculty and the name changed to The Iowa State Journal of Research. To meet financial pressure and render the Journal partly self-supporting, page charges of $\$ 10$ per page were instituted in 1978. In keeping with the changing times, in 1979, rigorous off-campus peer review structure was instituted. This, a major undertaking for a multidisciplinary journal, rendered editorial input on the part of several participating faculty more complex than at any time in the past. Recently, also, a new cover was designed, replacing that which, except for minor changes, had been used since 1926. The eighties have also seen the addition of a "From the Editors" column and the sporadic initiation of a book review section. Anyone currently scanning the Journal will see that its output is approximately half and half symposia (from both the sciences and the humanities) and author issues, in the latter, the biological and agricultural sciences predominating.

Happy birthday, $I S J R$. What, for better or worse, may the next ten years bring? D.I.

# LEGUMINOSAE OF UNITED STATES. ASTRAGALUS L.: III. SPECIES SUMMARY F-M. ${ }^{17}$ 

Duane Isely ${ }^{18}$


#### Abstract

This is the third portion of a taxonomic-descriptive treatment of Astragalus, native, established, and cultivated in the United States. Following keys to species (Isely, 1983a), the succeeding parts include, for each species, a description of the plant, its geographic range and habitat, synonymy listing, keys to varieties, if any, and usually a brief discussion.

Index descriptors: Astragalus, Leguminosae, United States flora.


The first entry in this series (Isely, 1983a), "Keys to United States species" of Astragalus, included an extensive introduction and acknowledgments. The second (Isely, 1984) "Species summary A-E," therefore, required only a brief introduction. Please refer to these publications if information about coverage, format, and terminology beyond that explicit in the following pages is desired.

I note further only that if the condition of pubescence is not stated, it may be assumed to be basifixed, that the term "Lancoid. Lanceolate in three dimensions" listed in the short glossary in the primary introduction has been abandoned for the more elegant "lanceoloid," and that "PI" is the standard U.S. Department of Agriculture designation for Plant Introduction entries. Astragalus knightii Barneby, herein, was described after publication of the key to species (Isely, 1983a) and consequently was not included.

To facilitate reference use before completion of the parts of this summary of Astragalus, each section contains an independent "Literature Cited."

I thank Ms. Carol Greiner and Kay Klier for their careful reading of the manuscript prior to journal composition.

## Astragalus falcatus Lamarck (1783) <br> Established?

Robust, strigulose perennial of glabrate aspect from a superficial crown with erect, clump-forming stems 4-7 dm. Pubescence dolabriform.

[^0]Leafstalk 5-15 cm; leaflets 21-35, elliptic-oblong, 1-3 cm , ca. 3-6 $r$. Lowermost stipules connate, remainder free. Racemes exserted with $20+$ quickly deflexed flowers $9-11 \mathrm{~mm}$; axis elongating to $0.5-2 \mathrm{dm}$ in fruit. Calyx tube 3-3.5 mm; teeth $0.5-1 \mathrm{~mm}$. Corolla greenish-yellow ("buds dull red, opening pale greenish-yellow, keel brighter yellow"; from an herbarium label); standard little reflexed. Ovules ca. 10-15. Legumes reflexed-incurved, subsessile, bilocular, deciduous with pedicel, tardily dehiscent; body oblong- or lanceolate-falcate, triquetrouscompressed, $1.5-3 \mathrm{~cm} \times 3-4 \mathrm{~mm}$, dorsally sulcate; valves coriaceous, strigulose; dehiscence presumably on ground, said to be apical.

Se WA, c UT, and possibly elsewhere; introduced for agricultural trial, and locally escaped. Native of Asia Minor. June-Aug.

Astragalus falcatus in flower has somewhat the aspect of the native $A$. canadensis, but the deflexed, curved pods that fall with the pedicel are entirely different. It has been repeatedly introduced (NA) by the U.S. Department of Agriculture and planted in several states. It has been reported, ostensibly as a member of the established flora, by Barneby (1946, 1964), Hitchcock (1961), and Welsh (1978). All U.S. collections seen, however, that represent purportedly established populations are more than 30 years old. A. falcatus thus is probably only an agricultural waif.

Williams and Barneby (1977) have recently reported a higher concentration of poisonous nitro-toxins in Astragalus falcatus than in any native species and state, "The status of A. falcatus in the United States was thus changed from a species recommended for range revegetation to one recommended for eradication."

## Astragalus feensis Jones <br> Map 73

A. feensis Jones (1898); Hamosa feensis (Jones) Rydb. (1927); A. sanctae-fidei Tidestr. (1941).

Cinereous or silvery, villosulous, acaulescent or shortly caulescent perennial from superficial origin with clustered crowns or short, prostrate stems $1-6 \mathrm{~cm}$. Leafstalk $4-9 \mathrm{~cm}$; leaflets (7-) 9-15 (-17), cuneate-obovate to oblanceolate, obtuse, $3-12 \mathrm{~mm}, 2-3 r$, often folded, sometimes glabrate above. Stipules free. Racemes $>$ or $\pm$ leaves with $7-12$ subumbellate or loosely disposed, ascending-spreading flowers $12-16 \mathrm{~mm}$, becoming reclinate in fruit. Calyx tube subcylindric, 4.5-6.5 mm ; teeth $1-2 \mathrm{~mm}$. Corolla pale pink-purple, barely graduated, standard oeillate. Ovules ca. 25-35. Legumes divaricate-humistrate, sessile, bilocular or nearly so, deciduous, dehiscent; body crescentriclanceoloid, incurved to $180^{\circ}$, triquetrous, deltoid-cuspidate beaked,
(1-) 2-3 $\mathrm{cm} \times 4-5 \mathrm{~mm}$, dosally sulcate; valves coriaceous, reticulate, strigulose; dehiscence on ground, apical, both sutures. Argophylli: Pseudoargophylli.

E NM. Stony or sandy slopes with juniper. Ca. 1500-1900 m. April-May.

This species and Astragalus waterfallii, to the south, look like typical members of the Argophylli in flower; i.e., they are tuftedsubacaulescent and have subcapitate or shortly racemose "heads" of narrow flowers. But the fruits are triquetrous and bilocular, atypical for that section. Fruiting $A$. feensis can usually be recognized by its strongly curved, often subhamate pods.

## Astragalus filipes Torrey ex Gray <br> Map 70

A. leptophyllus Nutt. (1834) nom. ambig., non Desf. (1800); A. stenophyllus [sensu] T. \& G. (1838); Homalobus stenophyllus [sensu] (T. \& G.) Rydb. (1900); Phaca stenophylla [sensu] (T. \& G.) Piper (1906).
A. filipes Torr. ex Gray (1864); H. filipes (Torr. ex Gray) Heller (1913); A. stenophyllus var. filipes (Torr. ex Gray) Tidestr. (1937).
H. macgregorii Rydb. (1923); Astragalus macgregorii (Rydb.) Tidestr. (1937).
A. filipes var. residuus Jeps. (1925); A. stenophyllus var. residuus (Jeps.) Barn. (1950).
Strigulose or glabrate, green or cinereous perennial from a superficial crown with clustered, clump-forming, erect or spreading, often distantly leafy stems $3-8 \mathrm{dm}$. Leafstalk $2-9(-10) \mathrm{cm}$; leaflets (7-) 9-19 (-21), often distant, oblong-lanceolate to linear or filiform, flat or involute, $5-20(-30) \mathrm{mm}, 4-25 r$; terminal leaflet articulate or decurrent. Lower stipules connate. Racemes exserted, loose, with elongating axis, and $20+$, soon spreading or reflexed, sometimes upswept flowers (9-) 11-14 mm. Pedicels $1.5-5 \mathrm{~mm}$. Calyx tube 3-5.5 (-6) mm; teeth ca. 1 mm . Corolla whitish, ochroleucous to dull lemonyellow, (9-) 11-14 mm; standard recurved $45^{\circ}-80^{\circ}$; keel upcurved $90^{\circ}$ $120^{\circ}$. Ovules $12-20$. Legumes spreading to deflexed, conspicuously exserted-stipitate $6-14 \mathrm{~mm}$ with filiform stipe, unilocular, persistent, dehiscent; body elliptic-oblong to oblong, flat, tapering both directions, 15-25 (-30) $\mathrm{mm} \times(3-) 4-5(-6) \mathrm{mm}$; valves papery, cross-striate, strigulose or glabrate; dehiscence proximal, ventral. Cusickiani: Inversi.

S British Columbia to n Baja California. Transmontane WA and OR, s ID, n CA, and c NV; also disjunctly, s cismontane CA. Xeric open
slopes, flats, washes, canyons, grassland and/or sagebrush, juniper "waysides," and "scabland"; with increasing elevation to pines and open ridges; roadsides; various soils; widespread and abundant. In s CA: chaparral, foothill slopes. (100-) $300-2750 \mathrm{~m}$. May-June (-July, higher elevations).

Astragalus filipes is possibly the most abundant and widely dispersed Astragalus in much of the sagebrush country of the Columbia and northern Great Basin. In most of its range it is the only one with connate stipules and pendulous, exserted-stipitate, flat, unilocular pods. In northern California it overlaps slightly with the related $A$. inversus, which has a strigulose or mottled pod. The pod of A. filipes in this area is glabrous. The southern California fragment of A. filipes in fruit resembles the sympatric A. trichopodus var. phoxus, but the latter has free stipules.

Astragalus filipes is geographically multiracial with conspicuous variation in leaflet proportions, raceme length, and legume pubescence (the basis of varieties or affiliated species) somewhat as follows:

1. Leaflets "broad," usually 4-8 $r$, sometimes cinereous with partly villosulous pubescence; s CA. Southern California type
2. Leaflets broad or narrow, strigose or glabrate; c NV and $n$.
3. Leaflets commonly linear-filiform, 8 - $20 r$, involute; plants with sparsely foliose aspect; fruiting racemes lax, often 10 cm+; legumes strigulose or glabrous; WA, c OR and sporadically s.

Columbia Basin type
2. Leaflets commonly flat and broader, 4-10 r; plants more foliose than above; racemes often $5-10 \mathrm{~cm}$ and compact; legumes glabrous; c OR, ID and s.

Great Basin type

Beyond this evident geographic-morphological variegation, Astragalus filipes evidently includes more than one cytological group. Head (1957) reported $2 \mathrm{n}=24$ for three Oregon populations, whereas Spellenberg (1976) reported $2 \mathrm{n}=11$ from the same state. Further study will be required to determine if there is a relationship between origin and chromosome number. I am presently hesitant to define formal varieties, but I suspect at least the disjunct southern group deserves nomenclatural listing.

Flower color is variously reported on herbarium labels. The flowers, initially white or greenish-white on opening, rapidly acquire a yellow hue.

Astragalus flavus Nuttall (1838)
Maps 71, 72
Subacaulescent or usually caulescent, seleniferous, strigose (- pilose), usually cinereous perennial of superficial or aerial origin from ascending or horizontal, sometimes thinly thatched caudices; stems numerous, simple, commonly whitish, prostrate-assurgent and radiating from crown in a circular, concave mass, to 2.5 dm . Pubescence dolabriform, appressed or spreading. Leafstalk 4-15 cm; leaflets (7-) 9-17, narrowly elliptic to linear-oblong, often involute or folded, 4-8 $r$, glabrate or pubescent above. Lower stipules connate. Peduncles usually $>$ foliose portion of stems; racemes erect, exserted, spicate and compact, then elongating, with 10-20+ ascending flowers 9-15 (-18) mm; bracts sometimes conspicuous. Pedicels in flower 0.10.6 mm . Calyx tube campanulate to subcylindric, $3-5 \mathrm{~mm}$; teeth $1-4$ $(-5) \mathrm{mm}$. Corolla yellow-white, pink-purple or faint lavender; keel often conspicuously maculate. Ovules 8-15. Legumes ascending or erect, sessile, unilocular, deciduous with pedicel, tardily dehiscent, partially enveloped by the persistent calyx; body ovoid to ellipsoidoblong, obcompressed, 7-12 (-14) mm $\times 4-5 \mathrm{~mm}$; dorsal face flat or slightly depressed, ventral face proximally deeply sulcate, the conspicuous salient suture dividing the groove, thus giving a bisulcate appearance; valves initially subfleshy, becoming coriaceous at maturity, strigulose or subvillous; dehiscence on ground or raceme, apical and downward. Ocreati: Ocreati.

Primarily diagonal se half of UT and w CO; n to s WY; s to nw NM, AZ (-se NV). Desert scrub with sagebrush or juniper, alkaline, clay soil.

The recognition marks of this abundant, low elevation, often badlands species are its bird's-nest appearance, spicate racemes, and ventrally two-grooved pods partly enclosed by the calyx. It has three blending forms that have been called varieties.

## Key to varieties of Astragalus flavus

1. Petals pink-purple to reddish; calyx teeth $3-4(-5) \mathrm{mm}, \pm$ or $>$ tube; calyx tube strongly villous to villous-hirsute; ec UT.
var. argillosus
2. Petals yellow to white (-lavender-tinged); calyx teeth usually 1-2.5 $\mathrm{mm},<$ tube; tube glabrescent or villous.
3. Petals ochroleucous-cream to yellow (-lavender or striate in intermediates); keel $8-10 \mathrm{~mm}$; calyx ca. 5.5-7.5 mm; sw WY, w CO, c to ne UT, to nw NM, ne AZ. var. flavus
4. Petals white to faintly lilac-tinged; keel 6.5-8 (-8.5) mm; calyx ca. 4-6.5 mm; s UT, n AZ, and se NV. var. candicans
A. argillosus Jones (1891); Cnemidophacos argillosus (Jones) Rydb. (1913); A. flavus var. argillosus (Jones) Barn. (1964).
Range as given in key. Gravelly-clay or sandy flats and washes with pinyon-juniper, Atriplex. 1200-1500 m. (April-) May-June.

Var. argillosus has small flowers ( $9-11 \mathrm{~mm}$ ) and short fruits (to 10 mm ). The leaflets are pubescent on both sides and commonly silvery; those in the other varieties are at least medially glabrescent above.

Var. candicans Gray
Map 71
A. flavus var. candicans Gray (1876); A. confertiflorus Gray (1878); Cnemidophacos confertiflorus (Gray) Rydb. (1913).

Range as given in key. Lower elevations in river valleys, sterile clay-gravel, pinyon-juniper badlands. 600-1700 m. April-May.

Ideal var. candicans has almost pure white flowers. The inflorescences, with quickly loosening axes, $3-10 \mathrm{~cm}$, average longer than those of the higher elevation var. flavus. The pods are shorter, tending to be ovoid rather than broadly oblong. The variety occurs in typical form especially in Washington and Kane cos., Utah; those of eastern Utah and Arizona are intermediate toward var. flavus.
A. flavus Nutt. (1838); Tragacantha flaviflora Kuntze (1891) non T. flavus (Hook. \& Arn.) Kuntze (1891); A. flaviflorus (Kuntze) Sheld. (1894); A. nuttallianus Speg. (1902) non DC. (1825); Cnemidophacos flavus (Nutt.) Rydb. (1906); A. confertiflorus var. flaviflorus (Kuntze) Jones (1923).
Range as given in key. Bluffs, desert flats, eroded slopes, alkalineclay, sandstone or shale soils. 1700-2250 m. (April-) May-June (-Aug.).

Var. flavus, the most widely distributed, primarily eastern portion of the species, has initially subcapitate or broadly spicate racemes, large yellowish flowers, a large pod, and calyx teeth that are usually shorter than tube. The fruiting raceme elongates or remains short so that the contiguous pods overlap. Var. flavus blends with both of the other kinds.

Astragalus flexuosus (Hooker) Don (1832)
Map 74
Shortly or conspicuously rhizomatous, pubescent perennial from a subterranean or nearly superficial caudex with decumbent to spreading-ascending, usually clustered stems 1-5 dm. Pubescence of straight and appressed or incurved (-spreading) hairs $0.3-0.6 \mathrm{~mm}$.

Leafstalk $3-8 \mathrm{~cm}$; leaflets (11-) 15-23, elliptic or narrowly oblong, truncate or retuse, $4-15 \mathrm{~mm}, 2.5-5.5 r$, flat or folded, pubescent or glabrate above. Lower stipules connate. Flowering racemes $\pm$ leaves, soon elongating and exserted, with 10 -numerous, spreading, then declined flowers $7-11 \mathrm{~mm}$. Calyx tube campanulate, $2.5-4 \mathrm{~mm}$; teeth $0.5-1.5$ (-2) mm. Corolla drab ("dirty flesh color"), pale lilac or lavender, or pinkish or purple, or bicolored, upswept in one variety; standard recurved ca. $45^{\circ}$ or to $90^{\circ}$; keel recurved $90^{\circ}$ or more, usually acute. Ovules $15-25$. Legumes spreading or usually deflexed, sessile or stipitate to 1.2 (-2) mm, unilocular, oblong, persistent, dehiscent; body oblanceolate or ellipsoid, straight or slightly incurved, subterete (or appearing laterally compressed when immature) or somewhat obcompressed, turgid or inflated (var. greenei), 11-20 (-24) mm $\times 2.5-9 \mathrm{~mm}$; neither surface sulcate or both slightly so; valves papery to subcoriaceous, reticulate or cross-rugose, sometimes mottled, strigulose to glabrate; dehiscence apical, ventral. Scytocarpi: Scytocarpi.

S Canada and w U.S. W MN to w MT, s to s AZ and NM. High plains in the n , e slope of Rockies extending into the Colorado and Rio Grande drainage to the w and s.

Astragalus flexuosus, one of the more widely distributed and common species of the Rockies, is a rhizomatous plant with connate stipules, small flowers of dull to purple tint, and oblong, subterete, sessile or barely stipitate, persistent, turgid (-inflated), 1 -celled, pubescent (-glabrous) pods. It and its immediate relatives (subsection Scytocarpi) constitute a complex group among which Barneby (1964) has created reasonable order from pre-existing chaos.

## Key to varieties of Astragalus flexuosus

1. Legumes ovoid to ellipsoid, subinflated, (4-) $5-9 \mathrm{~mm}$ diam. sessile, rounded at base, pubescent; n and w NM to ec AZ. var. greenei
2. Legumes oblong to oblanceolate, not inflated, $2.5-4.5 \mathrm{~mm}$ diam., sessile to shortly stipitate, sometimes glabrous, usually narrowed to base; range as follows.
3. Legumes (10-) $12-25 \mathrm{~mm}$; calyx (3-) $3.5-5$ (-6) mm; keel $5.5-8$ mm , the obtuse apex incurved about $90^{\circ}$; range of species except barely into UT, absent from AZ. var. flexuosus
4. Legumes $10-15 \mathrm{~mm}$; calyx $3-4 \mathrm{~mm}$; keel ca. 5 mm , the rounded or acute apex incurved to ca. $120^{\circ}$; w CO and adjacent UT (-AZ).
var. diehlii

Var. diehlii (Jones) Barneby
A. diehlii Jones (1923); Pisophaca diehlii (Jones) Rydb. (1929); A. flexuosus var. diehlii (Jones) Barn. (1944).

Range as given in key. Deserts, canyons, washes, roadsides; with pinyon-juniper, Atriplex; sandy-clay to shale soils. $1350-1700 \mathrm{~m}$. (April-) May-July (-Aug.).

In usual form, var. diehlii differs from the more widespread var. flexuosus not only by the stated key characters, but by its fewer leaflets (often no more than 11 to 15), its small, light-colored, upswept flowers, and its short, proportionately broader or subinflated, strictly sessile, usually straight pods. But the variety is certainly contoured by degrees, and Utah material includes intermediates.

## Var. flexuosus

Map 74
Phaca flexuosa Hook. (1831); A. flexuosus (Hook.) Don (1832); Homalobus flexuosus (Hook.) Rydb. (1906); Pisophaca flexuosa (Hook.) Rydb. (1929).
Phaca elongata Hook. (1831) non A. elongata Willd. (1802); A. flexuosus var. elongatus (Hook.) Jones (1902); Pisophaca elongata (Hook.) Rydb. (1929).
Phaca fendleri Gray (1849); A. fendleri (Gray) Gray (1853); A. flexuosus var. fendleri (Gray) Jones (1902); Homalobus fendleri (Gray) Rydb. (1906).
Pisophaca sierrae-blancae Rydb. (1929); A. flexuosus var. sierrae-blancae (Rydb.) Barn. (1944).
Pisophaca saundersii Rydb. (1929).
Pisophaca ratonensis Rydb. (1929).
Range of species except for sw periphery; to s NM, slightly in se UT, not in AZ.

Grasslands, sagebrush, oak thickets, eroded knolls, pinyon-juniper upwards to open areas and meadows in yellow pine or fir; dry to mesic sites along streams; roadsides; frequent and abundant. (300-) $750-2750 \mathrm{~m}$. (May-) June-July (-Aug.).

The species with which typical Astragalus flexuosus is most frequently confused are A. gracilis (in flower) and A. tenellus (in flower or fruit). The differences are:

1. Leaflets 2-10 $r$; ovules 5-9; stipules 2-4 (-5) mm. A. gracilis
2. Leaflets $2.5-5 r$; ovules $15-25$; stipules (3-) 5-7 mm. A. flexuosus and
3. Origin superficial; ovules 4-8; pods flat. A. tenellus
4. Origin subterranean; ovules $15-25$; pods subterete or slightly obcompressed.
A. flexuosus

See Barneby (1964) for an analysis of the considerable geographic variance within var. flexuosus. I believe further study might allow its segregation into two (or possibly more) intergradient but reasonably discrete taxa.

Var. greenei (Gray) Barneby
Map 74
A. greenei Gray (1880); A. gracilentus var. greenei (Gray) Jones (1898); Pisophaca greenei (Gray) Rydb. (1929); A. flexuosus var. greenei (Gray) Barn. (1960).
Phaca gracilenta Gray (1849); A. gracilentus (Gray) Gray (1864); Pisophaca gracilenta (Gray) Rydb. (1929).

Pisophaca stictocarpa Rydb. (1929); A. stictocarpus (Rydb.) Tidestr. (1937).
E AZ (Gila Co.); w NM (Grant Co.); n NM (Sandoval and Santa Fe cos.). Barren and eroded open sites, clay to sandy soils, usually with juniper. 1350-2300 m. April-June.

Astragalus flexuosus var. greenei, found at the southwestern periphery of the species, has moderately or strongly inflated pods and is usually villosulous. It merges with var. flexuosus in northern New Mexico. It is commonly confused with $A$. hallii, which has larger flowers and mottled pods.

The considerable pod variation within var. greenei does not correlate with its interrupted areas of distribution and does not seem to be of taxonomic significance.

Astragalus frigidus (L.) Gray
Glabrate, erect perennial with simple stems; leaflets ca. 7-17, ovate or elliptic, commonly more than 1 cm wide; stipules unifoliateamplexicaul, conspicuous; racemes exserted, with 10-20+ quickly deflexed flowers $12-14 \mathrm{~mm}$; calyx strigulose, oblique, barely toothed; corolla ochroleucous with subequal petals; legumes persistent, stipitate, unilocular, moderately bladdery-inflated, ellipsoid, acute, ca. $2-3 \mathrm{~cm} \times$ 5 mm ; valves papery, initially strigulose. Europe.

Bailey and Bailey (1941). No U.S. material seen.
This is the Eurasian phase of the circumboreal complex that includes the North American Astragalus americanus and A. umbellatus.

Map 73
Phaca subcinerea auct.; A. subcinereus auct. pro parte.
Shortly rhizomatous, initially cinereous, strigose perennial from subterranean caudices with sparsely foliose, decumbent to ascending,
initially silvery stems to 4 dm . Leafstalk $3-10 \mathrm{~cm}$; leaflets $9-15$, oblanceolate to linear, (4-) 6-12 (-15) mm, 5-9 $r$ (lowermost 3-6 $r$ ), flat, involute to folded, glabrate above. Lower stipules connate. Racemes $\pm$ or $>$ leaves, moderately elongating with $10-15$, ascending, then declined flowers $6.5-8 \mathrm{~mm}$. Calyx tube $2-3 \mathrm{~mm}$, white-strigose; teeth $1-1.5 \mathrm{~mm}$. Corolla red-purple to rose or bicolored; standard oeillate, upcurved ca. $90^{\circ}$; wings $\pm$ standard; keel recurved $90^{\circ}$, acute to subporrect. Ovules 20-30. Legumes spreading or declined, sessile or incipiently stipitate, unilocular, persistent, slowly dehiscent; body bladdery-inflated, ovoid, slightly obcompressed, ca. $2-3 \mathrm{~cm} \times 1.2-2 \mathrm{~cm}$; ventral face slightly sulcate; valves firmly papery, mottled, strigose; dehiscence apical, ventral. Scytocarpi: Scytocarpi.

Ne AZ and adjacent UT (-CO, NM). Primarily of San Juan River basin; sandy plains, benches, dunes, washes; with sagebrush, ephedra, juniper. 1350-1850 m. May-June.

Astragalus fucatus looks like a member of the Inflati but has the rhizomatous origin and connate stipules of the Scytocarpi. Therein, it is distinguished by its mottled, bladdery-inflated, strigulose pods, its sparsely foliose aspect, and the somewhat upswept flowers with a subporrect keel.

Astragalus fucatus has historically been confused with $A$. subcinereus of southwestern Utah and adjacent Arizona, which has pale flowers and villosulous pubescence of curved hairs. A. flexuosus var. greenei, also with inflated pods, has larger flowers, and the fruits are not mottled.

## Astragalus funereus Jones

Map 75
A. funereus Jones (1908); Xylophacos funereus (Jones) Rydb. (1925); A. purshii var. funereus (Jones) Jeps. (1936); A. newberryi var. funereus (Jones) Clokey (1942).
Subacaulescent to caulescent, caespitose or mat-forming, tomentose perennial from a superficial origin with prostrate stems 1-6 cm . Pubescence densely white-tomentose or pannose with sinuous, tangled hairs ca. 1-1.5 mm. Leafstalk 2-6 cm; leaflets 9-15, obovate to elliptic, $3-12 \mathrm{~cm}$, ca. 1.5-2.5 r. Stipules free. Racemes $\pm$ or $>$ leaves, subumbellate or briefly racemose with $4-8$ ascending flowers $2.2-3 \mathrm{~cm}$; peduncles ultimately reclinate, axis little elongating. Calyx tube commonly black-pubescent, cylindric, $9-11 \mathrm{~mm}$; teeth $2-4 \mathrm{~mm}$. Corolla pinkpurple or purple-tipped, drying blue or violet, narrow; keel $\pm$ or $>$ wings. Ovules $30^{+}$. Legumes ascending-humistrate, sessile, unilocular, deciduous, tardily dehiscent; body lanceoloid to ellipsoid-acuminate,
moderately or sharply incurved, obcompressed, 2.5-4 (-5) cm $\times 1-1.3$ mm ; valves fleshy, coriaceous, largely obscured by a tomentum of hairs to 2 mm ; dehiscence said to be on ground, apical. Argophylli: Eriocarpi.

CA, Inyo Co., e edge of Death Valley, and adjacent Nye Co., NV. Clay ridges, volcanic talus, rock debris in canyons. Local. Ca. 13501500 m. March-April.

This dazzlingly beautiful species looks somewhat like a misplaced Astragalus utahensis with the flower proportions of $A$. coccineus. Although possibly seen in life by no more than half a dozen botanists, it has been reported beyond its relatively limited range because some $A$. newberryi has been identified as $A$. funereus. $A$. newberryi is strictly acaulescent, heavily thatched, and has sericeous rather than tomentose leaflet pubescence.

Astragalus galegiformis L.
Tall, herbaceous, inconspicuously pubescent perennial. Leaflets ca. 23-33; elliptic or elliptic-oblong, glabrate above; stipules free; racemes elongate with numerous, quickly deflexed, yellow flowers 14 15 mm ; legumes deflexed, long-stipitate, bilocular, deciduous with pedicels, naviculate or shortly triangular-lanceolate, triquetrouscompressed, ca. 1-1.5 cm, glabrous. Sw Asia and adjacent Europe.

Bailey and Bailey (1941). One U.S. specimen (ISC).

Astragalus gambelianus Sheldon Map 75
A. nigrescens Nutt. (1848) non Pall. (1800); A. gambelianus Sheld. (1894); Hesperastragalus gambelianus (Sheld.) Heller (1905).
A. elmeri Greene (1895); Hesperastragalus elmeri (Greene) Rydb. (1926); A. gambelianus subsp. elmeri (Greene) Abrams (1944); A. gambelianus var. elmeri (Greene) J.T. Howell (1948).
Diminutive or vigorous, sparsely puberulent annual with simple or usually basally branched, ascending to erect stems $0.5-2.5 \mathrm{~cm}$. Leafstalk $1-6 \mathrm{~cm}$; leaflets $7-13$, obovate-cuneate, oblong to oblanceolate, notched, $2-5$ (-9) mm, (2-) 2.5-4 $r$, glabrate or pubescent above. Stipules free. Racemes shortly-exserted, subcapitate, then elongating and spicate, with (3-) 5-10 (-15) initially ascending, quickly deflexed flowers 2.5-4 (-6) mm. Pedicels $<1 \mathrm{~mm}$. Calyx tube 1-1.5 mm , black-villous; teeth $0.5-1 \mathrm{~mm}$. Corolla white to lavender (-violet) with
maculate keel; standard scarcely reflexed. Ovules 2. Legumes contiguous and somewhat imbricate, reflexed, sessile, bilocular with a narrow septum, deciduous, "dehiscent"; body strongly obcompressed, ovate in dorsal view, slightly incurved, ca. $3-4 \mathrm{~mm} \times 2.5-3.5 \mathrm{~mm}$; ventral suture raised, straight or concave; dorsal face broadly sulcate; valves thickly papery to somewhat corky, silvery when young, becoming rugulose, substrigulose or incumbent-puberulent; "dehiscence" consisting of separation of the two valves through the septum into two indehiscent halves. Microlobium: Gambeliani.

Cismontane CA (-OR and Baja California); most abundant in Coast Ranges but extending to lower Sierra Nevada in n CA. Grassy slopes, dry creek beds, with chapparal, oaks and pine, tolerant of serpentine, succeeding in disturbed areas; common and abundant. Ca. 500-900 (-1350) m. (March-) April-June.

Astragalus gambelianus is a ubiquitous annual, easily recognized by its dark-pubescent inflorescences of tiny, subsessile, capitate or spicate, quickly reflexed flowers and its retrose-imbricate, broadly obcompressed pods that break into halves. Var. elmeri is based on large-flowered variants, primarily of Marin County, that apparently occur casually with the usual form.

Map 76
Strigulose, low and often diminutive annual (-biennial) with simple or basally branched, radiating and decumbent-ascending or tufted stems 0.2-2 dm. Leafstalk (2-) $4-10 \mathrm{~cm}$; leaflets 5-9 (-13), elliptic, oblanceolate or oblong, obtuse, $5-15 \mathrm{~mm}, 3-7 r$, commonly folded, usually glabrate above. Stipules free. Racemes included, the peduncles $0.5-2.5 \mathrm{~cm},<$ leaves, with $3-8$ loosely disposed, ascending to finally reflexed flowers $5-7.5 \mathrm{~mm}$; fruiting axis somewhat elongating, but remaining included (except in the rare var. triquetrus). Calyx tube $1.5-2.5 \mathrm{~mm}$; teeth $0.5-1.5 \mathrm{~mm}$. Corolla white (-purple), lightly veined with faintly maculate keel which is incurved $100^{\circ}-120^{\circ}$. Ovules ca. 7-15. Legumes declined, sessile, unilocular (-subunilocular), deciduous, tardily dehiscent; body bladdery-inflated, asymmetrically halfovoid or sharply lunate-incurved, usually triquetrous-compressed, $15-25 \mathrm{~mm} \times 7-10 \mathrm{~mm}$, with a conspicuous, deltoid beak; valves membranous-papery, strigulose; dehiscence after falling, apical. Inflati: Aridi.

WY to se WA, s to s NV and UT (nw AZ, CA).
Astragalus geyeri is a homely, annual species with small, drab flowers largely hidden by the foliage, and inflated pods intercalary among the leaves. Its considerable, albeit fragmented range is the
largest of the Inflati, being approached only by $A$. allochrous, the only other widely distributed species.

## Keys to varieties of Astragalus geyeri

1. Legumes unilocular; leaflets oblanceolate or oblong, 3-8 $r$; range of species except as follows. var. geyeri
2. Legumes subunilocular with septum $0.5-1.5 \mathrm{~mm}$ wide; leaflets elliptic, 2-3 r; se NV and adjacent AZ. var. triquetrus

## Var. geyeri

Map 76
Phaca annua Geyer (1847) non A. annus DC. (1802); A. geyeri Gray (1864).
Range of species except s NV and adjacent AZ. Open sandy hillsides, dunes, desert flats, washes with sagebrush, juniper, etc.; locally abundant. (150-) 750-2150 m. May-June (-July).

Var. geyeri is the only annual Astragalus in the northern portion of its range.

Var. triquetrus (Gray) Jones Map 76
A. triquetrus Gray (1878); A. geyeri var. triquetrus (Gray) Jones (1898); Phaca triquetra (Gray) Rydb. (1929).

NV, s Clark Co., and adjacent nw Mohave Co., AZ. Sandy deserts, flats, and washes with creosote bush, adjacent to the Colorado River and affluents; rare and local. Ca. 450-600 m.

Considering the minuscule specific differences among members of the Inflati, the little known var. triquetrus could reasonably be taken as a separate species. Not only disjunct from typical A. geyeri, it differs in its partly septate pod with fewer (7-11) ovules and in the broader leaflets, which are pubescent on both sides. In the limited material seen, the racemes are longer than in the typical variety, and the pods, thus, are not submerged among the foliage. The pods are possibly smaller and less inflated than in var. geyeri.

## Astragalus gibbsii Kellogg

Map 77
Astragalus gibbsii Kellogg (1863); Homalobus gibbsii (Kellogg) Rydb. (1924); H. plummerae Rydb. (1924).
Slightly rhizomatous, villosulous perennial from a subterranean caudex with clustered, spreading or decumbent stems to 3.5 dm . Pubescence mostly spreading or retrorse on stems and incumbent on leaves. Leafstalk $3-9 \mathrm{~cm}$; leaflets $13-19$, obovate to cuneate-oblong, rounded or retuse, 4-15 (-20) mm, 1.5-2.3 $r$, usually flat. Stipules, at least of rhizomes, connate, the upper free. Racemes ascending,
exserted, moderately elongating in fruit, with 10-many, crowded, spreading to imbricate-reflexed flowers $13-17 \mathrm{~mm}$. Pedicels in fruit 2.5-4.5 mm. Calyx tube subcylindric, obliquely attached, gibbous, 7-10 mm ; teeth 2.5-3.5 mm. Corolla yellowish, "stubby"; standard fleshy, recurved and distally plicate; wings $\pm$ or $>$ standard. Ovules 20-30. Legumes reflexed, spreading or upwardly curved, exserted-stipitate 1-2 cm, unilocular, persistent, slowly dehiscent; body asymmetriclanceolate, oblong or oblong-lanceolate (nearly straight-), crescentic or hamate to $180^{\circ}$, laterally compressed but turgid at maturity, $2-3 \mathrm{~cm}$ $\times$ (4-) $5-8 \mathrm{~mm}$; valves initially fleshy, becoming coriaceous, reticulate, villosulous; dehiscence initiating on raceme, convergent, both sutures. Collini.

Ne CA, s Lassen to n Mono cos. and contiguous NV. E foothills of Sierra Nevada; middle elevation sagebrush slopes and flats to yellow pine. 1300-1650 m. May-June.

Astragalus gibbsii has asymmetric, truncated flowers, coarse, crescentic, long-stipitate pods, and spreading or declined stem pubescence. It is the southwestern peripheral element of a complex, including also $A$. curvicarpus and $A$. collinus, that possibly could be treated as a single species. $A$. gibbsii and $A$. collinus are similar in flower but are separated geographically by the intermediary $A$. curvicarpus, which includes both forms with foreshortened and those with "normal" flowers. A. gibbsii consistently differs from contiguous A. curvicarpus in its spreading or retrorse stem pubescence, its conspicuous, connate basal or subterranean stipules, and coarser, turgid pods.

## Astragalus giganteus Watson

Map 78
A. giganteus Wats. (1882) non (Pall.) Sheld. (1894); A. texanus Sheld. (1894).
A. yaquianus Wats. (1888); A. giganteus var. yaquianus (Wats.) Jones (1923).
Tomentose or villous, robust perennial from a superficial crown with solitary to few-clustered, erect, scarcely branched stems to 8 dm . Pubescence initially white, villous-tomentose, thinning or becoming tawny in age, of both short, incurved, tangled and longer (to 2 mm ), nearly straight, divergent or ascending hairs. Leafstalk $10-35 \mathrm{~cm}$; leaflets 17-31 (-35), ovate or elliptic, decreasing in size upwards on leafstalk, 1-5 cm, 2.5-4.5 $r$, cinereous to greenish. Stipules free. Racemes exserted with numerous crowded, divergent, then declined flowers $15-21 \mathrm{~mm}$; axis $0.5-2 \mathrm{dm}$ in fruit. Pedicels in flower $1-4 \mathrm{~mm}$, in
fruit $4-9 \mathrm{~mm}$. Calyx tube subcylindric, $7-8.5 \mathrm{~mm}$; teeth $3-6 \mathrm{~mm}$. Corolla ochroleucous-yellow, narrow. Ovules $30+$. Legumes erect or strongly ascending, sessile, bilocular or semibilocular, persistent, dehiscent; body asymmetrically ovoid or ellipsoid-acuminate, somewhat inflated, nearly straight or incurved, slightly obcompressed, $1.5-2.5 \mathrm{~cm}$ $\times 8-12 \mathrm{~mm}$, nearly flat or slightly depressed on both surfaces; valves coriaceous, smooth to mildly rugulose or reticulate, glabrous; dehiscence apical, both sutures. Gigantei.

Trans-Pecos TX, adjacent NM and Chihuahua. Openings in woodland, pinyon-juniper, open slopes, gravel bars; local. Ca. 16002600 m. (May-) June-Sept.

This species possibly has the largest leaves of any American Astragalus. It is a villous-tomentulose plant with spires of ochroleucous flowers that produce long-pedicelled, plump-coriaceous, glabrous, semibilocular or bilocular pods. The New Mexico and Texas population groups are disjunct, likewise that in Chihuahua.

## Astragalus gilensis Greene

Map 78
A. gilensis Greene (1881); Batidophaca gilensis (Greene) Rydb. (1929).

Acaulescent or subacaulescent, cinereous or silvery, pubescent perennial from a thatched, superficial or aerial caudex; new growth ca. $0-1.5 \mathrm{~cm}$. Pubescence dolabriform. Leaves clustered, sometimes spreading on ground; leafstalk $3-8 \mathrm{~cm}$; leaflets $13-21$ (-23), elliptic to lanceolate, acute, 3-12 mm, 2-3 $r$. Stipules free. Peduncles radical or nearly so, 1.3-1.5 dm, spreading to reclinate in fruit; racemes with 7$20^{+}$, subcapitate to shortly racemose, spreading or partly declined flowers $6.5-10 \mathrm{~mm}$. Pedicels $0.5-1.5 \mathrm{~mm}$. Calyx tube $2.5-4 \mathrm{~mm}$; teeth $1-2.5 \mathrm{~mm}$. Corolla pinkish to pink-purple with white-tipped wings and oeillate standard, graduated or wings $\pm$ standard. Ovules ca. 7-10. Legumes ascending or spreading, sessile, unilocular, deciduous, dehiscent; body ovoid-acuminate to ellipsoid, subterete, subtrigonous or somewhat obcompressed, $5-7 \mathrm{~mm} \times 2-4 \mathrm{~mm}$, cuspidate; dorsal face flat or somewhat depressed; valves subcoriaceous, villosulous-strigulose; dehiscence apical, both sutures. Humillimi: Humillimi.

W NM and e AZ, Mogollon Mts.; also nc NM. Openings in pine forests, dry gravelly flats; locally common. Ca. 1350-2600 m. (May-) June-Aug (-Sept).

This is a small, acaulescent, silvery plant with dolabriform pubescence. The subcapitate racemes are exserted above the leaves; the clustered, unilocular pods are tiny.

Astragalus gilmanii Tidestrom
Map 77
A. triflorus var. morans Crum ex Jeps. (1936); A. wootonii var. morans (Crum ex Jeps.) Barn. (1949).
A. gilmanii Tidestr. (1937).

Low, puberulous annual or evanescent perennial with basally branched, decumbent-ascending stems $0.5-2.5 \mathrm{dm}$. Pubescence loosely strigulose to villosulous. Leafstalk $2-7 \mathrm{~cm}$; leaflets $9-13$, elliptic or oblanceolate, obtuse, $3-12 \mathrm{~mm}, 2-4.5 r$, commonly folded. Racemes included with $4-8$, loosely disposed, ascending to ultimately declined flowers $6-8 \mathrm{~mm}$. Fruiting pedicels $3-4.5 \mathrm{~mm}$. Calyx tube $2.5-3.5 \mathrm{~mm}$; teeth $1-1.5 \mathrm{~mm}$. Corolla pink-purple. Ovules ca. 10. Legumes spreading or reflexed, sessile or substipitate by gynophore, unilocular but with funicular flange, deciduous, tardily dehiscent; body bladdery-inflated, obliquely ovoid or ellipsoid and acuminate, terete to slightly obcompressed, $1.4-2.5 \mathrm{~cm} \times 8-16 \mathrm{~mm}$ (to 2 cm wide when pressed); valves papery-membranous, strigulose with curved hairs; dehiscence not seen, presumably on ground, apical. Inflati: Aridi.

CA, Inyo Co. Panamint Mts. Desert mts. adjacent to Death Valley; flats, canyon slopes, with sagebrush and pinyon-juniper. 2000-3050 m. May-July.

Astragalus gilmanii is the only Astragalus of its region with bladdery-inflated, unilocular pods and bright colored flowers. It differs also from its relatives in the incumbent-puberulent rather than strictly strigose (with straight hairs) pubescence of the pods and the presence of a well-developed funicular flange.

Astragalus glycyphyllos Linnaeus Established
A. glycyphyllos L. (1753); Hedyphylla glycyphylla (L.) Rydb. (1929).

Robust, scantily strigulose perennial from a slightly subterranean base with decumbent or ascending clump-forming stems $0.4-1 \mathrm{~m}$. Leafstalk 0.6-2 dm; leaflets 9-13, ovate or elliptic, 1-4 cm, 1.5-2.5 r, glabrous above. Stipules conspicuous on young growth, the lower connate. Racemes included with 10-15 ascending, then spreading or declined flowers $11-13 \mathrm{~mm}$. Calyx tube $3-4 \mathrm{~mm}$; teeth $1-3 \mathrm{~mm}$, subulate to filamentous. Corolla ochroleucous, often purple-stained. Ovules ca. 20-25. Legumes ascending, stipitate $3-4 \mathrm{~mm}$, bilocular, persistent, tardily dehiscent; body narrowly oblong, straight to curved, tapering to the filiform beak, trigonous, $3-4 \mathrm{~cm} \times 4-5 \mathrm{~mm}$, dorsally sulcate; valves thinly coriaceous, glabrous; dehiscence not seen.

Locally naturalized in e U.S., and an experimental introduction. Native of Europe. Creek banks, orchards, agricultural plantings. June-Aug.

Astragalus glycyphyllos is a classic entry in regional manuals of the northeastern states. Its listing seemingly derives from ancient ballast records and the existence of two persistent colonies, one from Cattaraugus County, New York, from which there are several collections from 1928-1948 (GH), and one in Indiana from an orchard in Fulton County, where, fide Deam (Accession 57,052 in 1936, NY), the landowner said it had persisted at least 75 years. Deam, (1940), however, listed A. glycyphyllos only among excluded species. A 1963 collection from Middlesex County, Connecticut, however, now provides more recent validation.

Astragalus glycyphyllos has also been recently introduced by the U.S. Department of Agriculture and is sometimes planted in botanic gardens.

Astragalus gracilis Nuttall
Map 79
A. gracilis Nutt., Fraser Cat. 1813 nom. nud.; Dalea parviflora Pursh (1814); A. gracilis Nutt. (1818); A. parviflorus (Pursh) MacMill. (1892) non Lam. (1783); Phaca gracilis (Nutt.) MacMill. (1892) pro syn.; Microphacos gracilis (Nutt) Rydb. (1906); M. parviflorus (Pursh) Rydb. (1913); A. microphacos Cory (1936); A. gracilis var. parviflorus (Pursh) Gates (1940).
A. gracilis var. erectus Hook. (1847).
A. microlobus Gray (1864); M. microlobus (Gray) Rydb. (1906); A. parviflorus var. microlobus (Gray) Jones (1923).
A. parvifolius (Nutt.) sensu Gray (1864) pro syn. non Phaca parvifolia Nutt. (1838).
Briefly rhizomatous, strigulose perennial from a subterranean or nearly superficial crown with solitary or clustered, sprawling to erect, commonly diffusely branched stems (1-) 2-6 (-7) dm. Leafstalk 2-6 cm , often curved; leaflets $9-15$, ranging from linear-involute and distant to oblong, truncate and retuse, $4-20 \mathrm{~mm}, 2-10(-15) r$, flat, involute or folded, glabrate above. Lower stipules connate. Racemes slightly to much exserted, commonly lax and flexuous with $10-20+$, ascending, ultimately spreading or declined flowers $5-8 \mathrm{~mm}$. Pedicels in flower $0.6-1 \mathrm{~mm}$, in fruit to 1.7 mm . Calyx tube $1.5-2.5 \mathrm{~mm}$; teeth $0.5-1 \mathrm{~mm}$. Corolla usually pale lavender, sometimes purple or dull greenish-purple, usually pallid on specimens; petals graduated or wings $\pm$ standard; keel incurved $90^{\circ}-130^{\circ}$. Ovules 5-9. Legumes
spreading or reflexed, sessile, unilocular, persistent, dehiscent; body commonly boat-shaped, in side view ovoid or half-ovoid, incurved, conspicuously-cuspidate; in dorsal view, ovate or elliptic, 4.5-8 (-9) $\mathrm{mm} \times 3-3.5 \mathrm{~mm}$; dorsal and ventral faces convex or depressed; ventral suture prominent; valves coriaceous, cross-rugose, strigose; dehiscence apical. Scytocarpi: Microlobi.

Saskatchewan to TX Panhandle. E slopes of Rockies and w plains; w ND, s MT, s to ne NM, nw TX, w OK. Short-grass prairies, rocky slopes, sand hills, knolls, along rivers and in creek beds, pine bluffs; in w portion of range with juniper and sagebrush; mostly sandy soils, sometimes gypsum or shale outcrops. Ca. 900-2150 m. (s, April-) May-July.

Astragalus gracilis, a common species of the High Plains, is a rhizomatous, usually diffusely branched plant that bears numerous, tiny, boat-shaped, cross-rugulose pods. In fruit, it should be confused with none other. In flower, the tall forms are usually recognized by their elongate racemes and linear leaflets, but the low, modest kinds resemble $A$. flexuosus, which see for pair comparison. Key determinations of $A$. gracilis may be frustrated by poor development of the basal rhizomes or their absence on specimens.

Astragalus gracilis has traditionally been considered to include two related species, e.g., Porter (1951) distinguished A. gracilis with broader leaflets and comparatively larger pods from A. parviflorus with linear leaflets and smaller pods, the two taxa having approximately the same inclusive range. Welsh (1960), the first to treat the complex as one species, described (1) taller plants with long racemes and numerous flowers and (2) low plants with shorter few-flowered racemes and broader leaflets and suggested that introgression with $A$. flexuosus might be responsible for some of the features of the second group. Barneby (1964) regarded A. gracilis inclusive of these forms as one species without taxonomic division and expressed skepticism about Welsh's introgression hypothesis.

Porter's (1951) classification of Astragalus gracilis is unsatisfactory because pod size and leaflet width do not correlate. Welsh's (1960) informal group characterization, however, is helpful in describing variability in the species. The first category of mostly erect, diffuse plants, often with filiform or inrolled upper leaflets, is particularly characteristic of the eastern and southeastern part of the range. The second, which includes low or prostrate-ascending kinds, is mostly western, especially of Wyoming, Montana, Colorado, and western Nebraska.

Astragalus grayi Parry ex Watson
Map 80
Astragalus grayi Parry ex Wats. (1874); Ctenophyllum grayi (Parry ex Wats.) Rydb. (1913); Cnemidophacos grayi (Parry ex Wats.) Rydb. (1929).
Seleniferous, sparsely strigulose perennial of yellow-green aspect from a superficial or shortly subterranean caudex with basally leafless, clustered and clump-forming, erect stems 2-4 dm. Leafstalk 4-9 cm; leaflets 5-11, thick, narrowly oblong, oblanceolate or linear, sharply acute or almost spinulose-tipped, $1.5-5 \mathrm{~cm}, 5-15 \mathrm{r}$, flat with slightly involute margins, the terminal confluent with rachis. Lower stipules connate. Racemes slightly $>$ leaves with $10-20+$, crowded or loosely spaced flowers $15-20 \mathrm{~cm}$. Calyx tube cylindric, $5-8 \mathrm{~mm}$, slightly white-fringed at orifice; teeth $1-2 \mathrm{~mm}$. Corolla ochroleucous-cream, somewhat marcescent. Ovules 15-20. Legumes ascending, sessile, unilocular, persistent, dehiscent; body oblong-ellipsoidal, straight or slightly incurved, subterete, cuspidate-beaked, $9-16$ (-18) mm $\times 3-3.5 \mathrm{~mm}$; valves thick, initially fleshy, becoming coriaceous, smooth or crossrugulose, glabrous (-strigulose); dehiscence apical, both sutures. Pectinati: Pectinati.

S MT to s WY. Dry sage-grassland, clay slopes, alkali flats, gullied badlands; locally common but infrequent. 1200-2300 (-2600) m. (May-) June (-July).

Astragalus grayi differs from its basally leafless relatives (e.g., A. pectinatus, $A$. toanus) that often have reduced foliage in its erect pods combined with ochroleucous flowers.

## Astragalus gypsodes Barneby (1956)

Map 78
Strigulose, often cinereous, sometimes shortly rhizomatous perennial from superficial or subterranean multicipital caudices that terminate woody taproots; stems clustered, decumbent to ascending, 1-3.5 dm, commonly elongating after flowering. Leafstalk $5-15 \mathrm{~cm}$; leaflets 15-23 (-27), elliptic to lanceolate, $5-20 \mathrm{~cm}, 2.5-5 r$, pubescent on both sides. Stipules free. Racemes initially erect and $>$ foliage with 10 -many, ascending to spreading flowers $19-23 \mathrm{~mm}$; fruiting racemes reclining and often included due to subsequent stem elongation. Calyx tube broadly cylindric, $7.5-10 \mathrm{~mm}$; teeth $3-5 \mathrm{~mm}$. Corolla purple, often white-tipped. Ovules 30+. Legumes usually humistrate, sessile, bilocular, deciduous, tardily dehiscent; body broadly cylindric, nearly straight, subterete, $2.5-4.5 \mathrm{~cm} \times 1-2 \mathrm{~cm}$; sutures superficial or dorsal face somewhat depressed; valves fleshy, commonly red when immature, at maturity spongy with walls $1.5-2.5 \mathrm{~mm}$ thick, somewhat wrinkled,
glabrous; dehiscence after falling, not seen, said to be basal and upwards, ventral. Sarcocarpi: Sarcocarpi.

Se NM (s Eddy Co.) and adjoining trans-Pecos TX. Gypsum-clay soils, gullied slopes; locally plentiful. Ca. 750-1200 m. March-April.

Astragalus gypsodes is unmistakable in fruit by its large, sausagelike pods, which, heavy and succulent when immature, become light and spongy or corky at maturity. In flower it looks like an ascending A. crassicarpus with unusually long racemes, but leaflets of the latter species are glabrate above.

## Astragalus hallii Gray

Map 81
Shortly or extensively rhizomatous, puberulent perennial from a subterranean caudex with usually clustered, ascending or decumbentspreading stems $1-6 \mathrm{dm}$, which may form mats exceeding 1 m diam. Leafstalk $3-8 \mathrm{~cm}$; leaflets 11-23 (-27), ovate, elliptic-oblong or oblanceolate, obtuse or retuse, $4-14 \mathrm{~mm}, 2-4.5 r$, flat or folded, often glabrate above. Lowermost stipules connate. Racemes usually exserted, initially dense, loosening in fruit, with $10-20+$ soon spreading or declined flowers $13-18 \mathrm{~mm}$. Calyx tube campanulate or shortcylindric, gibbous, 4.5-6.5 (-7) mm; teeth 1-2 (-3.5) mm. Corolla purple to lilac or whitish; standard often oeillate. Ovules ca. 20-30. Legumes ascending-humistrate or declined, subsessile to stipitate 1-2 (-4.5) mm , unilocular, persistent, dehiscent; body asymmetrically ovoid to ellipsoid-oblanceolate or -oblong, turgid or inflated, subterete to moderately obcompressed, $15-25 \mathrm{~mm} \times(4-) 6-12 \mathrm{~mm}$; ventral suture usually prominent; dorsal and ventral faces convex to broadly depressed or grooved at full maturity; valves initially thinly succulent, becoming heavily (-thinly) papery or coriaceous, glabrous, puberulent or strigulose; dehiscence distal. Scytocarpi: Halliani.

CO Front Ranges to sw CO and n NM; AZ, Flagstaff Plateau to sw NM.

As other Scytocarpi, Astragalus hallii is a rhizomatous plant with connate stipules and unilocular, persistent pods. It and $A$. puniceus differ from the others in having larger flowers and a subcylindric calyx. A. puniceus, A. hallii, and A. flexuosus var. greenei, all with inflated pods, differ as follows:

1. Flowers ca. 10 mm ; calyx tube ca. $3-4 \mathrm{~mm}$; legumes sessile or substipitate; n and w NM to ec AZ . A. flexuosus var. greenei
2. Flowers ca. 13-20 mm; calyx tube ca. $4.5-8 \mathrm{~mm}$; pods usually stipitate where overlapping in range with above.
3. Se CO and adjacent NM and OK; pods sessile or substipitate, coriaceous, turgid or slightly inflated; pubescence villosulous with curved hairs (-strigose).
A. puniceus
4. Range other than above; pods stipitate $0.5-4 \mathrm{~mm}$, coriaceous or papery, distinctly inflated; pubescence strigulose (-villosulous).
A. hallii

## Key to varieties of Astragalus hallii

1. Legumes $4-7(-8) \mathrm{mm}$ diam., ellipsoid to ellipsoid-oblanceolate, turgid to inflated, glabrate or sparsely strigulose; leaves not cinereous, the leaflets commonly flat; CO, barely into $\mathrm{n} N$ and ne AZ.
var. hallii
2. Legumes $6-12 \mathrm{~mm}$ diam., obovoid to asymmetrically ellipsoid, usually inflated, plainly pubescent; leaves often cinereous, with folded leaflets; AZ, w NM, and Kane Co., UT. .
var. fallax
Var. fallax Barneby
Map 81
Astragalus fallax Wats. (1885) non Fisch. (1853); A. famelicus Sheld. (1894); A. gracilentus var. fallax (Wats.) Jones (1898); Pisophaca famelica (Sheld.) Rydb. (1929); A. hallii var. fallax Barneby (1960).
Range as given in key. Open yellow pine forest, juniper-oak, grassland-juniper, sometimes weedy; various soils. $1700-2200 \mathrm{~m}$. (May-) June-July (-Sept.).

Var. fallax is multiracial and includes some three entities of possible taxonomic significance, which have been reviewed by Barneby (1964).

Var. hallii
Map 81
Astragalus hallii Gray (1864); A. gracilentus var. hallii (Gray) Jones (1898); Homalobus hallii (Gray) Rydb. (1906); Pisophaca hallii (Gray) Rydb. (1929).
Astragalus shearii Rydb. (1904); Atelophragma shearii (Rydb.) Rydb. (1906).
Range as given in key. Middle elevations with sagebrush to mountain meadows and spruce-aspen; also mesophytic flood plains, lakesides, and persistent in disturbed or ruderal areas, roadsides and reseeded range; frequent and often abundant. 2300-3050 m. June-July (-Sept.).

The typical variety of Astragalus hallii is commonly more foliose than var. fallax, and the pubescence is usually of longer hairs, 0.5 mm or more, those of var. fallax being ca. $0.2-0.4 \mathrm{~mm}$. The fruiting raceme is prostrate with variously directed but usually divergent pods,
whereas the raceme of var. fallax usually remains ascending, bearing declined pods.

Astragalus harrisonii Barneby (1964)
Map 80
Rhizomatous, ephedroid, glabrate perennial from a subterranean crown with clustered, bushy-branched, often flexuous, greenish stems 4-7 dm. Leafstalk $1.5-5 \mathrm{~cm}$; lower leaves (mostly absent at flowering) with 2-6 distant leaflets, the remainder reduced to filiform, curved leafstalks with or without a confluent terminal leaflet. Stipules free, those of rhizomes amplexicaul. Racemes much exserted, 1-4 dm, tenuous, with $4-12$ remotely spaced, ascending flowers $8-9 \mathrm{~mm}$. Pedicels 2.5-5 mm. Calyx tube $1.5-3 \mathrm{~mm}$; teeth ca. 0.5 mm . Corolla lavender to purple; keel incurved $100^{\circ}-110^{\circ}$. Ovules $10-12$. Legumes pendulous, stipitate $3-4 \mathrm{~mm}$, unilocular, persistent, dehiscent; body oblong-ellipsoid, straight or slightly decurved, subterete to slightly obcompressed, $1.5-2.5 \mathrm{~cm} \times 3-3.5 \mathrm{~mm}$; ventral suture prominent; valves papery, reticulate, strigulose to subglabrous; dehiscence apical. Lonchocarpi: Lancearii.

UT, Wayne Co., Capital Reef National Monument near Fruita, known only from type locality. Sandy banks and sand pockets on rock ledges; white sandstone "soils." Ca. 1750 m. May-June.

This local species is distinguished by its capillary phyllodial foliage, filiform racemes and stipitate pods.

Astragalus hartwegii Benth.
This is a Mexican species, similar to Astragalus vaccarum that Kearney and Peebles (1942) reported from Arizona. The two differ as follows:

1. Flowers $7-9 \mathrm{~mm}$; calyx tube $2-3.5 \mathrm{~mm}$, obliquely attached; ovules ca. 15-18; Mexico.
A. hartwegii
2. Flowers $4-6 \mathrm{~mm}$; calyx tube $1.6-2 \mathrm{~mm}$, symmetrically attached; ovules ca. 6-10; se AZ, sw NM.
A. vaccarum

Astragalus henrimontanensis Welsh (1978)
Map 80
A. stocksii Welsh (1974) non Benth. ex Bunge (1868).

Acaulescent, cinereous, strigulose perennial from superficial or aerial, clustered, thatched caudices. Leafstalk $3-8 \mathrm{~cm}$; leaflets 7-13, ovate to elliptic-oblong, $5-12 \mathrm{~mm}, 2.5-5 r$, greenish above. Stipules clustered, free. Racemes arcuate-ascending, usually $<$ leaves, reclinate in fruit, with (2-) 3-8 contiguous, ascending flowers $15-18 \mathrm{~mm}$. Calyx tube cylindric, $8-10 \mathrm{~mm}$; teeth $2-3 \mathrm{~mm}$. Corolla ochroleucous or
bicolored; keel maculate. Ovules ca. 30. Legumes ascendinghumistrate, sessile, unilocular, deciduous, tardily dehiscent; body lanceoloid-incurved, obcompressed, $2-3.5 \mathrm{~cm} \times 6-9 \mathrm{~mm}$; ventral face broadly sulcate; valves initially fleshy, becoming coriaceous at maturity, strigose; dehiscence not seen, presumably on ground and apical. Argophylli: Argophylli.

UT, Garfield Co., and AZ, Mohave Co., local. Pinyon-pine and ponderosa pine. Ca. 2200-2700 m. May.

Plants referred to as $A$. henrimontanensis are essentially acaulescent and have well thatched caudices. Because these are the overt distinctive characters of the subsection Newberryani of the Argophylli, I initially [on the basis of one specimen and Welsh's original description (Welsh, 1978)] assumed it to be of that group. But now that more collections have accumulated, I think it more likely it is but a reduced form of the polymorphic $A$. argophyllus. Lying within the range of $A$. argophyllus var. panguicensis, and with essentially the same fruit, it is probably most closely related to that variety. Because $A$. henrimontanensis is entered in the foregoing key to species of Astragalus (Isely 1983a, p. 111) with the acaulescent $A$. newberryi group, the name is listed here for reference consistency. Turn back to A. argophyllus var. stocksii Barneby (Isely, 1984, p. 121) for its updated classification.

Astragalus holmgreniorum Barneby (1980)
Map 85
Acaulescent, pilose perennial from a superficial crown. Pubescence of hairs ca. 1-2 mm. Stipules free. Leaves humistrate, 5-12 (-15) cm ; leaflets $7-15$, obovate or obcordate, $5-15 \mathrm{~mm}$, ca. 1.5 r , bicolored, yellow-green above, blue-green below. Peduncles $3-8 \mathrm{~cm}$, quickly declinate and procumbent; rachis short, not elongating in fruit. Flowers 5-15, umbellate, ascending, ca. 21-33 mm. Calyx $10-12 \mathrm{~mm}$, pilose; tube cylindric. Corolla pink-purple, drying blue-purple; standard little recurved, rhombic; wing and keel petals long-clawed with narrow blades. Ovules 30+. Legumes humistrate, sessile, bilocular, deciduous, delayed-dehiscent; body oblong or asymmetrically elliptic, moderately lunate-incurved, triquetrous, $3-5 \mathrm{~cm} \times 6-9 \mathrm{~mm}$; dorsal face sulcate; valves coriaceous, glabrous; dehiscence on ground, from both base and apex. Argophylli: Pseudoargophylli.

Sw UT (Washington Co.) and immediately contiguous nw AZ (Mohave Co.). Locally abundant, Virgin River Valley ca. $6-8 \mathrm{~km} \mathrm{~s}$ of St. George, UT. "Gravelly clay hills at upper limit of Larrea zone." Ca. 800850 m . May.

I have seen three specimens (BRY) of this recently discovered, apparently local species. With the characteristic facies of the Argophylli, it is unique in its region in its bilocular, glabrous pods.

## Astragalus hoodianus T. Howell

Map 82
A. hoodianus T. Howell (1893); A. conjunctus var. hoodianus (T. Howell) Jones (1898); Phaca hoodiana (T. Howell) Piper (1906); Cnemidophacos hoodianus (T. Howell) Rydb. (1929) A. reventus var. hoodianus (T. Howell) Peck (1941).
A. conjunctus var. oxytropidoides Jones (1895); Tium oxytropidoides (Jones) Rydb. (1929); A. reventus var. oxytropidoides (Jones) C. L. Hitchc. (1961).
Chemidophacos knowlesianus Rydb (1929).
Tufted, barely or plainly caulescent, usually cinereous, strigose or villosulous perennial from a superficial caudex (1-) 2-4 dm; stems clustered, ascending to erect, $<$ peduncles. Leaves erect; leafstalk 5-18 cm ; leaflets $25-35$, distant, (elliptic-) oblong, $0.5-2.5 \mathrm{~cm}$, ca. 5-9 r, commonly folded, glabrate above, often ultimately deciduous, leaving naked, persistent rachises. Lowermost stipules connate. Racemes robust with peduncles $1-3 \mathrm{dm}$, with $10-20+$ crowded, ascending to spreading flowers $18-22 \mathrm{~mm}$; axis elongating in fruit. Calyx tube campanulate, $6-8 \mathrm{~mm}$; teeth $4.5-7 \mathrm{~mm}$, semiaristate, usually curved or twisted. Corolla ochroleucous, keel maculate. Ovules 16-22. Legumes stiffly erect, sessile, unilocular or subunilocular, persistent, dehiscent; body ellipsoid to short-cylindric, plumply obcompressed, $1.5-2 \mathrm{~cm} \times$ $5-7 \mathrm{~mm}$, dorsally sulcate; valves fleshy and villosulous, becoming thickly coriaceous, rugulose-reticulate and thinly pubescent; dehiscence apical and downwards, both sutures.

Transmontane WA (Klickitat Co.) and adjacent OR (Wasco and Hood River cos.) at Columbia Gap. Slopes and canyons with grass, scub oak. 150 m or below. April-June. Conjuncti.

Astragalus hoodianus is distinguished from its immediate relatives (with connate stipules and erect, persistent, coriaceous pods) by its campanulate calyx tube, long divaricate calyx teeth, lower ovule number, and sometimes villosulous pubescence. Lying immediately northwest of $A$. conjunctus, it could be regarded as a variety of that species as Hitchcock (1961) has done.

## Astragalus hornii Gray

Map 86
A. hornii Gray (1868); Phaca hornii (Gray) Rydb. (1929).

Phaca tularensis Rydb. (1929); A. tularensis (Rydb.) Tidestr. (1937); A. hornii var. tularensis (Rydb.) Jeps. (1936).

Robust or slender, glabrate or villosulous annual with ascending, then sprawling or prostrate, glabrate or pubescent stems to 10 dm . Leafstalk $5-15 \mathrm{~cm}$; leaflets $15-29$, obovate to narrowly elliptic, rounded or retuse, $5-20 \mathrm{~mm}, 2-4.5 r$, often folded. Stipules free. Racemes subcapitate to shortly oblong, included to slightly exserted, with 10 $20+$, nearly sessile, ascending or spreading flowers $8-10 \mathrm{~mm}$; axis not elongating in fruit. Calyx tube $2.5-4 \mathrm{~mm}$; teeth $1.5-2.5 \mathrm{~mm}$. Corolla white, ochroleucous or pale lilac. Ovules 10-15. Legumes subcapitate, ascending or spreading, sessile, unilocular, subpersistent, tardily dehiscent; body bladdery-inflated, ovoid-acuminate to asymmetricovoid, straight or slightly incurved, subterete or laterally compressed, with a conspicuous acuminate beak, $1.3-1.8 \mathrm{~cm} \times 7-9 \mathrm{~mm}$; valves papery, shiny, villous; dehiscence presumably on ground and apical.

S interior CA, primarily San Joaquin Valley and disjunctly in Washoe Co., NV. Halophytic lake shores and saline clay flats or meadows, occasionally wet, disturbed areas; local. (April-) May-July (-Sept.).

Astragalus hornii is distinctive in its capitate clusters of small, light flowers that are followed by heads of small, bladdery pods. It resembles $A$. pycnostachyus, a coastal California halophyte, which is a perennial species with nodding flowers.

The habitat of Astragalus hornii has largely been destroyed, and most collections are 40-90 years old.

Astragalus howellii Gray (1879)
Map 82
Caulescent or tufted, commonly cinereous, villosulous perennial from a superficial caudex with clustered, short or evident, prostrate or erect stems $0.2-2 \mathrm{dm}$, or, including racemes, to 3.5 dm . Leafstalk 3-15 cm; leaflets 11-27, cuneate-elliptic, oblong or oblanceolate, (2-) 4-12 mm, 2.5-4 $r$, flat or folded. Stipules free, the lowermost amplexicaul. Peduncles $>$ or $<$ foliose portion of stem; racemes with (5-) 8-20+ diffuse, spreading to deflexed flowers $7-15 \mathrm{~mm}$. Calyx tube $2-5.5 \mathrm{~mm}$; teeth 1-2.5 mm . Corolla ochroleucous to lemon yellow, sometimes dull-striate; standard recurved $45^{\circ}-90^{\circ}$; wings $\pm$ standard. Ovules 12 20. Legumes reflexed, (stipitate-) exserted-stipitate $3-12 \mathrm{~mm}$, bilocular, slowly deciduous with pedicels, tardily dehiscent; body lanceolate, straight or slightly incurved, triquetrous-compressed, apiculate-beaked, 12-25 (-30) $\mathrm{mm} \times 3-4.5(-5) \mathrm{mm}, 5-7 r$; dorsal face broadly sulcate; valves villosulous (-substrigulose), stiffly papery; dehiscence presumably on ground, apical. Miselli.

Nc OR and (var. pauper) Kittitas Co., WA.

Astragalus howellii and its immediate relatives of the Columbia Basin have free stipules, and bilocular, exserted-stipitate, reflexed, dorsally sulcate pods. A. howellii is distinguished from A. arthuri by its broader, 5-7 $r$, pods and from $A$. onciformis by larger flowers and usually much longer peduncles.

Key to varieties of Astragalus howellii

1. Flowers $10-15 \mathrm{~mm}$; calyx tube $3.5-5.5 \mathrm{~mm}$; leaflets ca. 19-27; n OR, Wasco to Umatilla cos. var. howelli
2. Flowers $7-10 \mathrm{~mm}$; calyx tube 2.2-2.8 mm; leaflets ca. 11-21; s of above, Deschutes to Grant cos., OR; also Kittitas Co., WA.
3. Foliose stems mostly $>1 \mathrm{dm}$; leaflets commonly glabrate above; nc OR. var. aberrans
4. Foliose stems $<1 \mathrm{dm}$; leaflets pubescent above; WA.
var. pauper
Var. aberrans (Jones) C.L. Hitchcock
Map 82
A. misellus Wats. (1886); Phaca misella (Wats.) Piper (1906) A. howellii var. misellus (Wats.) Jones (1923); Tium misellum (Wats.) Rydb. (1929).
A. drepanolobus var. aberrans Jones (1902); A. howellii var. aberrans (Jones) C.L. Hitchc. (1961).
Nc OR, Deschutes to Grant cos. Stony basaltic hills, banks, plains with sagebrush, juniper. 300-1050 m. May-June (-July).

Hitchcock (1961) regarded it as a species (A. misellus) because "the discontinuities between ... A. howellii, A. misellus, A. arthuri, and $A$. onciformis ... are of about the same magnitude." I view these discontinuities as unequal. The differences between the geographically contiguous $A$. howellii and $A$. misellus are primarily quantitative, $A$. howellii being a bigger plant with larger flowers and more leaflets. On the other hand, the differences between these two and A. arthuri and $A$. onciformis to the east include also several qualitative features-see descriptions.

Var. aberrans usually has reasonably developed stems, but some material is scarcely distinguishable except by origin from the isolated var. pauper.

Var. howellii
Map 82
A. howellii Gray (1879); Tium howellii (Gray) Rydb. (1929).

Range as given in key. Dry basaltic slopes with grass or sagebrush.
Ca. 600-1000 m. May-June.

In var. howellii, the most vigorous phase of the species, the raceme plus peduncle is commonly $2-3 \mathrm{dm}$, and the pod commonly distinctly apiculate. The slightly different plants from Umatilla and Morrow cos. possibly represent another variety (Barneby, 1964).

Var. pauper (Barneby) Isely Map 82
A. misellus var. pauper Barneby (1964); A. howellii var. pauper (Barn.) Isely (1983).
Vicinity of Ellensburg, Kittitas Co., WA. April-May.
The only collections seen date from the last century.

## Astragalus humillimus Gray ex T.S. Brandegee <br> Map 80

A. humillimus Gray ex Brandg. (1876); Phaca humillima (Gray ex Brandg.) Rydb. (1906).
Diminutive, subcaulescent, cinereous perennial from superficial caudices that are thatched with encrusted stipules and subspinescent leafstalk remnants; new growth $0.5-1 \mathrm{~cm}$. Pubescence dolabriform. Leafstalk 8-15 mm, stiff; leaflets 7-11, obovate to elliptic-oblong, ca. $1-2 \mathrm{~mm}$ and $1.3-2 r$, appearing narrower due to folding. Stipules amplexicaul but free. Racemes immersed in leaves with 1-3 flowers ca. 6 mm . Calyx tube ca. 2.2 mm ; teeth ca. 0.8 mm . Ovules ca. 4. Legumes evidently spreading, sessile, unilocular, deciduous, oblong-ellipsoid, ca. $4.5 \mathrm{~mm} \times 2 \mathrm{~mm}$, laterally compressed; sutures carinate; valves stiffly papery, strigulose; dehiscence apical, downward, both sutures. Humillimi: Humillimi.

CO, Montezuma Co., Mesa Verde; NM, San Juan Co., Hogback Mt. Sandstone rock ledges, with pinyon. 1850-2150 m. June.

Astragalus humillimus was collected in 1875 from Mesa Verde, and despite search by several botanists was not seen again for more than a century and reasonably presumed extinct. It has recently (1981) been found in San Juan County, New Mexico, as just cited, and I have seen two collections at NY. A. humillimus, A. cremnophylax and $A$. siliceus are relicts related to $A$. gilensis. A. humillimus differs from these species in its persistent, almost pungent leafstalks.

## Astragalus humistratus Gray (1853)

Maps 83, 84, 85
Pubescent, often cinereous perennial from a superficial or shortly subterranean caudex with solitary or usually clustered, branched, decumbent and mat-forming or assurgent stems (1-) 2-6 dm. Pubescence strigose (-spreading, tomentose), abundant or inevident, dolabriform or mixed (-basifixed). Leaves often sessile; leafstalk 1-7 cm; leaflets (9-) 11-17, elliptic to oblong-lanceolate, acute, $3-15 \mathrm{~mm}$, ca.

4-8 $r$, flat or folded, glabrate or pubescent above. Lower or all stipules connate. Racemes slightly or considerably exserted, compact in flower, subsequently loosening, with (3-) 6-many ascending or divergent flowers $6-12 \mathrm{~mm}$. Calyx tube 2-4 mm, teeth $>$ or $\pm$ tube. Corolla commonly greenish-white or ochroleucous, dull purplestained, or purple (-bicolored), often conspicuously purple-striate when dry; keel upcurved to $90^{\circ}$, acute or porrect. Ovules 6-25. Legumes ascending, spreading or humistrate, sessile, unilocular, slowly deciduous with pedicel, tardily dehiscent; body diverse in shape, half-ovoid to obliquely oblong-lanceoloid, cuspidate, nearly straight or incurved to $180^{\circ}$, commonly obcompressed proximally and laterally compressed medially and distally, $8-20 \mathrm{~mm} \times 3-6.5 \mathrm{~mm}$; ventral suture superficial, carinate or not, dorsal face flat or sulcate; valves coriaceous, incumbent-villosulous, often mottled; dehiscence on ground, apical. Humistrati: Humistrati.

Sw U.S., w TX to NV, and slightly into contiguous Mexico.
Astragalus humistratus, a relatively common, homely Astragalus, is usually recognizable by facies: the prostrate habit, commonly basally congested and often sessile leaves with acute leaflets, the pale or dully varicolored flowers, and usually crescentic pods of variable proportions. Technically, it is characterized by partly dolabriform pubescence, connate stipules, a shallowly campanulate calyx with often elongate teeth, and the curved, unilocular pod that, when mature, commonly passes from obcompressed at the base to laterally flattened at the apex.

Astragalus humistratus is either spring- or fall-flowering; or with rains, may bloom both times.

## Key to varieties of Astragalus humistratus

1. Legumes $13-20 \mathrm{~mm}, 3-4 r$, often dorsally sulcate entire length; ovules ca. 20-25; w TX to se AZ.
2. Leaflets silvery or cinereous, pubescent on both faces; s NM and adjacent se AZ. var. sonorae
3. Leaflets not silvery, glabrate above or medially glabrous; primarily n of above in NM (-sw CO) but somewhat into AZ.
var. humistratus
4. Legumes $6-14 \mathrm{~mm}$, usually $1.5-2.5 r$, dorsally sulcate proximally or not; ovules 8-16; w NM to NV, s UT.
5. Local, Coconino Co., AZ, Kaibab Plateau; dwarf, matted plants; leaflets $2.5-5 \mathrm{~mm}$; racemes $3-6$ flowered. var. tenerrimus
6. Not as above; leaflets (4-) $7-15 \mathrm{~mm}$; racemes $6-20$ flowered.
7. Pubescence tomentose, cinereous or silvery with entangled, sinuous hairs; legumes ca. 3 mm diam.; ovules 8-9; local, s Apache Co., e AZ and adjacent NM.
var. crispulus
8. Pubescence not tomentose, of straight or curved hairs; legumes $3-6 \mathrm{~mm}$ diam.; ovules 8-16.
9. Leaflets glabrate and greenish above; legumes ovoid or halfovoid, plump, c to e AZ.
var. hosackiae
10. Leaflets pubescent above, cinereous or silvery; legumes shortly crescentic; w NM, nw across sw UT to s NV. var. humivagans

Var. crispulus Barneby (1944)
Map 84
Plants cinereous or silvery with matted pubescence of curled hairs. Flowers $7-8 \mathrm{~mm}$, whitish and remaining pale on drying; standard obovate to oblanceolate. Ovules 7-9. Legumes lunately incurved, laterally compressed, $8-10 \mathrm{~mm} \times 3 \mathrm{~mm}$.

Range as given in key. White and San Francisco mts. Open dry banks, road cuts in pine forests; local. Ca. 2200-2450 m. Aug.-Sept.

This local fall-flowering form is easily recognized by its tomentose gray foliage and other characters listed in the description. Its range lies within that of var. humistratus, and a few collections (referred to var. humistratus) are possibly intermediate with that variety. Barneby (1964), however, felt that var. crispulus is most likely related to var. humivagans.

Var. hosackiae (Greene) Jones
Map 83
A. hosackiae Greene (1885); A. humistratus var. hosackiae (Greene) Jones (1902); Batidophaca hosackiae (Greene) Rydb. (1929).
Plants greenish or somewhat cinereous; leaflets glabrate above; flowers 7-8 mm, usually pale, becoming lurid-purple when dry. Ovules $8-14$. Legumes ovoid, or half-ovoid, plump, ca. $6-9 \mathrm{~mm} \times 4-5 \mathrm{~mm}$ with scarcely raised ventral suture.

Range as given in key. Open dry areas, with yellow pine or oak; roadsides. Ca. 1500-2150 m. April-June; (July-) Aug.-Sept.

Var. hosackiae has the smallest flowers of the major varieties. It is easily identified by the (comparatively) tiny, almost inflated pods. It is locally sympatric with var. humivagans, ostensibly without blending.

Map 83
A. humistratus Gray (1853); Tium humistratum (Gray) Rydb. (1906); Batidophaca humistrata (Gray) Rydb. (1929).

Pisophaca datilensis Rydb. (1929); A. datilensis (Rydb.) Tidestr. (1937).

Plants greenish with leaflets glabrate above. Flowers $9.5-11.5 \mathrm{~mm}$, usually pale, drying purple or pale. Ovules ca. 18-25. Legumes oblonglanceoloid, incurved, $14-18 \mathrm{~mm} \times 4-6 \mathrm{~mm}$, proximally triquetrous, obcompressed dorsally, sulcate entire length.

NM, except sw corner, w to c AZ (-sw CO); disjunctly, Davis Mts. in TX; Chihuahua. Open gravelly, commonly disturbed sites; pinyonjuniper to pine, stream bars, canyons, roadsides; often abundant. Ca. 1350-2600 m. (May-) Aug.-Sept.

This is the large-flowered, major, eastern segment of the species. It overlaps with the cinereous var. sonorae, which has a similar pod, in the southwestern portion of its range, and with the short-podded western vars. humivagans and hosackiae in eastern Arizona. The pods are variable in form and compression.

Var. humivagans (Rydberg) Barneby Map 85
A. humistratus var. [no name provided] Gray (1878); Batidophaca humivagans Rydb. (1929); A. humistratus var. humivagans (Rydb.) Barneby (1956).
Leaflets pubescent on both sides. Flowers $7-10.5 \mathrm{~mm}$, usually pale, and remaining so or becoming purple on drying. Ovules 10-16. Legumes shortly lunate, obcompressed at base, laterally compressed above, $8-14 \mathrm{~mm} \times 3.5-5 \mathrm{~mm}$, conspicuously beaked; ventral suture conspicuous; dorsal face sulcate only at base.

Range as given in key. Pinyon-juniper to yellow pine; limestone or (upwards) igneous soil; common and abundant. Ca. 1500-2450 m. May-Aug. (-Sept.).

Variety humivagans, the northwestern segment of $A$. humistratus, is the only representative of the species in Utah, Nevada, and northwest Arizona, except that it is replaced by the miniature var. tenerrimus north of the Grand Canyon. South and east, it is peripherally sympatric with both vars. humistratus and hosackiae, which differ before flowering in their above-glabrate leaflets; plants with fruit may be distinguished by the characters tabulated in the key.

Var. sonorae (Gray) Jones Map 84
A. sonorae Gray (1853); A. humistratus var. sonorae (Gray) Jones (1902); Batidophaca sonorae (Gray) Rydb. (1929).
B. stipulacea Rydb. (1929).

Leaflets pubescent both surfaces. Flowers usually purplish, 8-11 mm . Legumes oblong or oblong-lanceoloid, lunate, $12-20 \mathrm{~mm} \times 3-4$
mm, proximally narrowly triquetrous; dorsal face sulcate at least half of length.

Sw NM and adjacent AZ; Sonora. Open bottomland slopes, rocky hillsides with juniper, grassland-yucca, slightly to yellow pine; ruderal. Ca. 1350-2000 m. March-May (-Sept.).

Vars. sonorae and humistratus have similar fruits. They are allopatric except for overlap in southwestern New Mexico. They differ in that, of the two, var. sonorae has more spreading pubescence that is persistent on upper leaf surfaces, flowers that are usually initially purplish, and pods that are more narrowly triquetrous with a weaker ventral suture. Var. sonorae is usually of lower elevations than var. humistratus and is primarily spring-flowering.

Var. tenerrimus Jones
Map 83
A. humistratus var. tenerrimus Jones (1895); Batidophaca tenerrima (Jones) Rydb. (1929); A. sonorae var. tenerrimus (Jones) Kearney \& Peebles (1939).
Leaflets $2.5-5 \mathrm{~mm}$, pubescent on both sides. Pubescence cinereous, of appressed, straight hairs. Flowers $3-6,6-7 \mathrm{~mm}$, pale and remaining so after drying. Ovules $10-14$. Legumes lunate, $6-9 \mathrm{~mm} \times 3-4 \mathrm{~mm}$.

AZ, Coconino Co., Kaibab Plateau. Open rocky meadows or pinyon-juniper adjacent to pine or aspen; locally common. 2450-2750 m. July-Sept.

These are little mat-forming plants with tiny foliage and pods, and light-colored flowers. They are presumably upper elevation derivatives of var. humivagans, with which they are confluent.

## Astragalus hypoxylus Watson

A. hypoxylus Wats. (1883); Hamosa hypoxyla (Wats.) Rydb. (1927).

Shortly caulescent, low, decumbent, strigulose perennial from superficial origin. Leafstalk $1-4 \mathrm{~cm}$; leaflets $9-13$, obovate, $2-4.5 \mathrm{~mm}$, glabrous above. Stipules free. Racemes slender, exserted, subcapitate and scarcely elongating in fruit, with ca. 8-18 ascending flowers 7-8 mm . Calyx tube ca. 3 mm , $\pm$ teeth. Corolla probably purple. Ovules ca. 6. Legumes ascending, sessile, bilocular, deciduous, presumably dehiscent; body lanceolate, slightly arcuate, triquetrous, 8-10 mm $\times 2-3 \mathrm{~mm}$, dorsally sulcate; valves papery, strigulose. Leptocarpi: Parvi.

AZ, Cochise Co.; known only from type collection in 1882 from "Fort Huachuca."

Several botanists have recently searched for this plant in the Huachuca Mountains without success. I have not seen the specimens
representing it (GH and UC), and the description is derived from Barneby (1964). A. hypoxylus is seemingly similar to Astragalus nothoxys, which is common in the area of collection.

## Astragalus inflexus Douglas ex Hooker <br> Map 87

A. inflexus Dougl. ex Hook. (1831); Phaca inflexa (Dougl. ex Hook.) Piper (1906); Xylophacos inflexus (Dougl. ex Hook.) Rydb. (1913).
Caulescent (-subacaulescent), cinereous, sericeous to villoustomentose perennial from a superficial origin with clustered, prostrate, mat-forming stems $0.5-3 \mathrm{dm}$ that are sometimes accompanied by caudices with radical leaf clusters. Pubescence of fine, ultimately tangled hairs. Leafstalk $4-14 \mathrm{~cm}$; leaflets (9-) 15-23, elliptic, obovate to oblanceolate, $7-15 \mathrm{~cm}, 1.5-3 r$, acute. Stipules free, the upper often conspicuous, attenuate-filamentous. Racemes $\pm$ foliage, loosely racemose to subumbellate with $8-15(-20)$ ascending flowers 18-23 cm ; axis becoming 2-6 cm in fruit. Calyx tube cylindric, $8-10 \mathrm{~mm}$, the filamentous teeth (3-) $4-6 \mathrm{~mm}$ and often curved. Corolla narrow, purple or bicolored; standard oeillate. Ovules 20-30. Legumes ascending, substipitate or stipitate by gynophore $0.6-1.8 \mathrm{~mm}$, unilocular but sutures contiguous, deciduous, tardily dehiscent; body short-oblong or ovoid-lanceoloid, abruptly curved, obcompressed to didymous, $1.5-2.5 \mathrm{~cm} \times 7-9 \mathrm{~mm}$; ventral face or both ventral and dorsal faces sulcate; valves coriaceous, the surface initially obscured by the dense indumentum that thins at maturity; dehiscence on ground, apical. Argophylli: Eriocarpi.

Se WA and adjacent ID and OR (along Snake River and tributaries); disjunctly, e and w of the continental divide in w MT (-se ID). River banks, bars, benches, cliffs (western segment); dry, grassy, sagebrush or juniper slopes (Montana); locally abundant. Ca. 3001200 m . April-June (-July).

Astragalus inflexus is distinguished from others of the Eriocarpi by its caulescent habit, numerous flowers, numerous leaflets and attenuate stipules. It is sometimes confused with A. purshii var. glareosus from which it most easily differs in its long calyx teeth and more strongly caulescent habit.

The Montana segment of the species, which does not cling to rivers as do those in the Oregon-Washington-Idaho triangle, is possibly varietally distinct.

## Astragalus insularis Kellogg (1884)

Map 86
Strigulose, commonly cinereous annual or biennial with diffuse, or basally branched, decumbent stems $0.5-4 \mathrm{dm}$. Leafstalk $3-10 \mathrm{~cm}$;
leaflets (9-) 11-17, elliptic-oblong, 4-20 mm, 3-5 r, somewhat distant, commonly folded and backwardly curved. Stipules free. Racemes included with $4-9$, loosely disposed, ascending to reflexed flowers 5.5 7.5 mm . Calyx tube $2-2.7 \mathrm{~mm}$; teeth $1-2 \mathrm{~mm}$. Corolla pink-purple, standard oeillate. Ovules 8-12. Legumes spreading or declined, sessile, unit,cular with narrow funicular flange 1 mm or less, deciduous, ta،dily dehiscent; body bladdery-inflated, half-ovoid or -ellipsoid to incurved-ovoid in lateral view, conspicuously beaked, $1.5-2.4 \mathrm{~cm} \times 5$ 15 mm ; valves papery, strigulose, often purplish or mottled; dehiscence on ground, said to be apical. Inflati: Aridi.

Colorado Desert and Baja California. Our representative of this species is Astragalus insularis var. harwoodii for which the above description is specific.

Var. harwoodii Munz \& McBurney ex Munz
Map 86
A. insularis var. harwoodii Munz \& McBurney ex Munz (1932); A. harwoodii (Munz \& McBurney ex Munz) Abrams (1944).

S CA and adjacent AZ and Mexico. Colorado Desert; sand dunes, washes, creosote bush scrub. Ca. 0-300 m. Feb.-April.

There is no Astragalus in the Colorado Desert related to $A$. insularis except for $A$. nutans, which extends south from the Mohave to the Chuckwalla Mountains in Riverside County. The latter has fewer ( $7-13$ ) leaflets, larger ( $8-11 \mathrm{~mm}$ ) flowers, and usually symmetric pods.

## Astragalus inversus Jones

Map 88
A. inversus Jones (1893); Homalobus inversus (Jones) Rydb. (1923); A. filipes var. inversus (Jones) Jeps. (1925).

Scantly strigose perennial from a superficial caudex with clustered, decumbent to spreading, sparsely foliose and somewhat rushlike stems to 5 dm . Leaves reduced upwards on stem; leafstalk $4-10 \mathrm{~cm}$, leaflets ( $0-$ ) 5-11, filiform, distant, $5-25 \mathrm{~mm}, 8-20 r$, flat or mostly involute; terminal leaflet confluent with leafstalk or obscurely jointed; uppermost leaves with 0-2 lateral leaflets. Lowest stipules connate. Racemes exserted with $5-12$, distant, soon nodding flowers $9-12 \mathrm{~mm}$. Calyx tube $3-4 \mathrm{~mm}$, campanulate to obconic; teeth $0.5-1$ mm . Corolla pinkish, ochroleucous- or white-tipped; petals subequal; keel lanceolate-incurved to a subporrect tip. Ovules ca. 12-15. Legumes pendulous, stipitate 6-14 mm , unilocular, persistent, dehiscent; body oblong or oblong-lanceolate, straight to slightly decurved, laterally compressed, (2-) 2.5-3.5 (-5) cm $\times 4-5 \mathrm{~mm}$, with conspicuous, filiform
beak; valves papery, usually mottled, strigulose to glabrate; dehiscence proximal, ventral. Cusickiani: Inversi.

Ne CA. Dry pine woodland or open sagebrush slopes, basaltic or igneous soils; infrequent or overlooked. 1200-1850 m. June (-Aug.).

Astragalus inversus, probably a derivative of A. filipes, differs in its xerophytic reduction, unique keel shape, and mottled pods.

## Astragalus inyoensis Sheldon ex Coville <br> Map 88

A. inyoensis Sheld. ex Cov. (1893); Tium inyoense (Sheld. ex Cov.) Rydb. (1929).
Inconspicuously strigose perennial from a superficial caudex with sparsely leafy, prostrate, mat-forming stems to 5 dm . Leafstalk 2-5 cm, shorter than internodes; leaflets 11-19, obovate to elliptic, obtuse to retuse, $3-10 \mathrm{~mm}, 2-5 r$, often folded, glabrate above. Stipules free, lowermost amplexicaul. Racemes exserted with 6-10 ( -15 ) loosely disposed, ascending, spreading or finally declined flowers $8-11 \mathrm{~mm}$. Calyx tube $2.5-3.5 \mathrm{~mm}$; teeth $1-2 \mathrm{~mm}$. Corolla pink-purple, whitetipped; standard recurved $45^{\circ}-90^{\circ}$; keel broad, $\pm$ or $>$ wings. Ovules ca. 20. Legumes spreading or declined, stipitate $2-4 \mathrm{~mm}$, semibilocular, slowly deciduous with pedicels, dehiscent; body incurvedlanceolate $30^{\circ}-180^{\circ}$, triquetrous-obcompressed below, but with laterally compressed beak, $12-15 \mathrm{~mm} \times 5 \mathrm{~mm}$, cuspidate $3-4 \mathrm{~mm}$, dorsally sulcate; valves coriaceous or thickly papery, rugulose, inconspicuously strigulose; dehiscence on raceme or ground, through beak.

CA, Inyo Co., from Westgaard Pass s to Darwin Mesa; NV, Nye and Lincoln cos. Atomic test area and Timpahute Range; desert mountains, rocky open or brushy slopes and streambanks with sagebrush-pinyon, locally common. Ca. 1500-2300 m. May-June.

Astragalus inyoensis differs from other species of its region by its long internodes, bright purple flowers with a large, broad keel and usually crescentic pods. It is abundant along rocky banks of the creek and roadside as one approaches Westgaard Pass from the southwest.

## Astragalus iodanthus Watson (1871)

Map 89
Scantily strigulose (-villosulous) perennial of commonly glabrate aspect from a superficial (-subterranean) caudex with clustered, usually decumbent, often mat-forming stems to 4 dm . Leafstalk 3-5 cm ; leaflets (11-) 13-19, obovate, obtuse or retuse, $5-15 \mathrm{~mm}, 1-2.5 r$, glabrate above. Stipules free, inconspicuous. Racemes short, included, with (5-) 7-15, initially subumbellate, then loosening, ascendingspreading, ultimately declined flowers $9-15 \mathrm{~mm}$. Calyx tube cylindric, 2.5-5 mm; teeth 1-2.5 mm. Corolla pink-purple or pale with lavender
tips, wings and keel $<$ or $\pm$ standard. Ovules ca. 15-30. Legumes reflexed or humistrate, sessile, unilocular or proximally semibilocular, deciduous, slowly dehiscent; body ellipsoid or oblong-oblanceoloid, sharply incurved $90^{\circ}-360^{\circ}$ or more, commonly looped so that the tip crosses the base at right angles, obcompressed or triquetrous, (1.5-) $2.5-4 \mathrm{~cm} \times 3.5-8 \mathrm{~mm}$, acuminate-beaked; ventral suture superficial, slightly carinate; dorsal face flat or deeply sulcate; valves thinly coriaceous, often mottled, strigulose or glabrate; dehiscence apical, through beak, initiating on raceme or on ground. Diphysi.

C NV (-ne UT) to se OR and sw ID, barely into contiguous CA.
In fruit, Astragalus iodanthus is commonly recognizable by its characteristically obcompressed and looped or hamate fruit. In flower it is scarcely distinguishable from some of the glabrate, northern phases of $A$. lentiginosus (as vars. platyphyllidius or lentiginosus) except that these have whitish flowers with graduated petals. $A$. iodanthus in flower has been confused also with $A$. cibarius, which, however, has conspicuous, nerved, lower stipules.

Astragalus iodanthus is racially various as to color, size and proportions of the petals, fruit conformation, position of caudex, and nature of vesture.

Key to varieties of Astragalus iodanthus

1. Plants from a superficial caudex; vesture strigulose or if (rarely) villosulous, hairs less than 1 mm ; range of species.
2. Calyx tube $3.5-5 \mathrm{~mm}$; corolla $12-14 \mathrm{~mm}$; legumes ca. (4-) 5-8 mm wide; NV, barely into surrounding states. var. iodanthus
3. Calyx tube 2.5-3 (-3.5) mm; corolla $9-12 \mathrm{~mm}$; legumes $3.5-6$ mm wide; sw ID and adjacent OR.
var. vipereus
4. Plants from a subterranean caudex; vesture subvillosulous with curved hairs $\pm 1 \mathrm{~mm}$; relatively local, Nye, Lyon, and Esmeralda cos., NV and Mono Co., CA.
var. pseudiodanthus
Var. iodanthus
Map 89
A. iodanthus Wats. (1871); A. iodanthus var. typicus Barn. (1944).
A. iodanthus var. diaphanoides Barn. (1944).

Range as given in key. Dry sagebrush-pinyon hillsides, valleys, canyons, washes, at lower elevation in alkaline soils with Sarcobatus and Atriplex; locally common. Ca. 1200-2450 (-2750) m. (April-) MayJune (-July).
A. pseudiodanthus Barn. (1942); A. iodanthus var. pseudiodanthus (Barn.) Isely (1983).
Range as given in key. Sandy deserts, especially of dunes and alluvium of old beach (Mono Lake). Ca. 1700 m and 2050 m . May-June.

The flowers and fruits of Astragalus pseudiodanthus are those of A. iodanthus, and I am interpreting it as a deep sand ecotype.

Var. vipereus Barneby (1964)
Map 89
Range as given in key; primarily along the Snake River and affluents. Barren sagebrush slopes, bluffs, in sand, clay or shale. Ca. $750-1200 \mathrm{~m}$. May-June.

Representatives of this variety tend to be smaller in stature, flowers, and fruits than var. iodanthus, and the plants are possibly more pubescent. Although seemingly clinal in nature, var. vipereus is easily named on a geographic basis.

Astragalus iodopetalus (Rydberg) Barneby
Map 90
Xylophacos iodopetalus Rydb. (1925); A. iodopetalus Greene ex Jones (1923) in syn., Rydb. (1925) in syn., (Rydb.) Barn. (1947).
X. stipularis (Jones) [sensu] Rydb. (1917) non basionym.

Shortly caulescent, sparsely villous perennial from superficial origin, with clustered, prostrate stems. Leafstalk $5-15 \mathrm{~cm}$; leaflets 17 25 (-27), smaller apically, obovate, elliptic, to oblanceolate, 4-15 (-20) $\mathrm{mm}, ~ 2.5-4 r$, glabrate above. Stipules free. Racemes ascending, ultimately reclinate, short-racemose, with $10-20+$ ascending flowers $18-21 \mathrm{~mm}$. Calyx tube cylindric, $7-10 \mathrm{~mm}$; teeth $3-5 \mathrm{~mm}$. Corolla purple, narrow. Ovules $30+$. Legumes ascending, humistrate, sessile, unilocular or nearly bilocular from a narrow septum, deciduous, tardily dehiscent; body ovoid-acuminate to ellipsoid-lanceolate, proximally obcompressed and didymous, distally laterally compressed, (1.5-) $2-3 \mathrm{~cm} \times 8-10 \mathrm{~mm}$, sulcate on both surfaces; valves initially fleshy, becoming coriaceous, rugulose, glabrous; dehiscence on ground, apical, both sutures. Argophylli: Argophylli.

Sw CO and n NM. Dry slopes with scrub oak and pinyon; locally common. Ca. 1850-2450 m. May-June.

Astragalus iodopetalus, perhaps most closely allied to A. tephrodes var. brachylobus, can be distinguished from its relatives by its glabrous pods. Barrell (1969) has said, "A. iodopetalus is easily one of the most memorable plants in Gunnison Basin. In open sagebrush
country it commonly grows in a gray-green cushion eight inches in diameter and five or six inches high; at the bottom around the edges, are a dozen or more lavish heads of blue [probably more properly, purple] flowers."

Astragalus iselyi Welsh (1974)
Map 170
Low, caulescent, seleniferous short-lived perennial from a superficial origin with clustered, decumbent or ascending, sparsely strigulose stems 1-2.5 dm. Pubescence partly of closely appressed, flattened hairs. Leafstalk 3-7 cm; leaflets (3-) 5-13, thick, rhombic-elliptic, 1-3 $\mathrm{cm}, 2-4 r$, cinereous-strigulose, or those of lower leaves glabrate. Stipules free. Racemes included or usually shortly exserted on peduncles $2-10 \mathrm{~cm}$ with 8-15 (-20) quickly divergent flowers 17-20 mm . Pedicels in fruit $3-4 \mathrm{~mm}$. Calyx tube cylindric, $5.5-6.5 \mathrm{~mm}$, darkstrigulose; teeth $2-3 \mathrm{~mm}$. Corolla pure white, fading ochroleucous. Ovules $30+$. Legumes spreading-declined, sessile or substipitate, unilocular or subunilocular, persistent or dehiscent; body oblongellipsoid, subterete, moderately inflated, 2-3.5 $\times 1-1.5 \mathrm{~cm}$, cuspidatebeaked, slightly sulcate both dorsally and ventrally; valves fleshy, becoming coriaceous, strigulose; dehiscence apical, both sutures, downward. Preussiani: Sabulosi.

UT, s Grand and n San Juan cos., foothills of the La Sal Mts. Clay and gravel slopes, salt desert shrub and pinyon-juniper. Ca. 1500-1800 m. March-April.

Astragalus iselyi, closely allied to A. sabulosus, differs conspicuously from that species in its much smaller, white flowers. It blooms earlier than $A$. sabulosus: "The earliest I have seen $A$. sabulosus in flower is 15 April while I have a specimen of $A$. iselyi in flower on 4 March" (Welsh, pers. comm., 1980). Its relatively recent detection probably owes to the fact that it is very early flowering and most observations have been of fruiting plants.

I expressed the view that this taxon should be treated as a varietal segregate of $A$. sabulosus to its author, Dr. S.L. Welsh. He responded by taking me on a trip across Utah to visit collection localities of the two, enunciating primarily the ecological differentiation and geographic isolation of the two kinds rather than their less impressive morphological differences. Granting that the appropriate rank-categorization of these two taxa lies on a definition-periphery, its present listing is partly in deference to Dr. Welsh.

## Astragalus jaegerianus Munz

Map 91
A. dumetorum Jaeger (1940) non Hand-Mazz. (1933); A. jaegerianus Munz (1941).
Straggling, pubescent, shortly rhizomatous perennial from a subterranean crown with slender, procumbent or clambering, sparsely foliose, branched and often zig-zag stems to 7 dm . Pubescence of flattened, somewhat scalelike hairs. Leafstalk $2-6 \mathrm{~cm}$, commonly shorter than internodes and curved; leaflets $9-15$, oblong to linear, 5-12 $r$, flat or folded, cinereous or greenish, usually more pubescent above than below. Stipules free. Racemes numerous, with 5-15 laxly disposed, ascending, then declined flowers $7-10 \mathrm{~mm}$. Calyx tube 2.5-4 mm , black-strigose; teeth $1-2 \mathrm{~mm}$. Corolla lavender-purple or ochroleucous; standard recurved to $90^{\circ}$; keel $\pm$ wings, lunate, subporrect. Ovules 15-20. Legumes reflexed, stipitate or exsertedstipitate $3-5 \mathrm{~mm}$, bilocular, persistent or slowly deciduous with pedicels, dehiscent; body oblong, laterally compressed (plump when immature), $15-22 \mathrm{~mm} \times 4-5 \mathrm{~mm}$; sutures carinate; valves initially fleshy and often mottled, becoming thinly coriaceous and rugulose at maturity, glabrous; dehiscence apical, both sutures.

CA, San Bernardino Co., central Mohave Desert, local between Barstow and Goldstone. Rocky granitic soils, commonly with yucca or Joshua tree, growing under and through shrubs. Ca. 1050-1150 m. April-May.

The salient characters of Astragalus jaegerianus are its subterranean origin, straggly-clambering habit, the long, subporrect keel and straight, deflexed, laterally compressed, bilocular pods. The contiguous A. pachypus has similar pods but is an erect-clumped plant with much larger flowers.

Astragalus jejunus Watson
Map 90
A. jejunus Wats. (1871); Phaca jejuna (Wats.) Rydb. (1913).

Strigulose, usually cinereous, tufted, subacaulescent or shortly caulescent perennial from slightly subterranean to superficial, branching, slightly thatched caudex; annual elongation $1(-3) \mathrm{cm}$, the entire plant rarely exceeding 1 dm . Leaves erect; leafstalk stiff, $1-5 \mathrm{~cm}$, subspinulose-tipped, persistent; leaflets tiny, ascending, easily deciduous, 9-17, ovate, elliptic-lanceolate or linear, acute, 1-5 mm, 4-8 $r$, often folded; terminal leaflet continuous with rachis. Stipules imbricate, connate. Racemes $>$ leaves with $3-6$ spreading flowers $5-7 \mathrm{~mm}$. Calyx tube $1.5-2 \mathrm{~mm}$; teeth $0.5-1 \mathrm{~mm}$. Corolla pinkish, lavender or bicolored; standard upcurved $70^{\circ}-90^{\circ}$, keel incurved $100^{\circ}$ or more. Ovules $10-15$. Legumes spreading, sessile, unilocular, deciduous with or without
pedicel, dehiscent; body bladdery-inflated, subglobose to obovoid, slightly asymmetrical, (0.8-) 1-1.5 (-1.8) $\mathrm{cm} \times 0.8-1.2 \mathrm{~cm}$, beakless or with filiform style remnants; valves mottled, papery-membranous; subdiaphanous, inconspicuously strigulose; dehiscence apical, both sutures to base, the valves then separating. Jejuni.

Sw WY and adjacent UT and CO, also disjunctly, White Pine Co., NV. Bare clay or limestone soil on knolls, ridges, hills; with juniper and sagebrush. Ca. 2000-2300 m. May-June.

Astragalus jejunus is a little, tufted plant that at maturity produces a mass of tiny, inflated pods amidst broomy clusters of leaf rachises.

Astragalus johannis-howellii Barneby (1957)
Map 81
Strigulose perennial from a superficial caudex with numerous, clustered, slender, decumbent stems $2-20 \mathrm{~cm}$. Leafstalk $4-6 \mathrm{~cm}$; leaflets 13-21, contiguous, obovate to oblanceolate, obtuse, $2-5 \mathrm{~mm}$, $2.5-5 r$, flat or folded, all jointed to rachis, glabrate above. Stipules connate. Racemes included, with 6-12 loosely distributed, deflexed flowers ca. 5 mm . Calyx tube 2 mm ; teeth $1-1.7 \mathrm{~mm}$. Corolla white, scarcely graduated; standard recurved ca. $90^{\circ}$; keel incurved ca. $110^{\circ}$, acute-tipped. Ovules 5-10. Legumes reflexed, substipitate $0.5-2.5 \mathrm{~mm}$, bilocular or nearly so, deciduous with pedicels, tardily dehiscent; body half-ellipsoid or ellipsoid-oblong, slightly incurved, compressedtriquetrous, $7-10 \mathrm{~mm} \times$ ca. 3 mm , dorsally sulcate; valves papery, puberulent, dehiscence presumably on ground and apical. Neonix.

E CA, Mono Co., Owens Valley, contiguous to Crowley Lake. Known only from type locality. Sandy sagebrush scrub. Ca. 2150 m . June-Aug.

Astragalus johannis-howellii has conspicuously connate stipules, fine feathery foliage, and tiny flowers and fruits. Two species of its region resemble it in appearance: $A$. lentiformis with sessile pods, and $A$. lemmonii with free stipules and short, compact racemes.

The type locality of Astragalus johannis-howellii has been largely inundated by Lake Crowley (Barneby, 1957), but a specimen (Dedecker 1908 NY!) collected in 1958 from " n side of Crowley Lake," indicates some survival.

Astragalus kentrophyta Gray (1864)
Maps 92, 93, 94
Pubescent, silvery or green, prickly perennials of diverse habit from superficial or aerial caudices and a taproot. Plants caulescentascending to 3 dm high, or caespitose, or prostrate-matforming to pulvinate, forming mats or cushions to 4 dm diam. Pubescence
dolabriform (often obscurely so) or basifixed; hairs appressed or spreading, straight or curved. Internodes: (1) short, the leaves immersing the stem in a spiny mass, or (2) elongate, the foliage spaced and often accompanied by axillary leaf clusters. Leaves pinnate to subpalmate; leafstalk $0.4-2 \mathrm{~cm}$; leaflets 3-7 (-9), ellipticlanceolate, subulate or oblanceolate, flat or involute, $0.3-1.5(-2) \mathrm{cm} \times$ ca. 1 mm wide, $4-15 r$, usually rigid and thick, carinate, confluent with rachis, softly or stiffly spine-tipped. Lower stipules connate. Racemes intercalary, short, subsessile to pedunculate 1.5 cm , with 1-3, ascending, then declined flowers $4-9(-10) \mathrm{mm}$. Calyx tube $1.5-3 \mathrm{~mm}$; teeth $0.5-3.5$ $(-5) \mathrm{mm}$. Corolla white to pink-purple; standard $\pm$ wings; keel much shorter. Ovules 2-8. Legumes spreading or deflexed, sessile, unilocular, subpersistent or deciduous from receptacle, dehiscent; body lenticularovoid, ellipsoid, or lanceolate-acuminate, laterally compressed to subterete, $4-9 \times 1.5-4 \mathrm{~mm}$, with or without a distinct beak; valves thick-papery, strigose or villous; dehiscence convergent, the valves separating by both sutures. Ervoidei: Submonospermi.

S Canada (Saskatchewan and Alberta) and w U.S. Several floristic provinces; high plains to e slopes of Sierra Nevada; MT and e ND, s to NM, w to e CA.

Unique in its commonly indurated, spinose, confluent leaflets and tiny, subsessile to pedunculate racemes, Astragalus kentrophyta elicits the initial reaction "Who would imagine this is an Astragalus?" This barrier past, it is rarely misidentified at the specific level. The infraspecific taxonomy is, however, perplexing, as this treatment and Barneby's (1951a, 1951b, 1964) summaries bear witness.

Astragalus kentrophyta includes two major subgroups: (1) Alpine or upper elevation, prostrate-matted to pulvinate-depressed plants, usually with bright purple flowers and basifixed pubescence; ovules mostly $5-8$. And (2) lower elevation kinds that range from prostrate to bushy and ascending with white or lavender flowers; pubescence, in part, dolabriform; ovules 2-4. These represent Astragalus tegetarius and A. kentrophyta, respectively, of authors as Hitchcock (1961).

The widely distributed alpine forms (Astragalus kentrophyta var. implexus herein), probably represent the basic stock from which, in various parts of its range, the other kinds, seemingly confluent with var. implexus, are independently derived. Thus the complex cannot realistically split into two species. Since the similar regional phases do not merit the rank of species, all are classified as components of $A$. kentrophyta. Data supporting this position have been supplied by Barneby (1964).

I find pod shape more variable (and less useful as a key character) than characterized by Barneby (1964), and the differentiation of pubescence conditions often frustrating. With the exception of the ubiquitous Astragalus kentrophyta var. implexus, the varieties are largely allopatric, and the geographic tabulation following the primary key may facilitate determinations.

Key to varieties of Astragalus kentrophyta

1. Leaflets $3-5$; plants caespitose-pulvinate, strongly prickly; Sierra Nevada, CA (Mono and Fresno cos.).
var. danaus
2. Leaflets 5-9; plants various in habit; leaves prickly to flaccidtipped; absent from CA except for White and Inyo mts. (Inyo Co.).
3. Petals purple (-white) with broadly obovate standard; leaflets $2-5(-8) \mathrm{mm}$; ovules $5-8$; foliage pubescence commonly of curved and ascending hairs, clearly basifixed or partially dolabriform; plants mat-forming or pulvinate; primarily of upper elevations but downward to 2000 m (occasionally lower), and there intergradient with other varieties; widely distributed, OR, CA (Inyo Co.), e to Rocky Mts. Front Ranges.
var. implexus
4. Petals white to light lavender except in se UT where var. implexus does not occur and among intermediates with var. implexus; standard narrowly obovate to oblanceolate; leaflets commonly $8-12 \mathrm{~mm}$; ovules $2-4$; pubescence clearly or obscurely dolabriform; plants various in habit; mostly of middle elevations or below (exception var. ungulatus in NV).
5. Of n high plains, e MT to ne CO and e. var. kentrophyta
6. Rocky Mts. and w.
7. Flowers purple; calyx teeth $3.5-5 \mathrm{~mm}$; legumes $7-10$ mm ; along Colorado River, se UT (-AZ).
var. coloradoensis
8. Flowers white; calyx teeth $0.5-3 \mathrm{~mm}$; legumes to 7 mm ; distribution not as above.
9. Legumes $3.5-5 \mathrm{~mm}$, ovoid-lenticular, apiculate or essentially without a beak; se OR to w WY, also NM.
10. Calyx teeth $0.5-1.5 \mathrm{~mm}$; NM.
var. neomexicanus
11. Calyx teeth $2-3 \mathrm{~mm}$; se OR to w WY (-ne UT).
12. Legumes 4-7 mm, ovoid-lanceolate, tapering into a conspicuous beak; not of above states.
13. Plants diffuse to ascending, not mat-forming; internodes well developed and exposed; UT, n AZ, w CO, CA, Inyo Co.
var. elatus
14. Plants prostrate, mat-forming; internodes concealed by foliage or exposed.
15. NV; plants silvery-pubescent.
var. ungulatus
16. Se WA (or OR?), probably extinct; plants greenish or cinereous.
var. douglasii

## Geographic tabulation of varieties of Astragalus kentrophyta

See lead 2 in above key for further characters of var. implexus, which occurs in most regions.

California-Nevada

1. Of CA Sierra Nevada in Fresno and Mono cos. var. danaus
2. Not in CA Sierra Nevada.
3. Of middle or upper elevations, White and Inyo mts., CA and NV; flowers purple; plants cinereous to greenish with mostly basifixed hairs.
var. implexus
4. Middle elevations, ca. $1500-2150 \mathrm{~m}, \mathrm{NV}$; flowers white; plants silvery with dolabriform pubescence.
var. ungulatus
Oregon-Washington-Idaho
5. Along Columbia River, WA and (or) OR. var. douglasii
6. Not in WA.
7. Flowers white; plant mat-forming to diffuse with exposed internodes; lower elevations, ca. 900 m , s of Snake River in w ID and adjacent OR.
var. jessiae
8. Flowers purple; plant usually mat-forming or pulvinate with hidden or short internodes; upper elevations; $n$ of Snake River, c ID and ne OR.
var. implexus

## Montana-Wyoming

1. High plains, e MT, WY.
var. kentrophyta
2. Mts., further west.
3. W WY; flowers white; plants prostrate to diffuse, usually with well-developed internodes; seemingly intergradient with following.
var. jessiae
4. WY and MT; upper to middle elevations; plants prostrate to pulvinate with hidden or short internodes.
var. implexus

## Utah-Arizona

1. Along Colorado River, se UT and slightly into AZ; calyx teeth 3.5-5 mm and legume 7-10 mm.
var. coloradoensis
2. Not as above; calyx teeth and legume smaller.
3. UT (but not se corner), s to n AZ, middle elevations; plants diffuse to ascending with internodes often 2 cm or more; flowers white to lavender; intergradient with following.
var. elatus
4. Through UT, middle to upper elevations; plants prostrate to pulvinate with short or hidden internodes; flowers purple (-white).
var. implexus

Colorado-New Mexico

1. High plains, ne CO.
var. kentrophyta
2. Not as above.
3. CO and barely into n NM; middle to upper elevations; plants prostrate to pulvinate with short or hidden internodes; flowers purple (-white); intergradient with var. elatus following.
var. implexus
4. CO and n NM, middle elevations; plants prostrate to diffuse with well-developed internodes to 1.5 cm or more; flowers white.
5. N NM. var. neomexicanus
6. CO .
var. elatus

## North Dakota-South Dakota-Nebraska

var. kentrophyta

Var. coloradoensis Jones
Map 94
A. kentrophyta var. coloradoensis Jones (1902); A. montanus var. coloradoensis (Jones) Jones (1923); Kentrophyta coloradoensis (Jones) Rydb. (1929); A. kentrophyta ssp. coloradoensis (Jones) W.A. Weber (1983).
Caulescent, mat-forming or assurgent with white-strigose stems; internodes to $1-1.5 \mathrm{~cm}$; pubescence mostly loosely strigose and dolabriform; leaflets ca. $5,5-15 \mathrm{~mm}$, prickle-tipped; calyx teeth 3.5-5 mm ; corolla purple, $7-10 \mathrm{~mm}$; ovules 4-8; legumes ellipsoid or lanceoloid-acuminate $7-10 \mathrm{~mm}$.

Se UT, barely in AZ; canyons of Colorado River and tributaries. Canyon slopes, washes, bluffs, talus. Ca. 1050-1500 m. April-May.

This form with large fruits and flowers, var. implexus features, is a misfit among the lower elevation forms in ovule number and flower color.

Var. danaus Barneby
Map 93
A. tegetarius var. danaus Barneby (1951); A. kentrophyta var. danaus (Barneby) Barneby (1951); A. kentrophyta ssp. danaus (Jones) W.A. Weber (1983).
Matted-pulvinate with internodes to 5 mm ; pubescence mostly basifixed; leaflets $3-5,5-15 \mathrm{~mm}$, prickle-tipped; corolla purple (-white and purple-tipped), ca. 4-5.5 mm; ovules 5-8; legumes lenticular, 3.5-5 mm.

CA, Mono Co. to adjacent Fresno Co. Sierra Nevada; alpine slopes, crests, rockslides, downward to pines; locally abundant. Ca. 3050-3950 m. July-Aug.

Var. danaus is presumably a local prickly-pulvinate derivative of var. implexus, which is contiguous in the White and Inyo mountains.

Var. douglasii Barneby (1964)
Map 93
A. kentrophyta ssp. douglasii (Barneby) W.A. Weber (1983).

Prostrate-matted; internodes $0.5-0.8 \mathrm{~cm}$; pubescence dolabriform; leaflets ca. $5-12 \mathrm{~mm}$; corolla white, ca. 6 mm ; ovules 2; legumes lanceolate, ca. 5 mm .

Se WA or adjacent OR, probably extinct. Dunes of river banks.
Var. douglasii is known only from three collections, all of the last century.

Var. elatus Watson
Map 94
A. kentrophyta var. elatus Wats. (1871); A. viridis var. impensus Sheld. (1894); A. viridis var. elatus (Wats.) Cockerell (1898); A. kentrophyta var. impensus (Sheld.) Jones (1902); Kentrophyta impensa (Sheld.) Rydb. (1906); A. impensus (Sheld.) Woot. \& Standl. (1915); A. montanus var. impensus (Sheld.) Jones (1923); A. tegetarius var. elatus (Wats.) Barn. (1951); A. kentrophyta ssp. elatus (S. Wats.) W.A. Weber (1983).

Ascending-branched (-decumbent), greenish (-cinereous); internodes (1-) 2-4 cm; foliage pubescence mostly strigulose, dolabriform; leaflets 5-$7,4-15 \mathrm{~mm}$, prickle-tipped; flowers whitish (-lavender), $5-6 \mathrm{~mm}$; ovules $2-4$; legumes ovoid-acuminate, $4-7 \mathrm{~mm}$, sometimes incurved-beaked.

W CO to e CA. Dry rocky slopes with sage and juniper, upwards to openings in pine forests; road cuts; common. (1200-) 1500-2600 (-3050 in CA). (May-) June-Aug.

These plants initiate growth as loose spiny pin-cushions. Then they develop ascending or sprawling, untidy, branched stems that terminate in a tangle of prickly leaves. Some specimens at intermediate elevations combine characters of vars. elatus and implexus; e.g., habit and ovule number of var. implexus, but flower color and pubescence of var. elatus.

Var. implexus (Canby ex Porter \& Coulter) Barneby
Map 93
A. tegetarius Wats. (1871); Homalobus tegetarius (Wats.) Rydb. (1904); Kentrophyta tegetaria (Wats.) Rydb. (1907); A. montanus var. tegetarius (Wats.) Jones (1923).
A. tegetarius var. implexus Canby ex Porter \& Coult. (1874); A. kentrophyta var. implexus (Canby ex Porter \& Coult.) Barn. (1951); A. kentrophyta ssp. implexus (Canby ex Porter \& Coult.) W.A. Weber (1983).
A. tegetarius var. rotundus Jones (1895); A. kentrophyta var. rotundus (Jones) Jones (1902); A. montanus var. rotundus (Jones) Jones (1923); K. rotunda (Jones) Rydb. (1924).
A. aculeatus Nels. (1899); K. aculeata (Nels.) Rydb. (1906).

Homalobus wolfii Rydb. (1904); K. wolfii (Rydb.) Rydb. (1906).
Kentrophyta minima Rydb. (1907).
Prostrate or pulvinate; internodes hidden by stipules or to $1(-2)$ cm; pubescence appressed to spreading, mostly basifixed, commonly including sinuous hairs; leaflets usually flaccid, 5-9, 2-5 (-8) mm; peduncles nil or well-developed; corolla purple (-white), (4-) $5-9 \mathrm{~mm}$. Ovules 5-8; legumes ellipsoid to oblong-tapering, 4-9 mm.

NV and e OR (-e CA, White and Inyo mts.), e to Rocky Mts., WY to n NM. Primarily alpine or subalpine mountain crests and gravelly slopes, talus, meadows, open areas in upper elevation forests; on limestone, granite, shale; frequent and abundant; to a lesser extent, middle elevations, woodland openings and with sagebrush, roadsides. (1200-) 2150-3700 m. June-Aug.

Typical var. implexus, a soft-prickly, matted plant, liberally bestowed with immersed or pedunculate bright pink-purple flowers, is the most attractive form of the species, and seemingly the common denominator to which all of the other forms are linked.

Var. implexus includes the following forms: (1) Plants diminutivecaespitose to pulvinate; stems short, scarcely creeping, of minimal annual growth, but producing mounds or compact carpets of
innumerable leaf clusters; leaflets mostly 5 mm or less. (2) Plants creeping and mat-forming; annual growth $1-2 \mathrm{~cm}$ and producing prostrate mats; leaflets mostly $5-7 \mathrm{~mm}$. (3) More robust mat-formers with stems to 2 dm , mostly of lower elevations.

Barrell (1969; Gunnison County, Colorado) said of var. implexus (as $A$. tegetarius), "The plant is like no other milkvetch in the Basin and can be recognized from horseback in the twilight."

Var. jessiae (Peck) Barneby
Map 92
Kentrophyta montana var. [no ephithet provided] Nutt. (1838).
A. jessiae Peck (1945); A. tegetarius var. jessiae (Peck) Barn. (1951); A. kentrophyta var. jessiae (Peck) Barn. (1951); A. kentrophyta ssp. jessiae (Peck) W.A. Weber (1983).
Caulescent, shortly prostrate, tufted or loosely ascending; internodes ca. $5-15 \mathrm{~mm}$, cinereous, pubescence strigulose, dolabriform; leaflets usually palmate, $5,4-10 \mathrm{~mm}$, prickle-tipped; corolla white or pink-tinged, ca. $5-6.5 \mathrm{~mm}$; ovules 2 ; legumes shortly oblong and essentially beakless, or shortly-tapering beaked, $3-4.5 \mathrm{~mm}$.

Sw WY (-ne UT), s ID, and adjacent OR. Mostly middle elevation sagebrush-juniper country, slopes, bluffs, knolls; dry sterile clay or sandy soil. Ca. 750-900 m. (ID); 1850-2150 m. (WY). May-Aug.

Var. jessiae looks much like var. elatus of Utah; the two varieties, however, differ as follows:

1. Stems often $2-4 \mathrm{dm}$ with internodes commonly $2-5 \mathrm{~cm}$; stems thinly pubescent, appearing glabrate without magnification.
var. elatus
2. Stems $0.5-2 \mathrm{dm}$, with internodes $0.5-2 \mathrm{~cm}$; stems closely pubescent, often appearing cinereous or white-canescent. var. jessiae

Var. jessiae seemingly merges with middle elevation, caulescent var. implexus and differential characters fail except possibly of ovule number and pod size as follows.

1. Ovules 2-3; legumes $3.5-5(-7) \mathrm{mm}$.
2. Ovules $4-8$; legumes $4-8 \mathrm{~mm}$.
var. jessiae
var. implexus
Since much material lacks fruit, arbitrary determination of dubious material must be based solely on ovule number.

The range of var. jessiae is of two parts, and the disjunct population groups are not the same, possibly suggesting independent derivation from var. implexus.

## Var. kentrophyta

Map 92
Kentrophyta montana Nutt. (1838); A. kentrophyta Gray (1864); A. montanus (Nutt.) Jones (1923) non L. (1753).
K. viridis Nutt. (1838); A. viridis (Nutt.) Sheld. (1894) non Bunge (1869); Phaca viridis (Nutt.) Piper (1906); A. tegetarius var. viridis (Nutt.) Barn. (1951).
Shortly caulescent, matted-prostrate; internodes $5-15 \mathrm{~mm}$; pubescence obscurely dolabriform; leaflets $5-7,5-10 \mathrm{~mm}$, flexuous or prickle-tipped; corolla white, 4-5.5 mm; ovules 2-3; legume ovoid or beaked, 4-7 mm.

High plains: w NE, adjacent WY, e MT, and w ND; also adjacent Canada. Usually open, bare, dry soil, ridges, bluffs, knolls; widely distributed, but apparently infrequent. Ca. 1200-1500 (-1850) m. June-July (-Sept.).

Var. kentrophyta, a High Plains mat-former with large pods, is disjunct from the species otherwise. Its distribution, as presently known, falls into three discrete areas, two in the United States and one in Canada.

Var. neomexicanus (Barneby) Barneby
Map 94
A. tegetarius var. neomexicanus Barn. (1951); A. kentrophyta var. neomexicanus (Barn.) Barn. (1951); A. kentrophyta ssp. neomexicana (Barn.) W.A. Weber (1983).
Decumbent-matted or ascending; internodes $4-15 \mathrm{~mm}$; pubescence strigulose, dolabriform; leaflets ca. $5,4-12 \mathrm{~mm}$, becoming prickly; flowers white; ovules 2-3; legumes ovoid, apiculate 3-4 mm.

Nw NM and De Baca Co. Banks and bars along streams, washes, cliffs, badlands. 1200-2150 m. June-Aug.

Var. neomexicanus resembles var. elatus in its elongate, sometimes ascending stems, prickly leaves and white flowers. But it has a small, essentially beakless pod, and reduced calyx lobes. The stipules of some specimens are all connate and the leaflets are usually recurved. The isolated De Baca County population (populations?) has somewhat the habit of var. kentrophyta, but the pungent leaflets and the short calyx lobes of var. neomexicanus.

Var. ungulatus Jones
Map 93
A. kentrophyta var. ungulatus Jones (1895); A. montanus var. ungulatus (Jones) Jones (1923); Kentrophyta ungulata (Jones) Rydb. (1924); A. tegetarius var. ungulatus (Jones) Barn. (1951); A. kentrophyta ssp. ungulatus (Jones) W.A. Weber (1983).

Prostrate and mat-forming; internodes hidden or evident and to 1 cm; pubescence cinereous or silvery, strigulose, dolabriform; leaflets ca. 5, 3-9 mm, flaccid or soft-prickly; flowers white with maculate keel; ovules 2-3; legumes lanceoloid-acuminate, beaked, 5-7 mm.

E and c NV, scattered localities. Calcareous knolls, eroded slopes with sagebrush. Ca. 1500-2150 m. May-July.

In common with var. elatus to the east, this variety has acuminatebeaked pods but is a silvery prostrate mat-former.

## Astragalus knightii Barneby (1983) ${ }^{19}$

Tufted, shortly caulescent, cinereous, pubescent perennial from a superficial or aerial sometimes slightly thatched caudex, with clustered decumbent-ascending stems $1-5 \mathrm{~cm}$. Pubescence dolabriform. Leafstalk $3-6 \mathrm{~cm}$; leaflets ca. 11-15, (ovate-) elliptic-oblong, strigose both sides, (2-) 4-8 mm, 4-7 $r$. Lowermost stipules inconspicuous, connate, two lobed, the subsequent ones evident, contiguous, and free or nearly so. Racemes terminal on stems or subradical, included or slightly $>$ foliage in flower, spreading or reclinate in fruit; flowers 5-10, spreading, then declined, $5-6 \mathrm{~mm}$. Pedicels ca. 1 mm . Calyx tube ca. 2.0-2.5 mm; teeth 1-1.5 mm. Corolla faintly pink-purple or pale; keel maculate. Ovules 12-15 on funiculi $1.0-1.5 \mathrm{~mm}$. Legumes pendulous or humistrate-spreading, substipitate $0.5-0.7 \mathrm{~mm}$, unilocular, seemingly persistent or ultimately deciduous with pedicel, presumably dehiscent; body obovoid or ellipsoid, turgid or inflated, moderately obcompressed, nearly symmetric, $10-14 \mathrm{~mm} \times 4-5 \mathrm{~mm}$; both faces slightly sulcate; valves papery, slightly mottled; dehiscence not seen, likely apical both sutures. Cusickiani.

Nw NM. Sandoval Co., s of Rio Puerco at confluence with Salado Creek, nw corner of Laguna Indian Reservation, ca. 25 airline miles w of Bernalillo; known only from type locality. Pinyon-juniper, loam over shale or sandstone. Ca. 1750 m. May.

This is a small caespitose plant, perhaps with the aspect of the Inflati but with inconspicuously connate lower stipules and dolabriform pubescence. It is evidently most closely related to the contiguous $A$. ceramicus despite its entirely different habit.

Astragalus layneae Greene
Map 108
A. layneae Greene (1885); A. malacus var. layneae (Greene) Jones (1893); Hamosa layneae (Greene) Rydb. (1927).

[^1]Strongly rhizomatous, villous, cinereous, subacaulescent or usually shortly caulescent perennial of subterranean origin, 2.5-3.5 (-4) dm; rhizomes glabrous; stems solitary, but often branched at ground level and appearing clustered, ascending or erect. Leafstalk $5-15 \mathrm{~cm}$; leaflets 13-19, broadly obovate, ovate or elliptic, $5-15(-20)$ mm, 1-2 $r$. Stipules free. Racemes exserted with 10-many, soon loose, ascending or spreading flowers $12-18 \mathrm{~mm}$, often reclinate in fruit. Calyx tube campanulate to subcylindric, $5-8 \mathrm{~mm}$; teeth $1-2 \mathrm{~mm}$. Corolla white or ochroleucous, purple-streaked and maculate-tipped; incurved to $100^{\circ}$. Ovules ca. 25-30+. Legumes ascending or divergent, sessile, bilocular, deciduous from receptacle, tardily dehiscent; body oblong, initially nearly straight except at tip, ultimately incurved through ( $90^{\circ}-$ ) 180- $320^{\circ}$, obcompressed or triquetrous, cordate or reniform in cross section, slenderly beaked, $3-5(-6) \mathrm{cm} \times 4-7 \mathrm{~mm}$, dorsally sulcate; valves initially fleshy, pilose and often mottled, becoming coriaceous and sometimes glabrate; dehiscence on ground, apical. Layneani.

Mohave Desert: s CA, s NV, and adjacent AZ. Flats, slopes, washes, desert mts. and foothills, often with Larrea; roadsides; locally abundant. Ca. 600-1500 m. April-May.

Astragalus layneae is the only extensively rhizomatous species of the Mohave Desert, but this condition is rarely known to the herbarium observer. Otherwise, the species is recognized by its free stipules, villous pubescence with hairs to 2 mm , untidily divergent to reclinate racemes whose whitish or bicolored flowers resolve into crescentic or almost annular, sessile, bilocular, quickly deciduous pods. It superficially resembles $A$. malacus, but that species arises from a ground level crown and has shortly stipitate, persistent pods that are lost only with the disarticulating pedicels.

Unlike nearly all autochthonous American species of Astragalus, A. layneae is tetraploid (Spellenberg, 1976).

## Astragalus leibergii Jones (1895)

Map 109
Astragalus leibergii Jones (1895); Astragalus arrectus var. leibergii (Jones) Jones (1902); Phaca arrecta var. leibergii (Jones) Piper (1906); Tium leibergii (Jones) Rydb. (1929).
Tufted-subacaulescent or shortly caulescent, strigulosevillosulous, subcinereous perennial 2-3.5 (-5) dm of superficial origin from clustered, slightly thatched caudices; foliose stems $0-3(-10) \mathrm{cm}$, with 1-3 internodes. Leaves mostly radical, erect, stiff; leafstalk (0.5-) 1-2 dm; leaflets 15-25 (-29), oblong to linear, mostly 1-2.5 cm, 5-10 r, commonly folded, often glabrescent above, commonly deciduous in age. Stipules scarious, connate or upper free. Peduncles subscapose or not, 1-3 dm; racemes with 8-many, ascending to spreading flowers

11-16 mm. Pedicels in fruit $2-4.5 \mathrm{~mm}$. Calyx tube $3-5 \mathrm{~mm}$; teeth $1.5-4$ mm . Corolla white; standard recurved ca. $90^{\circ}, \pm$ or $<$ wings; keel incurved $100^{\circ}-120^{\circ}$, acute-tipped. Ovules ca. 20-30. Legumes erect, stipitate or exserted-stipitate $3-8 \mathrm{~mm}$, subunilocular, persistent, dehiscent; body oblong-lanceolate or oblong, straight or slightly falcate, plump, subterete-obcordate or obcompressed-triquetrous, 15$25 \mathrm{~mm} \times 4-7 \mathrm{~mm}$, dorsally sulcate; valves initially thick and subfleshy, becoming coriaceous and usually transversely wrinkled, glabrate to strigose; dehiscence apical and downward, both sutures. Conjuncti.

Central transmontane WA, Columbia River Valley. Hillsides and plains, commonly in sagebrush, basaltic scablands. Ca. 300-900 m. (April-) May (-June).

Astragalus leibergii is more frequently subacaulescent than its relatives $A$. conjunctus and $A$. reventiformis. Fruiting specimens with mostly naked leafstalks (leaflets deciduous) present a whisk broomlike appearance.

Astragalus lemmonii A. Gray (1873)
Map 109
Greenish, sparsely strigulose perennial from a superficial or slightly subterranean caudex with numerous, prostrate, slender stems to 3 dm . Leaves $1-5 \mathrm{~cm}$; leaflets $9-13$, elliptic to oblanceolate, acute, 2-10 mm, ca. 2.5-4 $r$, flat or folded, glabrate above. Stipules free, the lowermost amplexicaul. Racemes subcapitate or ovoid, arising from lower as well as upper nodes, shorter than subtending leaves, those of upper stem nodes usually unequally paired in axils; flowers 5-10, ascending, $5-6 \mathrm{~mm}$; axis scarcely elongating. Calyx tube ca. 2 mm ; teeth 1-1.5 mm. Corolla white to lilac-striate; keel incurved $100^{\circ}-120^{\circ}$. Ovules 4-8. Legumes spreading or reflexed, sessile, bilocular, deciduous, dehiscent; body half-ovoid to oblong, straight or slightly curved, compressed-triquetrous, $4-7 \mathrm{~mm} \times 1.5-2 \mathrm{~mm}$, dorsally sulcate; valves papery, strigulose; dehiscence said to be from base upwards, both sutures. Chaetodontes: Lemmoniani.

C transmontane OR and e CA, s to Mono Co. Scattered stations in e foothills of Cascades and Sierra Nevada. Poorly drained, springmoist soils, Juncus-Carex meadows, usually contiguous to streams or lakes; apparently uncommon (represented in herbaria primarily by old collections). Ca. 1200-1500 (-2000) m. May-June.

This is a delicate little plant with subcapitate, non-elongating racemes, which are distinctly shorter that the subtending leaves. There are two or even three racemes from some nodes, and the pods are of miniature size.

Astragalus lentiformis Gray ex Brewer \& Watson (1876) Map 109
Pubescent perennial from a superficial caudex with decumbent, radiating stems 1-1.5 dm. Leafstalk 1-3.5 cm; leaflets 9-13 (-15), narrowly obovate to oblanceolate, $2-10 \mathrm{~mm}, 2.5-4 r$, often folded, glabrate above. Lower stipules connate. Racemes short, little elongating in fruit, with $5-10$ contiguous, quickly deflexed flowers $6-7 \mathrm{~mm}$. Calyx tube $2-2.5 \mathrm{~mm}$; teeth $1-2 \mathrm{~mm}$, subulate or filamentous. Corolla ochroleucous to yellow; keel incurved $100^{\circ}-120^{\circ}$, acute. Ovules $5-10$. Legumes reflexed, sessile, bilocular, deciduous with pedicel, dehiscent; body ellipsoid-oblong or shortly oblong, compressed-triquetrous, 5-8 $\mathrm{mm} \times 3 \mathrm{~mm}$, cuspidate-tipped, obscurely dorsally sulcate; valves papery, villosulous; dehiscence said to be convergent through véntral suture. Chaetodontes: Lentiformes.

Ne CA, Plumas and Sierra cos. Dry soil with sagebrush or Jeffery pine; rare. Ca. 1500 m. May-June.

This local, inconspicuous plant has the small Chaetodontes pod, connate stipules, and tiny flowers in short racemes. The only modern collection seen is from the vicinity of Portola, Plumas County.

Astragalus lentiginosus Douglas ex Hooker (1831)
Maps 95-107, Figure 2
Pubescent to glabrate perennials (-annual) from a superficial crown or tap root with clustered (-simple), decumbent to erect stems 1-5 (-10) dm. Pubescence scant and plants of glabrate aspect, or conspicuous, strigose to villous or white-canescent; individual hairs straight, curved or sinuous, 0.1-1+ mm. Leafstalk $1-15 \mathrm{~cm}$; leaflets (3-) $9-25$, broadly ovate to narrowly elliptic-lanceolate, obtuse or retuse, 1.2-5 $r$, often folded and appearing narrower. Stipules free. Racemes included or exserted, short ( $1-4 \mathrm{~cm}$ ) or elongate and lax (to 20 cm ), with $4-20+$, subcapitate or loosely disposed, ascending or spreading flowers. Calyx tube campanulate or cylindric, $2.5-7.5 \mathrm{~mm}$, slightly gibbous; teeth $1-4(-5) \mathrm{mm}$, usually subulate. Corolla white, bicolored to pink-purple, $8-20 \mathrm{~mm}$. Ovules ca. $10-30+$. Legumes ascending or spreading, sessile (-substipitate), bilocular or nearly so (-subunilocular), deciduous, tardily dehiscent; body bladdery-inflated or coriaceous-inflated, or coriaceous and turgid; body asymmetrically subglobose, plumply ovoid to lanceoloid or oblong, usually incurved for entire length (-hamate), less frequently straight with an incurved beak, subterete to obcompressed, typically with a conspicuous deltoid, incurved unilocular beak; dorsal face commonly sulcate; ventral suture usually invaginated and clasping upper margin of septum;
valves membranous-diaphanous, papery or coriaceous, often mottled, glabrous to canescent; dehiscence on ground, apical. Diphysi.

W U.S. and adjacent Mexico. MT, WA, CA, w TX.
Astragalus lentiginosus is an unwieldy complex characterized by superficial perennial origin, free stipules, and deciduous, usually inflated, commonly bladdery, bilocular pods. Vastly multiracial, it includes numerous phases, herein listed as 40 varieties, a situation possibly unique among North American flowering plants.

Among Astragalus, the Inflati, especially the subsection Aridi, constitute a slightly analogous situation in that they include numerous, intimately and reticulately related forms. The taxa of the Inflati, however, mostly can be taken up as separate species because they have discrete characters and ranges, and there is essentially no confluence among them. In $A$. lentiginosus, on the other hand, the varieties are predominantly overlapping geographic or ecologic replacements of one another, and nearly all blend with one or several of their contiguous relatives. They cannot be considered species on either a philosophical or practical basis. Nor is it possible to divide the complex into two or three major groups representing subspecies or closely related species. The extremes, it is true, look like quite different species. The white-flowered, strongly perennial, decumbentascending, glabrate, northern kinds, as vars. lentiginosus and salinus, seemingly bear only superficial resemblance to the presumably derived, xeric, short-lived, usually ascending-erect, purple-flowered, and strongly pubescent southern desert forms that var. fremontii can typify. Both types, however, are but variants on a single pattern and are connected by an irregular reticulum of intermediate regional forms among the numerous other varieties.

The classification following largely adheres to that of Barneby (1964) except for subsidiary detail and the addition of a few taxa described in the intervening years. Were this treatment chronologically prior, I probably would have drawn broader lines in several groups, but it seems best to follow now established precedent.

The definitiveness of the maps is illusory in the sense that some specimens represent intermediates between one variety and another, and I have not categorized intermediates since this would vastly complicate the classification. Thus each specimen has been associated with a specific variety and so mapped.

In the varietal descriptions, the calyx is understood to be campanulate unless otherwise recorded.

Keys to varieties of Astragalus lentiginosus
Three key systems follow:
(I) A general key to all varieties.
(II) Regional keys as follows: (Figure 1 in Isely 1983a): (1) CANV, (2) WA, OR, ID, (3) MT, WY, (4) UT, AZ, (5) CO, NM, TX.
(III) A geographical listing for smaller regions as identified in Figure 2.
Somewhat different character sequences are used in the general and regional (I and II) groups of keys, and it is possible that some specimens that will not successfully key out in one can be identified in the other.

## Major exomorphic features

Principal headings in the keys mostly relate to flower size as defined by keel length, the length of the fruiting racemes, and pod inflation and texture. When the range of variation for one of these characters extends into both of a pair of category statements, the taxon is entered both directions in the keys, but multiple entry cannot accommodate all exceptions. Several measurements, or determinations, may facilitate the determination of the mode of variation.

Inflorescence length is specified in terms of the mature inflorescence because the axis usually elongates in fruit and distinctions are more evident at this time. Inflorescence differences, however, can usually be detected in flowering material because the inflorescences initially are usually either compact (the flowers closely contiguous within $1-2 \mathrm{~cm}$ ) or more loosely arranged on a longer axis.

Legumes (the fruits) are commonly defined as coriaceous or papery, inflated or not. While their reference is plain for many varieties, it is necessarily ambiguous for others. Again, where uncertainties in interpretation are anticipated, the subject is entered under both alternatives.

## Origin as a Key Character

Students commonly are overwhelmed by the keys to the varieties of $A$. lentiginosus. This is because of the large number of forms of this species and the intergradient nature of practically all morphological characters. Consequently origin (where collected) is used extensively in these keys, not only explicitly as in the Regional keys (II), but also in the General key (I). If the individual using the key does not know where a certain named county is located in a given state, it can easily be looked up in a gazeteer and its location is definitive. It is true that new discoveries may render range statements inaccurate, but the
same is true of the range of morphological variation accorded to the varieties, particularly the local ones of which our knowledge is probably imperfect.

## Identification without both flowers and fruit

The keys (I and II) require both flowers and fruit. It is not possible, I think, to prepare keys to the varieties of A. lentiginosus on the basis of either flowers or fruit alone, except for small geographic areas. The geographic ordination (Key Group III) may allow identification of material possessing only flowers or fruits by reducing the number of possibilities to a level practical for comparing descriptions.

One who uses the keys extensively will find that a few specimens cannot be identified with assurance. This is because the nature of variation of some varieties (as var. salinus) is such that it cannot be completely confined within an ordinary key, multiple entry notwithstanding, and because nearly all the varieties are confluent with one or several others.

## I. General Key

1. Flowers "small," keel $5.5-8.5 \mathrm{~mm}$.
2. Fruiting racemes short, to $4(-5) \mathrm{cm}$.
3. Species of c ( n to Alpine Co.) and s CA and sw NV.
4. Beak of legume filiform, terete, apiculate; plants diminutive with leaflets 2-7 mm; local, Sierra Nevada, Tulare Co., CA, and (disjunctly) Charleston Peak, Clark Co., NV. var. kernensis
5. Beak of legume tapering, triangular; plants various in size.
6. Beak of legume decurved; stems trailing, 3-10 dm; alkali flats, Inyo to Los Angeles cos., CA var. albifolius
7. Beak of legume ascending or incurved; stems various, 1-3 (-5) dm; habitat otherwise.
8. Local in San Bernardino and San Gabriel mts., w San Bernardino and Los Angeles cos., CA.
9. San Gabriel Mts., Los Angeles and adjacent San Bernardino cos.; flowers ca. 9-10.5 mm ; leaves silvery. var. antonius
10. San Bernardino Mts., San Bernardino Co.; flowers $10.5-14.5 \mathrm{~mm}$; leaves greenish to somewhat cinereous. var. sierrae

## (General Key)

6. Not of San Bernardino and San Gabriel mts., rather $n$ and $e$ of above; Alpine Co., s to Inyo, Tulare, and ne San Bernardino cos., CA, slightly to NV (-or of ne Mohave Desert).
7. Flowers pink-purple; of lower elevation deserts and adjacent mountains, usually below 2150 m ; CA and NV. (See also lead 17 for distinction from var. variabilis if keel 8-9 mm and plants from ne Mohave Desert). var. fremontii
8. Flowers whitish; species of higher elevations, $2100-3300 \mathrm{~m}$; CA, barely into NV.
9. Pubescence strigulose with usually curved hairs or subvillous; leafstalk $1.5-5 \mathrm{~cm}$ with ca. 15-21 crowded leaflets; Sierra Nevada, mostly Mono Co., CA.
var. ineptus
10. Pubescence strigulose with straight hairs; leafstalk 4-9 cm with ca. 17-27 leaflets; White and Inyo mts.; CA, n Inyo and adjacent s Mono cos.; NV, Esmeralda Co.
var. semotus
11. N or (and) e of above, from WA to ne CA, s to Lake Tahoe, also NV, ne and e of Lake Tahoe, (-w ID, sw WY, w UT).
12. Legumes coriaceous to papery but not diaphanous, if overlapping with following (var. salinus) in range or pod texture, ovary and young legume usually puberulent.
13. Legumes initially pubescent (glabrate in age), conspicuously or scarcely inflated; lower elevations; w to n CA, nw NV, w ID and e along Snake River. var. lentiginosus
14. Legumes glabrous, inflated; middle to upper elevations; ne NV.
var. scorpionis
15. Legumes thinly or membranous-papery, sometimes almost diaphanous, glabrous where overlapping with above.
16. Leaves subglabrate to closely strigose (or pubescence slightly spreading); hairs nearly straight.
17. Fruiting raceme loose; stems mostly simple; widely distributed, e OR and ne CA, e and s to sw WY, and w UT.
var. salinus
18. Fruiting racemes compact; stems often branching below; nw NV and adjacent CA just n of Lake Tahoe, and s OR. var. floribundus
19. Leaves subvillosulous with spreading or sinuous hairs; n NV.
var. macrolobus
20. Fruiting (and often flowering) racemes lax, becoming $4-18 \mathrm{~cm}$ long.
21. S AZ to w TX; flowers purple, often mostly appearing white on specimens.
var. australis
22. Distribution other than above; flowers either purple or white.
23. Beak of legume decurved; stems trailing, 3-10 dm; alkali flats. Inyo to Los Angeles cos., CA.
var. albifolius
24. Not as above.
25. Flowers purple; deserts, s NV and CA (-AZ).
26. Keel $6-8.5 \mathrm{~mm}$; primarily ne Mohave Desert, diminishing in contiguous regions; s NV (-AZ, -UT); CA, Inyo Co., extending into ne Kern and San Bernardino cos.
var. fremontii
27. Keel (8-) $8.5^{+} \mathrm{mm}$; primarily s and se Mohave Desert; CA, w Inyo to Los Angeles and Riverside cos.; slightly into NV. var. variabilis
28. Flowers whitish; n NV and adjacent states.
vars. salinus, floribundus and macrolobus (see leads 12 and 13)
29. Flowers "large," keel (8.5-) 9-16.5 mm.
30. Legumes subspheroid, ca. 1 cm diam.; valves coriaceous, slightly inflated; AZ, Coconino Co., vicinity of Flagstaff.
var. macdougalii
31. Legumes not spheroid or if so, larger than above; valves various; distribution various.
32. Legumes inflated; body ovoid to lanceoloid-incurved, either $7+\mathrm{mm}$ diam. or at least half as wide as long.
33. Fruiting racemes compact, 1-4 (-6) cm.
34. Of scismontane CA (one species $n$ to Santa Clara Co.), or of the Transverse Ranges and w across the desert to NV border.
35. Flowers ochroleucous (-greenish-yellow) or whitish (-pink-tinged).
36. Leaflets $3-8 \mathrm{~mm}$; of upper elevations (1850-2150 m), San Bernardino Mts., San Bernardino Co., CA var. sierrae
37. Leaflets $6-20 \mathrm{~mm}$; w Kern Co., extending to sw Fresno Co. and margins of contiguous coastal cos., CA. var. nigricalycis
38. Flowers pink-purple.
39. Legumes thinly or heavily coriaceous; plants greenish; cismontane CA, Santa Clara to Ventura cos.
var. idriensis
40. Legumes thinly to stiffly papery; plants commonly cinereous, silvery or white; Los Angeles Co. and adjacent s Kern Co., CA, across deserts to NV border.
41. Prostrate, strigulose with stems to 8 dm ; raceme axis $1-2 \mathrm{~cm}$ in fruit; rare, near Death Valley, Inyo Co., CA. var. sesquimetralis
42. Ascending or sprawling, commonly cinereous or silvery-white with stems $1-5 \mathrm{dm}$; raceme axis $3-4$ $(-6) \mathrm{cm}$ in fruit.
43. Widespread, Los Angeles Co., CA, across desert to NV border; plants commonly silvery but not deeply villosulous-canescent; calyx teeth 1-1.6 (-2.5) mm.
var. variabilis
44. Local, Riverside Co., CA, Coachella Valley; plants villosulous-canescent; calyx teeth $1.7-3 \mathrm{~mm}$.
var. coachellae
45. Neither of s nor cismontane CA.
46. Leaflets 3-5, linear-oblanceolate, the terminal one $>$ leafstalk; CA, Mono Co., near Bishop, known only from type locality.
var. piscinensis
47. Leaflets $7+$, the terminal one $<$ leafstalk.
48. Flowers white, lilac or with a maculate keel.
49. Beak of legume filiform, not tapering; local, upper elevations; Tulare Co., CA, and Clark Co., NV.
var. kernensis
50. Beak of legume triangular, tapering; range as follows.
51. Legumes coriaceous or thickly papery; leaflets broadly elliptic to obovate; OR and $n$ CA, e to sw WY and n UT.

## (General Key)

31. Keel 17-18.5 mm; calyx tube $8-10 \mathrm{~mm}$; legumes substipitate $0.5-1 \mathrm{~mm}$; local, Tooele Co., UT. var. pohlii
32. Keel $11-15 \mathrm{~mm}$; calyx tube $5-8.5 \mathrm{~mm}$; legumes sessile; not of Tooele Co., UT.
var. platyphyllidius
33. Legumes papery or thinly papery; leaflets various in shape; range not as above.
34. CA, Mono Co. (slightly into adjacent cos.); leafstalk leafstalk $1.5-5 \mathrm{~cm}$.
var. ineptus
35. Range not as above; leafstalk $3-15 \mathrm{~cm}$.
36. Legumes thinly or membranous-papery to diaphanous; varieties of middle elevations rather than mt. ranges.
37. Flowers white, small; keel rarely to 9.5 mm ; young pods glassy-diaphanous; of s UT and adjacent AZ var. vitreus
38. Flowers white to pale purple, larger; keel $10-12 \mathrm{~mm}$; pods thinly papery to membranous but scarcely diaphanous; widely distributed from CA to UT. var. salinus
39. Legumes papery to stiffly papery; varieties of NV mt . ranges (slightly to UT) as named following.
40. Of mt. ranges (Toiyabe, Wassuk, and Monitor) of c and w NV; pods mostly 1-2 cm .
var. toyabensis
41. Of mt. ranges (Ruby and others) of e NV (-adjacent UT). var. scorpionus
42. Flowers purple (may be faded in herbarium specimens).
43. AZ, Coconino Co., Kaibab Plateau, n rim and wall of Grand Canyon; stems prostrate or spreading; calyx teeth mostly $3-5 \mathrm{~mm}$.
var. oropedii
44. Distribution various, if of Coconino Co., AZ, s of Colorado River; calyx teeth mostly $1.5-3 \mathrm{~mm}$.
45. Legume beak short, bilocular; mountains in White Pine Co., NV.
var. latus
46. Legume beak unilocular, deltoid; distribution as indicated following.
47. Legumes thinly (-stiffly) papery; c and w NV.
48. Of $n$ Nye and adjacent cos., NV, upper elevations of mt. ranges; legumes thinly papery, glabrous (-puberulent). var. toyabensis
49. Of Nye and Mineral cos., NV, lower elevations; legumes usually stiffly papery, strigulose to canescent.
50. Mineral Co., NV; stems prostrate, to 8 dm ; raceme axis $1-2 \mathrm{~cm}$ in fruit.
var. sesquimetralis
51. Nye Co., NV; stems ascending or spreading, 1-5 dm ; raceme axis $3-4(-6) \mathrm{cm}$ in fruit.
var. variabilis
52. Legumes coriaceous or, if papery, not of NV distribution.
53. Immature legumes glassy-diaphanous, thinly papery at maturity; UT, e Kane Co.
var. wahweapensis
54. Pods thickly papery or coriaceous; flowers pinkpurple; range as follows.
55. Legumes strongly incurved with a conspicuous, acuminate beak $6-15 \mathrm{~mm}$; body usually ovoidacuminate; c and w UT to c NV. var. araneosus
56. Legumes slightly to strongly incurved with short, straight or curved beak $3-10 \mathrm{~mm}$; body often broadly ovoid to subglobose; ne AZ and nw NM, slightly in sw CO and se UT, disjunctly in TX Panhandle.
57. Keel $11.5-15 \mathrm{~mm}$; flowers various shades of pink-purple; legumes stiffly papery to subcoriaceous; range as above except for TX Panhandle. var. diphysus
58. Keel $14-18 \mathrm{~mm}$; flowers light pink-purple to lavender; legumes thinly papery, slightly diaphanous; TX Panhandle. var. higginsii
59. Fruiting racemes lax (loose or compact in flower), 4-20 cm.
60. Local in c Mohave Co., AZ; legumes thickly papery to subcoriaceous, glabrate to puberulous.
var. ambiguus

## (General Key)

44. Various in distribution; if of Mohave Co., AZ, with membranous or strigose pods.
45. Flowers white to ochroleucous or faded pale purple (color fugaceous), keel sometimes maculate.
46. Of c cismontane CA; wings $>$ keel; legumes villosulous (glabrate in age). var. nigricalycis
47. Not of CA; wings $\pm$ keel, legumes glabrate to strigulose. 47. Distribution from transmontane OR to UT.
48. Flowers white, small, keel rarely to 9.5 mm ; legumes papery to membranous-papery but scarcely diaphanous; OR to UT.
v́ar. salinus
49. Flowers white or faded purple, larger, keel $10-12 \mathrm{~mm}$; legumes membranous-papery and commonly glassy-diaphanous when immature; n AZ, contiguous sw UT (-Clark Co., NV).
var. vitreus
50. Distribution $s$ of above as indicated following.
51. Of se AZ and e; flowers in life pink-purple, but fading.
var. australis
52. Of c and w AZ; flowers white.
var. yuccanus
53. Flowers pink to purple.
54. Of s CA deserts.
55. Calyx teeth 1-1.5 mm, or if longer, not of Coachella Valley; foliage greenish to cinereous or silvery-canescent; widespread in deserts, s CA and sV ; (see also lead 17 if keel is ca. $8-9 \mathrm{~mm}$ long).
var. variabilis
56. Calyx teeth $1.4-3 \mathrm{~mm}$; foliage silvery or white, silky-canescent; local, CA, Coachella Valley, w Riverside Co. var. coachellae
57. Plants not of CA.
58. Of s AZ (Pima and Cochise cos.) to w TX.
var. australis
59. Of NV to n and c AZ (Maricopa Co.) to UT.
60. Of w NV; leaves villosulous; pods glabrous (-puberulent). var. kennedyi
61. Not of NV except very slightly in Clark Co., not with the combination of villosulous foliage and glabrous pods.
62. Of s Mohave, Yavapai, and Maricopa cos., AZ; stems persistently canescent at base; pods membranouspapery, usually glabrous.
var. yuccanus
(towards var. australis)
63. Of $n$ Mohave Co., AZ, and immediately contiguous NV and UT; not with the above combinations of characters.
64. Stems strigose-canescent; legumes strigose (-villosulous); at juncture of UT, AZ, and NV.
var. stramineus
65. Stems glabrate; legumes glabrous; Mohave Co., AZ, and s UT (-Clark Co., NV). var. vitreus
66. Legumes scarcely inflated, ellipsoid-acuminate, lanceoloid, oblong to hamate, $<7 \mathrm{~mm}$ diam., $<$ half as broad as long.
67. Of s CA and adjoining AZ (-NV) deserts; foliage and legumes silvery-canescent.
var. borreganus
68. Distribution otherwise; herbage and legumes glabrate to cinereous or puberulent.
69. Fruiting raceme $1-4 \mathrm{~cm}$.
70. Of WA, OR and slightly in adjacent states; flowers white or the wings and keel purple-tipped.
var. lentiginosus
71. Of UT, AZ, and CO; flower color as follows.
72. Legumes $7+\mathrm{mm}$ diam., n AZ, NM, barely into sw CO and se UT; in AZ mostly s of middle Coconino, Navajo, Apache cos.; distinguishable from var. palans in flower only by the usually shorter raceme axis, and seemingly intergrading with it.
var. diphysus
73. Legumes 4-7 mm diam.; s and sw UT, adjacent CO and n AZ ; in AZ mostly adjacent to Colorado River or $n$ of it; also in ne AZ.
74. Legumes $1.3-2.7 \mathrm{~cm}$; keel $10-15 \mathrm{~mm}$; range as stated above. var. palans
(General Key)
75. Legumes 1-1.3 cm; keel $8.5-10 \mathrm{~mm}$; "south-central Utah," known only from original collection.
var. ursinus
76. Fruiting racemes $4-20 \mathrm{~cm}$; flowering racemes also often elongate.
77. S AZ (Pima Co. and e) to w TX; flowers pink-purple but fading; glabrous (-pubescent).
var. australis
78. Not as above.
79. Of $s$ and sw UT, adjacent CO and n AZ; legumes often curved $90^{\circ}$ or more; flowers purple. var. palans
80. Of c AZ; legumes straight or gently incurved; flowers purple or light colored.
81. Local in w Maricopa Co., AZ; fruiting racemes $5-20 \mathrm{~cm}$.
var. maricopae
82. Local in n Yavapai and adjacent Coconino cos., AZ; fruiting racemes $4-6 \mathrm{~cm}$.
var. wilsonii

## II. Regional Keys

## Regional Key 1: California and Nevada

1. Flowers "large," keel (8.5-) 9-16 mm; axis of fruiting raceme short or long.
2. Axis of fruiting raceme $4-20 \mathrm{~cm}$.
3. Legumes not inflated, $1.5-2.3 \mathrm{~cm} \times 4.5-6 \mathrm{~mm}$; plants usually white-canescent or silvery; deserts, s CA, w San Diego Co., to Yuma Co., AZ.
var. borreganus
4. Legumes inflated, usually $>6 \mathrm{~mm}$ diam. unless length is considerably less than above.
5. Of CA.
6. Extreme ne CA.
var. salinus
7. C to s CA.
8. Flowers ochroleucous to greenish-yellow; calyx tube usually black-pubescent; s Coastal Ranges, w Kern to sw Fresno and margins of contiguous cos. var. nigricalycis
9. Flowers purple (-ochroleucous or fading pale); calyx not black-pubescent; Mohave or Colorado deserts, extending to e Coastal Ranges.
10. Calyx teeth $1.7-3 \mathrm{~mm}$; local, Colorado Desert, Riverside Co., Coachella Valley. var. coachellae
11. Calyx teeth 1-1.6 mm where approaching the above variety; widely distributed in $w$ and sw Mohave Desert, San Bernardino Co., w in Kern and Los Angeles cos. to Coastal Ranges.
var. variabilis
12. Of NV.
13. Flowers white, sometimes lavender-tipped; keel rarely exceeding 9 mm and racemes not exceeding 8 cm .
var. salinus
14. Flowers purple (-fading pale); keel $8-12 \mathrm{~mm}$; fruiting racemes $4-15 \mathrm{~cm}$.
15. Barely into s Nye Co. var. variabilis
16. Other than above.
17. Nw Nye to $s$ Washoe cos., calyx teeth $1.5-3 \mathrm{~mm}$, commonly bent outwards. var. kennedyi 10. Sw NV, Clark Co., calyx teeth 1-2 mm.
var. stramineus
18. Axis of fruiting raceme "short," $1-4 \mathrm{~cm}$.
19. Of CA.
20. Extreme ne CA.
21. Legumes membranous-papery; keel $7-8(-9.5) \mathrm{cm}$. var. salinus
22. Legumes thickly papery or coriaceous; keel $11-15 \mathrm{~mm}$.
var. platyphyllidius
23. C to s CA.
24. Keel 10-14 mm; cismontane CA, Santa Clara to Ventura cos.
var. idriensis
25. Keel 8-9.5 (-10) mm; not of cismontane CA.
26. Inyo Co., local; prostrate perennial with stems to 8 dm; flowers purple. var. sesquimetralis
27. Not as above; flowers white, purple-tipped or lavender.
28. San Bernardino Co., local; leaflets ca. 15-21, not crowded.
var. sierrae
29. Mono Co. and slightly of adjacent cos.; leaflets crowded or reduced to 3-5.
30. Leaflets 15-21; Mono and contiguous cos., e slope of Sierra Nevada. var. ineptus
31. Leaflets 3-5; local, Mono Co., near Bishop. var. piscinensis

## (Regional Key, CA and NV)

11. Of NV.
12. Keel 8.5-10 mm.
13. Mineral Co.; stems prostrate, to 8 dm ; raceme axis in fruit $1-2 \mathrm{~cm}$. var. sesquimetralis
14. Not of Mineral Co., or plants otherwise not as above.
15. Plants of lower and middle elevations, 900-2450 m ; legumes usually not mottled.
16. Flowers white, small, keel rarely to 9.5 mm ; legumes papery to membranous-papery but scarcely diaphanous; widely distributed in NV.
var. salinus
17. Flowers white to purple, larger, keel ca. 10 mm ; legumes membranous-papery and commonly glassy-diaphanous when immature; NV, Clark Co.
var. vitreus
18. Mt. ranges as listed following, mostly 2450-3350 m ; legumes usually mottled.
19. Mts. of e NV, White Pine, Eureka, and s Elko cos.; flowers white. var. scorpionis
20. Mts. of $c$ and $w$ NV, n Nye and adjacent cos. (Wassuk, Monitor, and Toiyabe ranges); flowers pink-purple (-white).
var. toyabensis
21. Keel $10-16 \mathrm{~mm}$.
22. Flowers white or pale; $n$ or se NV.
23. N NV; legumes thickly papery or coriaceous.
var. platyphyllidius
24. Se NV, Clark Co.; legumes membranous-papery.
var.vitreus
25. Flowers pink-purple; range as indicated.
26. Of upper elevations, mostly 2450-3350 m; mt. ranges as indicated.
27. White Pine Co., NV, Schell Creek, Egan, and Snake ranges; legume beak straight, or slightly incurved, deltoid to cuspidate, bilocular.
var. latus
28. N Nye, Lander, and Mineral cos., Wassuk, Monitor and Toiyabe ranges (likely other mts. in c to w NV); legume beak moderately incurved, deltoid, unilocular. var. toyabensis

## (Regional Key, CA and NV)

25. Of lower elevations, usually not over 2450 m , mostly c to e NV.
26. Legumes stiffly papery to subcoriaceous with a conspicuously long and incurved beak; of relatively wide distribution.
var. araneosus
27. Legumes membranous-papery, commonly diaphanous when immature; presently known only from Clark Co., NV.
var. vitreus
28. Flowers "small," keel $5.5-8.5 \mathrm{~mm}$; flowering and fruiting racemes short, $1-4 \mathrm{~cm}$ in most species.
29. Legumes stiffly papery to coriaceous.
30. N CA and n NV; flowers white.
var. lentiginosus
31. NV, Mineral Co., and CA, Inyo Co., local; flowers purple.
var. sesquimetralis
32. Pods thinly papery or membranous, sometimes diaphanous.
33. Plants with prostrate or scrambling stems $3-10$ dm; alkaline flats; CA, w Los Angeles, Kern, and Inyo cos., local.
var. albifolius
34. Plants with prostrate to erect stems, 1-5 dm; distribution various.
35. Axis of fruiting racemes $4-12 \mathrm{~cm}$; flowers purple (-pink, -white); ne Mohave Desert. var. fremontii
36. Axis of fruiting racemes $1-4(-8) \mathrm{cm}$; flowers white or lavender-tipped (-purple); distribution various.
37. Pubescence villosulous or strigose with incurved hairs; plants commonly cinereous.
38. N NV; leafstalk $4-10 \mathrm{~cm}$. var. macrolobus
39. CA, Mono Co. and slightly of adjacent cos.; leafstalk $1.5-5 \mathrm{~cm}$. var. ineptus
40. Plants strigose, usually with appressed and straight hairs; plants greenish or cinereous (-silvery).
41. Leaflets small, 2-10 mm.
42. Of San Bernardino and Los Angeles cos., CA.
43. Plants densely strigulose, cinereous or silvery; leaflets usually flat; San Gabriel Mts.
var. antonius
44. Plant sparsely strigulose, usually greenish; leaflets mostly folded and recurved; San Bernardino Mts.
(Regional Keys: CA \& NV; WA, OR, \& ID; and MT \& WY)
45. Not of San Bernardino and Los Angeles cos., CA.
46. CA, White and Inyo mts., nw Inyo and adjacent Mono cos., and Esmeralda Co., NV; legume beak incurved, deltoid.
var. semotus
47. CA, Tulare Co., and NV, Clark Co.; legume beak straight, filiform-cuspidate.
var. kernensis
48. Leaflets larger, $5-15 \mathrm{~mm}$, at least the larger ones exceeding 10 mm.
49. E CA, immediately $n$ of Lake Tahoe and adjacent NV.
var. floribundus
50. Ne CA, s to Lassen Co. and across NV.
51. NV; mt. ranges in White Pine, Eureka, and s Elko cos.; $2450-3350 \mathrm{~m}$; pods papery, commonly mottled.
var. scorpionis
52. NV, of scattered occurrence across the state; $900-2450 \mathrm{~m}$; pods usually membranous-papery, not mottled.
var. salinus

## Regional Key 2: Washington, Oregon, Idaho

1. Flowers "large," keel 11-15 mm; legumes thickly papery or coriaceous; c OR and s.
var. platyphyllidius
2. Flowers "small," keel $6-8.5 \mathrm{~mm}$; legumes and range as follows.
3. Legumes stiffly papery or subcoriaceous, diverse in shape, scarcely to strongly inflated, lunately to hamately incurved; transmontane WA and OR, slightly to se ID. var. lentiginosus
4. Legume bladdery-inflated, (stiffly papery-) membranouspapery to subdiaphanous, subglobose to ovoid-acuminateincurved; range as follows.
5. OR, Lake Co., local; flowering racemes usually compact.
var. floribundus
6. S ID and adjacent OR; flowering racemes usually loose.
var. salinus

## Regional Key 3: Montana, Wyoming

1. Flowers "large," keel 11-15 mm; pods thickly papery or coriaceous; sw MT, sw WY.
var. platyphyllidius
2. Flowers "small," keel 7-8 (-9.5) mm; pods membranous-papery, sw MT, sw WY.

## Regional Key 4: Arizona and Utah ${ }^{18}$

1. Fruiting racemes "long," $4-20 \mathrm{~cm}$.
2. Legumes not inflated; valves usually coriaceous (-stiffly papery).
3. Sw AZ, Yuma Co.; plants white-canescent or silvery.
var. borreganus
4. Range other than above; plants glabrate or pubescent, usually green.
5. S AZ, Pima Co., and e; pubescence commonly of curved hairs or spreading. var. australis
6. Range $n$ of above; pubescence strigose, of straight hairs.
7. Fruiting axis $4(-6) \mathrm{cm}$; legumes $7+\mathrm{mm}$ diam.; n AZ and se UT; somewhat overlapping with var. palans in $\mathrm{n} \mathrm{AZ} \mathrm{(and} \mathrm{probably} \mathrm{intergradient} \mathrm{with}$ it), but primarily s of that var. in middle Coconino, Navajo, and Apache cos. var. diphysus
8. Fruiting axis $2-20 \mathrm{~cm}$; legumes $4-7 \mathrm{~mm}$ diam., distribution follows.
9. C AZ, Maricopa Co.; legumes straight or slightly curved. var. maricopae
10. $S$ and se UT and $n ~ A Z ; ~ l e g u m e s ~(n e a r l y ~$ straight-) falcate to hamate; in AZ mostly adjacent to Colorado River or $n$ of $i t$.
11. Keel $10-15 \mathrm{~mm}$; legumes $1.3-2.7 \mathrm{~cm}$; range as stated above. var. palans
12. Keel 8.5-10 mm; legumes $1-1.3 \mathrm{~cm}$; "south central" UT; known only from original collection. var. ursinus
13. Legumes inflated; valves membranous-diaphanous, papery or coriaceous.
14. Legumes stiffly papery or coriaceous.
15. Se AZ; flowers initially pink-purple, fading in drying; keel 7-11 mm.
var. australis
16. Range other than above; flowers pink-purple; keel 1115 mm .
17. AZ, Mohave Co., immediately s of Colorado River, local; raceme axis $5-9 \mathrm{~cm}$.
var. ambiguus
18. E of above, widely distributed; raceme axis 1-4 (-6) cm .
var. diphysus
19. Legumes thinly papery, frequently membranous or diaphanous.
[^2]
## (Regional Key, AZ and UT)

11. Flowers "small," keel 6-8.5 (-9.5) mm.
12. Flowers purple (-white); nw corner Mohave Co., AZ, and contiguous Washington Co., UT.
var. fremontii
13. Flowers white (-lavender tipped); sw and ne UT.
var. salinus
14. Flowers "large," keel $10+$ mm.
15. Plants glabrescent, green; pods subdiaphanous when immature, not mottled; sw UT, and adjacent n AZ.
var. vitreus
16. Plants initially cinereous or silvery; pods not diaphanous, or if so, plants not immediately contiguous to above.
17. Of immediate confluence of AZ, NV, UT; pods papery, strigulose or villosulous. var. stramineus
18. AZ, c Mohave to n Maricopa cos.; pods membranouspapery, subdiaphanous, glabrous (-strigulose).
var. yuccanus
19. Fruiting racemes "short," $1-4(-5) \mathrm{cm}$.
20. Legumes not inflated or if slightly so, subspheroid, coriaceous.
21. Pods subspheroid, or shortly incurved, small, ca. 1 cm , Flagstaff region (merges with var. diphysus).
var. macdougalii
22. Pods ovate-acuminate to oblong, $1.5-3.5 \mathrm{~cm}$.
23. C AZ, $n$ Yavapai and adjacent Coconino cos., local; pods straight or slightly incurved. var. wilsonii
24. N of above, widely distributed; pods incurved to hamate (merges with var. diphysus; see leads \# 5-7).
var. palans
25. Legumes inflated, coriaceous or papery.
26. Flowers white or pale; sw and ne UT.
27. Legumes thickly papery or coriaceous; n UT except for report of var. platyphyllidius from Juab Co.
28. Keel 11-15 mm; calyx tube $5-8.5 \mathrm{~mm}$; legumes sessile; n UT (and Juab Co.?). var. platyphyllidius
29. Keel $17-18.5 \mathrm{~mm}$; calyx tube $8-10 \mathrm{~mm}$; legumes substipitate $0.5-1 \mathrm{~mm}$; local, Tooele Co., UT.
var. pohlii
30. Legumes papery to membranous-papery; w and sw UT as stated following.
(Regional Keys: AZ \& UT; and CO, NM, \& TX)
31. W UT (Juab Co.); inflorescences compact; legumes papery, commonly mottled.
var. scorpionis
32. Sw and ne UT (also reports from Box Elder and Sanpete cos.); inflorescences usually loose; legumes papery to membranouspapery, not mottled.
var. salinus
33. Flowers pink-purple.
34. Legumes diaphanous when immature, becoming membranous or thinly papery; s UT. var. wahweapensis
35. Legumes stiffly papery to subcoriaceous.
36. Legumes abruptly incurved apically, with a long beak; w and e UT s of Great Salt Lake.
var. araneosus
37. Legumes nearly straight or incurved with usually a short beak; AZ, slightly into se UT.
38. AZ, Coconino Co., n walls of Grand Canyon and Kaibab Plateau, local; calyx teeth 3-5 mm.
var. oropedii
39. S and e of above, widely distributed; calyx teeth 1.5-3 mm .
var. diphysus
Regional Key 5: Colorado, New Mexico, Texas
40. S NM to Trans-Pecos TX; flowers "small," keel 7-11 mm.
var. australis
41. N NM, w CO, and TX Panhandle; flowers "large," keel 10-15 mm.
42. Flowers white; nw CO.
var. platyphyllidius
43. Flowers pink-purple to lavender; south of above.
44. Legumes not inflated, nearly straight to hamately incurved; w CO and n NM (intergradient with following).
var. palans
45. Legumes strongly (-slightly) inflated; sw CO, nw and c NM (disjunctly, TX Panhandle).
46. Keel $11.5-15 \mathrm{~mm}$; flowers various shades of pinkpurple; legumes thickly papery to subcoriaceous; range as above except for TX Panhandle.
var. diphysus
47. Keel $14-18 \mathrm{~mm}$; flowers lavender; legumes thickly papery, initially subdiaphanous; TX Panhandle.
var. higginsii

## III. Regional tabulation of varieties of Astragalus lentiginosus.

The following enumeration may facilitate identifications through elimination. The regions listed in the following tabulation are identified in Figure 2. These, based on political boundaries, in some instances, consist of only a single large county, or part of a county. With the exception of regions 3 and 5 (six varieties each), each includes five or fewer varieties.

Botanical exploration, of course, may extend the range of some of the varieties beyond the tabulated areas, just as new knowledge frequently weakens or invalidates prior key statements about gross morphology.

WA-OR Region 1: WA and OR.
Varieties: floribundus, lentiginosus, platyphyllidius, salinus
CA Region 2: CA. S of OR-CA border to Eldorado Co. and w to Sonoma Co.
Varieties: floribundus, lentiginosus, platyphyllidius, salinus
Region 3: CA. S of Region 2, from Mono Co. w to Santa Cruz Co.
Varieties: floribundus, fremontii, ineptus, ineptus-floribundus intermediates, piscinensis, semotus
Region 4: CA. Fresno, Kings, Monterey, San Benito, Tulare cos.
Varieties: idriensis, ineptus, kernensis, nigricalycis Region 5: CA. Inyo Co.

Varieties: albifolius, fremontii, ineptus, micans, semotus, sesquimetralis, variabilis
Region 6: CA. Kern, Los Angeles, San Luis Obispo, Santa Barbara, Ventura cos.
Varieties: albifolius, antonius, idriensis, nigricalycis, variabilis
Region 7: CA. Imperial, Orange, Riverside, San Bernardino, San Diego cos.
Varieties: borreganus, coachellae, fremontii, sierrae, variabilis
NV Region 8: NV. N Washoe and Humbolt cos.
Varieties: lentiginosus, macrolobus, platyphyllidius, salinus


Figure 2. Astragalus lentiginosus: Regional tabulation of varieties. The numbers correspond to those listed in the text.

Region 9: NV. Elko Co.
Varieties: araneosus, macrolobus, platyphyllidius, salinus, scorpionis
Region 10: NV. S Washoe and Storey cos., and Carson City.
Varieties: floribundus, ineptus-floribundus intermediates kennedyi, macrolobus, salinus
Region 11: NV. Pershing, Churchill cos.
Varieties: kennedyi, macrolobus, toyabensis
Region 12: NV. Eureka and Lander cos.
Varieties: araneosus, kennedyi, macrolobus, scorpionis, toyabensis
Region 13: NV. White Pine Co.
Varieties: araneosus, latus, salinus, scorpionis
Region 14: NV. Douglas and Lyon cos.
Varieties: floribundus, ineptus, ineptus-floribundus intermediates, toyabensis
Region 15: NV. Mineral Co.
Varieties: fremontii, ineptus-floribundus intermediates, kennedyi, sesquimetralis, toyabensis
Region 16: NV. Esmeralda Co.
Varieties: fremontii, kennedyi, semotus
Region 17: NV. W Nye Co.
Varieties: fremontii, kennedyi, salinus, toyabensis, variabilis
Region 18: NV. E Nye Co.
Varieties: araneosus, fremontii, scorpionis, toyabensis Region 19: NV. Lincoln Co.

Varieties: araneosus, fremontii, salinus, scorpionis
Region 20: NV. Clark Co.
Varieties: araneosus, borreganus, fremontii, kernensis, stramineus
ID, MT Region 21: ID. Lemhi, Valley, Washington cos, and s to IDUT border; MT. Beaverhead, Gallatin, Madison cos.
Varieties: lentiginosus, platyphyllidius, salinus
WY Region 22: WY. Big Horn Co., s to Sweetwater Co., and w to WY-ID-UT border.
Varieties: platyphyllidius, salinus
UT Region 23: N UT. Box Elder, Cache, Daggett, Davis, Morgan, Rich, Salt Lake, Summit, Tooele, and Weber cos.
Varieties: araneosus, platyphyllidius, salinus, pohlii
Region 24: C UT. S of Region 23, from Grand Co. w through Wayne Co. to Beaver Co.
Varieties: araneosus, palans, salinus, scorpionis Region 25: UT. Garfield and Iron cos.
Varieties: araneosus, diphysus, salinus, wahweapensis Region 26: UT. Washington Co.
Varieties: fremontii, palans, salinus, stramineus, vitreus Region 27: UT. Kane, San Juan cos.
Varieties: araneosus, diphysus, palans, wahweapensis
CO Region 28: W CO from Larimer Co., s to Costilla Co., and w to CO-UT border.
Varieties: diphysus, palans, platyphyllidius
AZ Region 29: AZ. Mohave Co.
Varieties: diphysus, fremontii, palans, stramineus, vitreus
Region 30: AZ. S Mohave Co.
Varieties: ambiguus, palans, stramineus, vitreus, yuccanus
Region 31: AZ. N Coconino Co.
Varieties: diphysus, oropedii, palans, stramineus, vitreus
Region 32: AZ. S Coconino Co.
Varieties: diphysus, macdougalii, palans, wilsonii
Region 33: AZ. Apache, Gila, Navajo, Yavapai cos.
Varieties: diphysus, macdougalii, palans, wilsonii, yuccanus
Region 34: S AZ. S of Region 33.
Varieties: australis, borreganus, diphysus, maricopae, yuccanus
NM-TX Region 35: NM and TX (El Paso and Hudspeth cos.).
Varieties: australis, diphysus
Region 36: TX Panhandle
Variety: higginsii
Var. albifolius Jones
Map 95
A.lentiginosus var. albifolius Jones (1923); Cystium albifolium
(Jones) Rydb. (1929); A. albifolius (Jones) Abrams (1944).
Cinereous, strigulose perennial with slender, prostrate or scrambling stems $3-10 \mathrm{dm}$. Leafstalk $2-8 \mathrm{~cm}$; leaflets elliptic to oblanceolate-oblong, 3-4 $r$ or folded and appearing narrower, often more densely pubescent below than above. Raceme axis $1-6 \mathrm{~cm}$ in fruit. Flowers white or yellowish (-pink-purple). Calyx tube 3.2-4.5
mm . Keel 6-8.5 mm. Legumes bladdery-inflated, broadly ovoidacuminate, $1-1.7 \mathrm{~cm} \times 8-14 \mathrm{~mm}$ with decurved beak; valves membranous-papery, subdiaphanous, strigulose.

CA, w Los Angeles and adjacent Kern cos., and disjunctly, Inyo Co. Alkaline seepage areas or spring-moist flats. Ca. 650-1450 m. April-July.

Var. albifolius is an elongate, ungainly, trailing or scrambling halophyte. The decurved rather than incurved beak of the pods is technically distinctive but not conspicuous on herbarium specimens because of distortion in pressing.

Var. ambiguus Barneby
Map 101
A. lentiginosus var. mokiacensis fma. [beta] Barn. (1945); A. lentiginosus var. ambiguus Barn. (1964).
Robust glabrate or thinly strigulose perennial with erect stems $3-5 \mathrm{dm}$. Leaflets obovate to oblanceolate. Axis of fruiting raceme (4-) $5-9 \mathrm{~cm}$. Flowers purple. Calyx tube $5-5.5 \mathrm{~mm}$. Keel $11-12 \mathrm{~mm}$. Legumes inflated, subglobose or ovoid, $1.5-2.2 \mathrm{~cm} \times 1-1.5 \mathrm{~cm}$; valves stiffly papery or subcoriaceous, not mottled, glabrous (-puberulent).

AZ, Mohave Co. immediately s of Colorado River. Open slopes, local, 1200-1450 m. April-May.

See Barneby (1964; text for Astragalus mokiancensis and A. lentiginosus var. ambiguus) for an account of the several interpretations of this form.

## Var. antonius Barneby (1945)

Map 101
Cinereous or silvery, densely strigulose, prostrate perennial. Leafstalk $3-8 \mathrm{~cm}$; leaflets obovate to elliptic, $3-10 \mathrm{~mm}, 1.5-3 r$, mostly flat, pubescent both sides. Axis of raceme in fruit, 1-4 (-5) cm. Flowers said to be purple (usually pale on herbarium sheets). Calyx tube 3-4 mm . Keel 7-8 mm. Legumes bladdery-inflated, plumply ovoid-acuminate, $1.5-2(-2.5) \mathrm{cm} \times 1-1.5 \mathrm{~cm}$; valves papery, strigulose.

CA, e Los Angeles and adjacent San Bernardino cos. E San Gabriel Mts., dry open yellow pine forest, washes; locally common. 1500-2600 m. (April-) May-June.

Var. antonius is a San Gabriel homologue of var. sierrae of the San Bernardino Mts., from which it differs by its much denser pubescence and mostly flat leaflets.
A. araneosus Sheld. (1894); A. palans var. araneosus (Sheld.) Jones (1895); Cystium araneosum (Sheld.) Rydb. (1913); A. lentiginosus var. araneosus (Sheld.) Barn. (1945).
A. lentiginosus var. chartaceus Jones (1895).

Glabrate, ascending perennial with often thick stems 1-3 dm. Leaflets obovate to elliptic-oblanceolate, ca. 1.3-3 $r$. Flowers pinkpurple. Calyx tube $5-6.5 \mathrm{~mm}$. Keel $10-15 \mathrm{~mm}$. Axis of fruiting raceme $1.5-4(-5) \mathrm{cm}$. Legumes inflated, obliquely ovate-acuminate to lanceoloid, characteristically incurved with a long beak, $1.5-3(-4) \mathrm{cm} \times 8$-15 mm ; valves stiffly papery to subcoriaceous, sometimes mottled, glabrous (-puberulent).

W half of UT s of Great Salt Lake, w to c NV. Slopes, desert flats, canyons, washes, benches, usually with sagebrush, juniper or greasewood; common. Ca. 1450-2400 (-2500) m. April-June.

Var. araneosus is abundant and conspicuous in central Utah in late spring and, in much of its range, is the only one of its kind. The large flowers reach 2 cm , and the conspicuous beak of the pod, typically upturned $90^{\circ}$, identifies the variety. In southern Utah it blends with var. diphysus of northern Arizona to New Mexico, which has broadly ovoid, typically straight, but also curved, lanceoloid pods usually with a short beak.

Var. australis Barneby (1945)
Map 97
Short-lived, robust, pubescent perennial with decumbent-ascending stems $2-4 \mathrm{dm}$. Leaflets obovate to elliptic, 1.2-3.5 $r$, glabrate above. Flowers pink-purple, fading in drying. Calyx tube $5-7 \mathrm{~mm}$. Keel $7-11 \mathrm{~mm}, \pm$ wings. Axis of fruiting raceme $4-12 \mathrm{~cm}$. Legumes inflated (-little swollen, w portion of range), ovoid- or lanceoloid-acuminate, incurved or not, $1.2-2.3 \mathrm{~cm} \times 5-14 \mathrm{~mm}$; valves heavily papery, mottled or not, glabrous (-pubescent).

Se Arizona to w Texas and adjacent Mexico. Grassland and desert with cactus, yucca, mesquite, acacia, Larrea; roadsides, common and abundant. Ca. 600-1200 m. March-April.

Var. borreganus Jones (1898) Map 106
A. coulteri Benth. (1848); A.lentiginosus var. coulteri (Benth.) Jones (1898) sensu basionym; Cystium coulteri (Benth.) Rydb. (1913) sensu basionym.
A. arthu-schotti Gray (1864).
A. agninus Jeps. (1925); C. agninum (Jeps.) Rydb. (1929).

Strigulose-villosulous or sericeous, white-canescent or silvery winter-annual or biennial with prostrate or ascending-erect stems 1-3 dm . Leaflets obovate to elliptic, ca. 1.5-3 $r$, some folded and appearing narrower. Flowers pink-purple. Calyx tube $4-5 \mathrm{~mm}$. Keel $9-12.5 \mathrm{~mm}$. Axis of fruiting raceme (4.5-) $6-20 \mathrm{~cm}$. Legumes turgid or subinflated,
ovoid-acuminate to lanceoloid, nearly straight to incurved, $1.5-2.3 \mathrm{~cm}$ $\times 4.5-6 \mathrm{~mm}$ diam.; valves papery, villosulous.

CA, w San Diego Co. to Yuma Co., AZ; n to sw San Bernardino Co., CA, and Mohave Co., AZ; s into Sonora. Deserts: sand dunes and flats with Larrea; abundant in favorable seasons. Ca. 50-900 m. (Feb.-) March-April.

This is the only variety of Astragalus lentiginosus of the southern California deserts with an uninflated pod. In flower, it resembles the varieties variabilis, coachellae and fremontii, and is undoubtedly derived from this complex.

Var. coachellae Barneby ex Shreve \& Wiggins
Map 98
A. lentiginosus var. coachellae Barn. ex Shreve \& Wiggins (1964).
A. lentiginosus var. coulteri auct.; Cystium coulteri auct.

Villosulous-canescent winter-annual or evanescent perennial with erect stems 1-3 dm. Leaflets obovate to elliptic, 1.5-3 r. Flowers pink-purple, pale on specimens. Calyx tube 4.5-5.3 mm; teeth 1.7-3 mm . Keel $10.5-11.5 \mathrm{~mm}$. Axis of fruiting racemes (3-) $4-10 \mathrm{~cm}$. Legumes inflated, broadly ovoid-acuminate, $1.5-3 \mathrm{~cm} \times 1-1.4 \mathrm{~cm}$; valves stiffly papery, canescent, often mottled.

CA, Riverside Co., Coachella Valley. Colorado Desert; lower elevations, dunes, washes with Larrea. 0-300 m. March-April.

Var. coachellae, lying immediately southwest of the more widely distributed var. variabilis, differs from the contiguous representatives of that variety in its longer calyx teeth and more copious, silvery pubescence. It scarcely differs from Inyo County representatives of var. variabilis in any absolute terms.

Var. diphysus (Gray) Jones
Map 97
A. diphysus Gray (1849); A. lentiginosus var. diphysus (Gray) Jones (1895); Cystium diphysum (Gray) Rydb. (1906).
A. diphysus var. albiflorus Gray (1849); A. lentiginosus var. albiflorus (Gray) Schoener (1974).
Glabrate, coarse perennial with ascending stems $1.5-3.5 \mathrm{dm}$. Leafstalk 4-10 cm; leaflets obovate to elliptic-oblanceolate, 5-15 (-20) mm , 1.2-3.5 $r$, sometimes folded and appearing narrower. Flowers pink-purple in various shades. Calyx tube $5.5-8 \mathrm{~mm}$. Keel $11.5-15 \mathrm{~mm}$. Raceme axis $1-4(-6) \mathrm{cm}$ in fruit. Legumes inflated (-turgid), plumply ovoid (-lanceoloid), subterete or slightly obcompressed, with a straight or incurved, usually short beak, (1-) 1.5-2.7 $\mathrm{cm} \times(6-) 8-10$ (-15) mm; valves stiffly papery or coriaceous, mottled or not, glabrous.

N AZ, NM (-s UT and sw CO). Rocky desert slopes and plains, canyons with pinyon-juniper, yucca, mesquite, etc.; roadsides; locally abundant and conspicuous. Ca. (900-) 1500-2300 m. (March-) AprilMay (-June).

Var. diphysus has large flowers in short racemes and variously inflated, subcoriaceous, typically nearly straight pods. It is closely related to the varieties araneosus (fruits with a long, abruptly incurved beak) and palans (fruits little inflated) and seemingly intergrades with both. For example, plants in northern Arizona with little-swollen pods resemble those of var. palans, and my arbitrary distinction in some instances is based on degree of raceme elongation, i.e., the racemes of var. diphysus usually being the shorter of the two. On the other hand, populations from middle Arizona northward also include plants with pods more than 1 cm in diameter that frequently have incurved beaks. Some of those from southeastern Utah have long beaks and are incurved their entire length, and thus resemble var. araneosus. The latter can sometimes be distinguished from var. diphysus by its usually more shortly "bunched" racemes.

Var. floribundus A. Gray
Map 99
A. lentiginosus var. floribundus Gray (1865); Cystium floribundum (Gray) Rydb. (1929).
C. ormsbyense Rydb. (1929).

Glabrate or strigulose, prostrate or ascending perennial with stems 1-2 (-4) dm. Leaflets obovate, elliptic or oblanceolate, ca. 5-15 mm , 1.5-3.5 $r$. Flowers white. Calyx tube $3-4 \mathrm{~mm}$. Keel $6.5-8 \mathrm{~mm}$. Racemes typically compact in both flower and fruit, the fruiting axis $1-4(-8) \mathrm{cm}$. Legumes subglobose to obliquely ovoid-acuminate, bladderyinflated, $1-2 \mathrm{~cm} \times 7-12 \mathrm{~mm}$; valves papery, subdiaphanous, glabrous or strigulose.

E CA, e foothills of Sierra Nevada immediately n of Lake Tahoe (s Lassen Co. to Eldorado Co.), and adjacent NV; also OR, Harney and s Lake cos. Hillside scrub and sagebrush valleys, meadows. Ca. 12002050 m. May-June.

Var. floribundus is primarily of the Lake Tahoe area where it is the only form of $A$. lentiginosus. It is a plant of glabrate aspect with small, white flowers in short, dense racemes and usually clustered fruits. It differs from the polymorphic and widely distributed var. salinus in that the latter usually has the longer flowering and fruiting racemes.

The populations in southern Lake Co., Oregon, essentially identical with var. floribundus, blend with var. salinus. It might be
convenient to eschew morphological literalism on the assumption that their resemblance to the Tahoe plants is coincidental, and refer them to var. salinus.

Var. fremontii (A. Gray ex Torrey) Watson
Map 98
A. fremontii Gray ex Torr. (1857); A. lentiginosus var. fremontii (Gray ex Torr.) Wats. (1871); A. coulteri var. fremontii (Gray ex Torr.) Jones (1895); Cystium fremontii (Gray ex Torr.) Rydb. (1929).
A. eremicus Sheld. ex Cov. (1893); C. eremicum (Sheld. ex Cov.) Rydb. (1929); A. fremontii subsp. eremicus (Sheld. ex Cov.) Abrams (1944).
C. griseolum Rydb. (1929).

Pubescent annual or biennial, or evanescent perennial with ascending, often white-glaucescent stems 1-5 dm. Pubescence scant or dense, strigulose, villosulous or subcanescent. Leaflets obovate to broadly oblanceolate, 1.5-3.5 $r$. Flowers purple (-pink, white). Calyx tube $3-4.5 \mathrm{~mm}$. Keel $6-8.5 \mathrm{~mm}$. Axis of fruiting raceme (3-) 4-12 (-15) cm . Legumes bladdery-inflated, broadly to narrowly ovoid-acuminate, $1.5-3(-3.5) \mathrm{cm} \times(5-) 8-18 \mathrm{~mm}$; valves membranous-papery, often mottled, glabrous or pubescent.

S NV (-contiguous AZ and UT) and adjacent desert CA, n to Mono Co. Deserts and desert mountains; open flats, rocky slopes, washes, mostly sandy soil; a wide range of vegetational zones from yucca, joshua tree, pinyon-juniper-sagebrush, shadscale to Jeffrey pine; abundant. Ca. (600-) 900-2450 (-2750) m. April-June (-Oct.).

Var. fremontii, bearing small flowers in lax racemes, is a common Astragalus in southern Nevada and the adjacent Mohave of California. It is diverse in pubescence, becoming more canescent westward. To the south and west, in the Mohave desert, it passes into the largerflowered var. variabilis. Northward in western Nevada it fades into var. kennedyi.

Var. fremontii is commonly frequent along roadsides of hardsurfaced highways but does not extend into the desert beyond. Presumably this is because of the more ample moisture offered by highway runoff.

Var. higginsii Welsh \& Thorne (1981)
Glabrous, ascending perennial $1.5-3 \mathrm{dm}$. Leafstalk $4-10 \mathrm{~cm}$; leaflets (obovate-) elliptic or oblong-elliptic, truncate, 5-15 (-20) mm, (1.2-) 1.5-3 $r$, usually flat. Flowers in short racemes, lavender to lightly pink-purple; calyx tube 6-7.5 mm; keel $14-18 \mathrm{~mm}$. Raceme axis

2-4 (-6) cm in fruit. Legumes inflated, plumply ovoid (-lanceoloid), subterete, moderately incurved toward tip, $1.5-2.2 \mathrm{~cm} \times 0.8-1.4 \mathrm{~cm}$; valves thinly papery, glabrous.

TX Panhandle, Potter and Hutchinson cos. (not mapped). Canyon and roadside collections. May

This variety could easily be regarded as an isolated eastward extension of var. diphysus, which it closely resembles. The most ostensible differences between the two are the somewhat larger and perhaps lighter-colored flowers and the more thinly papery legumes of var. higginsii.

Welsh and Thorne (1981) cited two collections of Higgins, both from the type locality, "McBride Canyon on the southwestern side of Lake Meredith, Potter Co., Texas." A contiguous collection that I originally placed with var. diphysus is: Drake 2, Texas, Hutchinson Co., North of Plemons Bridge across the Canadian River; by roadside in sandy soil; May 6, 1965 (TEX!).

Var. idriensis Jones
Map 104
A. lentiginosus var. idriensis Jones (1902); Cystium idriense (Jones) Rydb. (1929); A. idriensis (Jones) Abrams (1944).
Cystium tehatchapiense Rydb. (1929); A. tehatchapiensis (Rydb.) Tidestr. (1937); A. lentiginosus var. tehatchapiensis (Rydb.) Barn. (1945).
A. lentiginosus var. caesariatus Barn. (1944).

Strigulose, prostrate-ascending perennial with stems $1.5-4 \mathrm{dm}$. Leafstalk $3-10 \mathrm{~cm}$; leaflets broadly to narrowly obovate, $3-15 \mathrm{~mm}$, ca. $2-3 r$, often folded, glabrate above. Axis of fruiting raceme $1-4 \mathrm{~cm}$. Flowers pink-purple (-ochroleucous). Calyx tube 4.7-7 mm. Keel 10-14 mm . Legume inflated or not, plumply half-ovoid to incurved-ovoid, $1.5-3 \mathrm{~cm} \times 5-15 \mathrm{~mm}$; valves initially fleshy, becoming thinly or heavily coriaceous, strigulose.

Cismontane CA, Santa Clara to Ventura cos.; South Coast Ranges. Dry slopes, valley meadows, grassland, sagebrush, pines. 600-1750 m. April-June.

This is the principal California, cismontane, purple-flowered variety of Astragalus lentiginosus. It is partly sympatric with the abundant var. nigricalycis, which has ochroleucous flowers and villosulous pubescence. It is an aggregate of several races that might be treated as one or several varieties (Barneby 1945, 1958, 1964).
A. ineptus Gray (1864); Phaca inepta (Gray) Rydb. (1900) quoad basionym; Cystium ineptum (Gray) Rydb. (1906); A. lentiginosus var. ineptus (Gray) Jones (1923).
Procumbent, pubescent, commonly cinereous perennial with numerous stems $5-30 \mathrm{~cm}$. Pubescence strigulose, with usually incurved hairs, or subvillosulous. Leafstalk $2-6 \mathrm{~cm}$; leaflets ca. 13-21, crowded, obovate to oblanceolate. $2-10 \mathrm{~mm}$, ca. 2-4 $r$, usually folded and glabrate above. Flowers white or purple-tipped. Calyx tube $4-5 \mathrm{~mm}$. Keel $7-9 \mathrm{~mm}$. Axis of raceme $1-2.5 \mathrm{~cm}$ in fruit. Legumes bladderyinflated, ovoid-acuminate, $1-1.8 \mathrm{~cm} \times 6-12 \mathrm{~mm}$; valves membranous or papery, strigulose (-glabrate).

CA, Mono and slightly of adjacent cos.; e slope of Sierra Nevada. Middle to upper elevations; open alpine crests and slopes, talus, canyons; at lower elevations, creek banks, sage meadows or with Jeffrey pine; roadsides; locally common. Ca. 2000-3600 m. July-Aug.

Var. ineptus is a procumbent, cinereous plant with small or tiny, cinereous leaves and usually included, subcapitate to shortly racemose inflorescences of light flowers that bear bladdery-inflated pods. Its basic characters are those of the lower elevation var. floribundus to which it is certainly related. It is similar also to the neighboring var. semotus, of the White and Inyo mts., that is often but briefly caulescent, is closely strigose, and has slightly larger leaves with less crowded leaflets; some specimens, however, are most easily identified by origin. Some low elevation material is seemingly intergradient with var. fremontii.

Var. kennedyi (Rydberg) Barneby
Map 95
Cystium kennedyi Rydb. (1929); A. lentiginosus var. kennedyi (Rydb.) Barn. (1945).
Annual, biennial or evanescent, robust, green to whitish tomen-tulose-villosulous perennial with decumbent-ascending stems 1.5-5 dm. Pubescence of incurved and spreading, contorted hairs. Leaflets obovate to oblanceolate, 1.5-3 $r$. Flowers purple. Calyx tube 4-5.5 mm; teeth $1.5-3 \mathrm{~mm}$, commonly bent outwards. Keel (8.5-) 9.5-13.5 mm. Fruiting axis of raceme (4-) $5-12 \mathrm{~cm}$. Legumes bladdery-inflated, usually narrowly (-broadly) ovoid-acuminate to lanceoloid, with a usually conspicuous, incurved beak, (2-) $2.5-3 \mathrm{~cm} \times 1-1.5 \mathrm{~cm}$; valves membranous-papery, glabrous (-puberulent).

W NV, nw Nye to $s$ Washoe cos. Dunes, washes, slopes, roadsides, usually in granitic, sandy-gravelly soil. Ca. 1200-1850 m. May-June.

Ideal var. kennedyi is distinguished from the ubiquitous var. fremontii to the south, with which it blends, by its larger flowers, sometimes out-curved calyx teeth, and typically narrower, ovoidlanceoloid pod.

Var. kernensis (Jepson) Barneby
Map 104
A. kernensis Jeps. (1925); Cystium kernense (Jeps.) Rydb. (1929); A. lentiginosus var. kernensis (Jeps.) Barn. (1945).
A. kernensis subsp. charlestonensis Clokey (1942); A. lentiginosus var. charlestonensis (Clokey) Barn. (1945).
Diminutive, strigulose perennial with prostrate stems $3-10 \mathrm{~cm}$. Leafstalk $1-5 \mathrm{~cm}$; leaflets broadly or narrowly obovate, 2-7 mm, 1.5-2.5 $r$, commonly folded. Axis of fruiting raceme $0.4-1.5 \mathrm{~cm}$. Flowers white (-pale lavender or blue). Calyx tube $3.5-4.5 \mathrm{~mm}$. Keel $7-8.5 \mathrm{~mm}$. Legumes humistrate, bladdery-inflated, subglobose to obovoid, 6-12 $\mathrm{mm} \times 6-10 \mathrm{~mm}$ with a straight, filiform, cuspidate beak; valves papery, mottled, strigulose.

CA, Tulare Co., Kern Plateau; and NV, Clark Co., Charleston Peak. Sandy or gravelly sage slopes, meadows or grassy openings in pine or fir, to alpine ridges. Ca. 2450-3200 m. July-Aug.

Var. kernensis is characterized by its tiny, subspheroid fruits with a cuspidate, straight beak. The California and Nevada populations are not identical, and a case can be made for treating them as separate varieties. Regardless of their formal classification, they are closely related, and the possible origin of their local bicentric occurrence has been discussed by Barneby (1964).

Var. latus (Jones) Jones
Map 95
A diphysus var. latus Jones (1893); A latus (Jones) Jones (1894); A lentiginosus var. latus (Jones) Jones (1923); Cystium latum (Jones) Rydb. (1929).
Glabrate, tufted, decumbent or ascending perennial with stems $0.5-1.5 \mathrm{dm}$. Leafstalk $5-10 \mathrm{~cm}$; leaflets broadly to narrowly obovate, 6-15 mm, 1.2-2.5 (-3) r. Flowers pink-purple. Calyx tube $5.5-8 \mathrm{~mm}$. Keel 11.5-14 mm. Racemes $<$ foliage, fruiting axis $1-2(-4) \mathrm{cm}$. Legumes inflated, ovoid- or ellipsoid-incurved-acuminate to subglobose, $1-2.5 \mathrm{~cm} \times 0.7-1.6 \mathrm{~cm}$, with an acuminate or deltoid, incurved to nearly straight, bilocular beak; valves thinly or heavily coriaceous, mottled or not, glabrous.

NV, White Pine Co., Schell Creek, Egan and Snake ranges. Ca. 2150-2900 m. May-July.

This variety is characterized by its coriaceous pods with a bilocular beak, which distinguishes it from var. toyabensis of the mountains of central and western Nevada. The isolated populations of var. latus are not identical. Several collections from the Schell Creek Range have large pods, ca. 2.5 cm and flowers $18-19 \mathrm{~mm}$. The pods of a collection from the Egans are obliquely subglobose, barely inflated, scarcely 1 cm in length, and the flowers are considerably smaller. A Snake Range specimen has pods of intermediate size.

## Var. lentiginosus

Map 100
A. lentiginosus Dougl. ex Hook. (1831); Phaca lentiginosa (Dougl. ex Hook.) Piper (1906); A. lentiginosus var. typicus Barn. (1945).
A. lentiginosus var. carinatus Jones (1923).

Strigulose to glabrate, commonly decumbent perennial. Leafstalk $4-9 \mathrm{~cm}$; leaflets obovate to elliptic, ca. 1.4-3 $r$. Flowers white (-lavender tinged). Calyx tube 2.8-4.2 mm. Keel 6-8.5 mm. Fruiting axis of raceme $0.5-3 \mathrm{~cm}$. Legumes humistrate, obliquely ovoid to lanceoloid-acuminate, lunately or hamately incurved, scarcely to strongly inflated, $1-2.3 \mathrm{~cm} \times 5-10(-12) \mathrm{mm}$, slightly obcompressed; ventral or dorsal face, or both, sulcate; valves stiffly papery or subcoriaceous, usually mottled, initially strigulose (-glabrate) but glabrate at maturity.

Nw U.S. and adjacent British Columbia. Transmontane WA and OR, weakly to n CA and nw NV, w ID (-east along Snake River to Bannock Co.). Dry sagebrush scabland or (and) with juniper, commonly basaltic soils; roadsides. Ca. 300-1200 m. May-June (-July).

Var. lentiginosus centers in the Columbia Basin in Washington and Oregon where, in the northern half of this range, it is the sole representative of the species. It is relatively consistent morphologically except for variation in pod size, shape, inflation, and texture. The fruits, on the average, are smaller, more incurved, less inflated and heavier-walled to the south and east. In the southern parts of its range, var. lentiginosus is sympatric with vars. salinus and platyphyllidius and, slightly, with var. floribundus. These varieties resemble var. lentiginosus in that they are glabrate plants with white flowers in short inflorescences. Vars. floribundus and salinus are identified by thinly papery, subdiaphanous pods that are usually initially glabrous. Var. platyphyllidius, as var. lentiginosus, has a distinctly coriaceous pod, but its flowers, typically, are conspicuously larger than those of the latter, i.e., calyx tube ca. $5.5-8 \mathrm{~mm}$ vs. $3-4 \mathrm{~mm}$. There is, evidently, some intermediacy between all these varieties, and
the assignment of some recondite specimens, especially of eastern Idaho, is arbitrary.

## Var. macdougalii (Sheldon) Jones

Map 105
A. macdougalii Sheld. (1894); A. lentiginosus var. macdougalii (Sheld.) Jones (1895); Cystium macdougalii (Sheld.) Rydb. (1929).

Glabrate perennial with ascending stems $1.5-3 \mathrm{dm}$. Leafstalk 4-9 cm ; leaflets elliptic, ca. $0.7-1.5 \mathrm{~cm}, 2-3 r$. Flowers pink-purple. Calyx tube ca. 4.5-5.5 mm; teeth 1.5 mm . Keel $11.5-13 \mathrm{~mm}$. Raceme 1-4 (-5) cm in fruit. Legumes subspheroid (-incurved-lanceoloid), slightly inflated, rounded, or subemarginate at apex with a short, straight beak, ca. 1 cm diam.; valves coriaceous, glabrous.

AZ, Flagstaff region. Open slopes; locally common. Ca. 1850-2150 m. May-June.

Var. macdougalii, no doubt, is little more than a local form of var. diphysus, differing only in the form and size of its pods. It merges with "normal" var. diphysus, but the extreme form, as herein described, is easily recognized.

> Var. macrolobus (Rydberg) Barneby
> Map 96
> Cystium macrolobum Rydb. (1929); A. lentiginosus var. macrolobus (Rydb.) Barn. (1945).
C. vulpinum Rydb. (1929).

Diffuse to ascending, villosulous and commonly cinereous perennial. Leafstalk $4-10 \mathrm{~cm}$, leaflets obovate to elliptic-oblong, 4-10 (-15) mm , ca. 1.5-3 $r$. Flowers white or ochroleucous. Calyx tube $3-4 \mathrm{~mm}$; teeth (1.5-) $2-3 \mathrm{~mm}$, often divergent (-recurved). Keel $6.5-8 \mathrm{~mm}$. Fruiting axis of raceme $3-6(-9) \mathrm{cm}$. Legumes bladdery-inflated, obliquely ovoid-lanceoloid to subglobose, slightly incurved, $1.5-2.5 \mathrm{~cm}$ $\times 0.7-1.4 \mathrm{~cm}$; valves papery, subdiaphanous, glabrous or strigulose.

N NV, sand dunes and sagebrush country; locally common. Ca. 1200-1500 m. May-June.

Var. macrolobus may be regarded as a peripheral facies of the heterogeneous var. salinus, replacing it to the south. It differs from that variety in its flexuous or spreading pubescence and the larger fruiting racemes and calyx teeth. I have referred intergradient southern Oregon specimens to var. salinus.

Glabrate perennial with ascending stems 2-7 dm. Leafstalk 5-15 cm; leaflets ovate to oblong-elliptic, $0.3-2 \mathrm{~cm}, 1.2-3 r$. Flowers ochroleucous.

Calyx tube 5.5-6.5 mm. Keel 11-12 mm. Fruiting axis of raceme 5-20 cm . Legumes not inflated, oblong, straight to slightly incurved, subterete, $2-3 \mathrm{~cm} \times 4-6 \mathrm{~mm}$; valves coriaceous, glabrous.

AZ, Maricopa Co. Washes and roadsides. Ca. 350-700 m. MarchMay.

This local form is easily recognized by its oblong or slightly falcate pods.

Var. micans Barneby (1956)
Map 104
Silvery-silky perennial with clumped stems 1-4 dm. Vesture villous-tomentulose, including hairs to 2 mm long. Leafstalk $4-12 \mathrm{~cm}$; leaflets ovate or obovate, ca. $0.5-1.5 \mathrm{~cm}, 1.5-2 r$. Flowers ochroleucous, distally darker or dark-spotted, drying cream or blue. Calyx tube ca. $4-5 \mathrm{~mm}$, teeth $1.5-2.5 \mathrm{~mm}$. Keel ca. 10 mm . Axis of fruiting raceme $4-10 \mathrm{~cm}$. Legumes moderately inflated, heavily papery, asymmetrically ovoid, $1.5-2 \mathrm{~cm} \times 8-10 \mathrm{~mm}$, silvery-villous or tomentulose, not mottled.

CA, Inyo Co., Eureka Valley, Eureka Dunes. Lower margins and slopes of stabilized dunes. Ca. 920 m . April-May.

Var. micans, a local adjunct of the polymorphic var. variabilis, differs from that variety in its usually longer calyx lobes, sericeous pubescence, ochroleucous to blue flower color, and specialized habitat and isolation. Its veracity as a named variety is, however, rendered dubious by recent collections of similar plants from several locations from Inyo Co., California and Nye Co., Nevada. I list it primarily on the basis of data assembled by Dr. Bruce Pavlik who is familiar with these plants in connection with a floristic-ecological survey of desert dunes in the Mojave Desert. Dr. Pavlik (pers. comm.) supports my statement (above) that var. micans resembles eastern California and Nevada var. variabilis in suggesting that "micans has been derived recently ... from Nevada populations of var. variabilis . . rather than from southern and western California populations."

Var. nigricalycis Jones
Map 101
A. lentiginosus var. nigricalycis Jones (1895); Cystium nigricalyce (Jones) Rydb. (1929); A. nigricalycis (Jones) Abrams (1944).

Coarse, villosulous or incumbent-puberulent, cinereous or greenish perennial with decumbent-ascending stems $2.5-5 \mathrm{dm}$. Leafstalk 6 -15 cm ; leaflets obovate to broadly oblanceolate, $6-20 \mathrm{~mm}$, ca. $1.5-3 \mathrm{r}$, commonly glabrate above in age. Flowers ochroleucous to greenishyellow. Calyx tube 4.5-6 mm, usually black-pubescent. Keel 11-13 (-14)
mm . Fruiting axis of raceme (3-) $4-10 \mathrm{~cm}$. Legumes inflated, asymmetrically ovoid-acuminate, $2-3.5 \mathrm{~cm} \times 1-2.2 \mathrm{~cm}$; valves firmly papery to coriaceous, commonly mottled, villosulous or glabrate in age.

CA, primarily w Kern Co., extending to sw Fresno Co. and contiguous coastal cos. South Coast Ranges; Valley to Sonoran Grassland; dry open fields, slopes of foothills; roadsides. Ca. 100-1700 m . March-April.

Within its range, var. nigricalycis is recognized by its yellowish flowers with usually black calyces, and large, inflated but firm pods. It grades slightly into the desert var. variabilis in Kern Co.

A label on a Heller specimen collected near Bakersfield in 1905 states, "It is very common . . in many places so thick that the bladdery pods are crushed under foot at every step." Although still locally common, often in secondary habitats, such a level of abundance, obviously, no longer exists.

Var. oropedii Barneby (1945)
Map 106
Glabrate or inconspicuously strigose, decumbent perennial with stems 2-4 dm. Leafstalk 5-12 cm; leaflets suborbicular to elliptic, 6-18 $\mathrm{mm}, 1.3-2.5 \mathrm{r}$. Flowers purple. Calyx tube $5-7.5 \mathrm{~mm}$; teeth $3-5 \mathrm{~mm}$. Keel $11-16 \mathrm{~mm}$. Axis of flowering racemes $1.5-4(-5) \mathrm{cm}$. Legumes inflated, half- or asymmetrically ovoid, $1.5-2.5 \mathrm{~cm} \times 5-15 \mathrm{~mm}$; valves papery, mottled, glabrous.

AZ, Coconino Co., Kaibab Plateau, north rim and upper walls of Grand Canyon. 2150-2450 m. June-Aug.

Var. oropedii can be identified by its long calyx teeth. Other varieties of Astragalus lentiginosus that occur in the Grand Canyon are: var. palans, south margin, coriaceous, uninflated pod; and var. vitreus, north slope (mostly $900-1500 \mathrm{~m}$ ), keel ca. $10-12 \mathrm{~mm}$, and fruiting racemes ca. $4-8 \mathrm{~cm}$.

Var. palans (Jones) Jones
Map 102
A. palans Jones (1893); A. lentiginosus var. palans (Jones) Jones (1898); Tium palans (Jones) Rydb. (1929).
A. amplexus Pays. (1915); Hamosa amplexa (Pays.) Rydb. (1917); Tium amplexum (Pays.) Rydb. (1929).
Glabrate perennial with ascending to erect stems $1.5-4 \mathrm{dm}$. Leafstalk $4-10 \mathrm{~cm}$; leaflets broadly obovate to obovate-elliptic, 6-20 $\mathrm{mm}, 1.2-3.5 r$, sometimes folded. Flowers pink-purple. Calyx tube 4.5-7 mm . Keel $10-15 \mathrm{~mm}$. Fruiting axis of raceme little or much elongating, $2-12 \mathrm{~cm}$. Legumes turgid or slightly inflated, ovate-acuminate to linear-lanceolate, straight to hamately curved, subterete to variously
compressed, (1.2-) 1.5-2.5 (-3) cm $\times 4-7$ (-8) mm, conspicuously cuspidate-beaked; valves initially succulent, becoming coriaceous or stiffly papery, mottled or not, glabrous (-strigulose).
$S$ and se UT, and $n$ AZ ( -NV ), w CO. Commonly in canyons of the Colorado River and tributaries, rocky-sandy or clay slopes, ledges, canyon-terraces, washes, alkaline flats; with shadscale, blackbrush etc.; open woodland; roadsides; common (1050-) 1200-2150 m. AprilMay.

Var. palans is various in inflorescence length, which ranges from short-included to much exserted, and in diverse shapes of the pods (Barneby, 1945, 1964). Its range, obliquely across southeastern Utah and into contiguous Arizona and Colorado, is primarily between that of vars. araneosus and diphysus. It scarcely differs from these in flower except that the racemes are usually more elongate. In fruit, in ideal form in southeastern Utah, it is easily recognized by its uninflated, coriaceous, often strongly curved pods. But it is intergradient in Arizona with var. diphysus, some populations including plants of several pod forms. No two people will identify such intermediate material quite in the same way. Var. palans by my determinations extends further south in Arizona than by those of Barneby (1964; as indicated by his distributional map). Colorado material tends to differ from that of Utah in having shorter racemes and more thinly textured pods.

Var. piscinensis Barneby (1977)
Map 103
Prostrate, pubescent, sparsely foliose perennial to 1 m . Leafstalk 1-2 cm; leaflets 3-5, linear-oblanceolate, the lateral $0.7-1.5 \mathrm{~cm}$, the terminal $1.4-3 \mathrm{~cm}$. Flowers lavender. Calyx tube ca. 4.5 mm . Keel 9 mm . Fruiting racemes $1.5-4 \mathrm{~cm}$. Legumes inflated, obliquely ovoidacuminate, 2-2.4 cm $\times 0.8-1.2 \mathrm{~cm}$, stiffly papery, mottled, strigulose.

CA, Mono Co., near Bishop; known only from type locality. Alkaline slough. Ca. 1300 m. June.

Var. piscinensis is unique in its reduced number of leaflets, the terminal one exceeding the leafstalk in length. The locality of the single collection is "BLM Spring, Fish Slough, northwest of Bishop, moist alkaline bank of slough" (DeDecker 3526).

I have seen no material of var. piscinensis. The preceding description is abstracted from Barneby (1977).

Var. platyphyllidius (Rydberg) Peck
Map 100
Cystium platyphyllidium Rydb. (1929); A. lentiginosus var. platyphyllidius (Rydb.) Peck (1941).
C. merrillii Rydb. (1929); A. merrillii (Rydb.) Tidestr. (1937).
C. cornutum Rydb. (1929); A. lentiginosus var. cornutus (Rydb.) Peck (1941).
Subglabrous, decumbent-ascending perennial with stems 1-3 dm. Leafstalk 4-10 cm; leaflets broadly obovate or elliptic, $8-18 \mathrm{~mm}, 1.2-3$ $r$. Flowers whitish (-bicolored, -pink-purple). Calyx tube 5-8.5 mm; teeth $2-4.5 \mathrm{~mm}$. Keel $11-15 \mathrm{~mm}$. Axis of raceme $1-3.5 \mathrm{~cm}$ in fruit. Legumes inflated, ovoid-acuminate to lanceoloid, straight, incurved or hamate, conspicuously beaked, $1.5-4(-4.5) \mathrm{cm} \times 0.7-1.4 \mathrm{~cm}$; valves thickly papery or coriaceous, glabrous (-puberulent).

Nc OR and ne CA, n NV, e to nw CO. Open arid plains and hills, gravel bars with sagebrush and juniper; locally common. Ca. 750-2150 m. May-June.

Var. platyphyllidius is one of the northern, usually whiteflowered, widely distributed varieties of Astragalus lentiginosus. It is partly sympatric with vars. lentiginosus and salinus, differing from both in its larger flowers and thicker-walled fruits. It is geographically variable (Barneby, 1945, 1964) in pod curvature and texture, and in flower size.

Var. pohlii Welsh \& Barneby (1981)
Map 107
Subglabrate, decumbent-ascending perennial with stems 1-3 dm. Leafstalk $4-8 \mathrm{~cm}$; leaflets broadly obovate to elliptic, $0.5-14 \mathrm{~mm}$, ca. 2 $r$. Flowers whitish. Calyx tube cylindric, $8-10 \mathrm{~mm}$; standard $20-23 \mathrm{~mm}$; keel $17-18.5 \mathrm{~mm}$. Axis of raceme in fruit $2-4 \mathrm{~mm}$. Legumes substipitate $0.5 \times 1 \mathrm{~mm}$, promptly deciduous; body inflated, ovoid or broadly lanceoloid, straight or moderately incurved, shortly beaked, $1.5-2.5 \mathrm{~cm}$ $\times 0.8-1.2 \mathrm{~cm}$; valves thickly papery or coriaceous, puberulent.

UT, Tooele Co., local in Rush Valley, n of Vernon. "Desert salt shrub Community." Ca. 1700 m. May-June.

This recently described plant differs from the more widely distributed var. platyphyllidius in its larger flowers and slightly stipitate pods.

Var. salinus (T. Howell) Barneby
Map 103
A. salinus T. Howell (1893); Cystium salinum (T. Howell) Rydb. (1906); A. lentiginosus var. salinus (T. Howell) Barn. (1945).
C. heliophilum Rydb. (1906); A. heliophilus (Rydb.) Tidestr. (1925).

Strigulose or glabrate, usually ascending and clump-forming (-prostrate) perennial, with usually unbranched stems 1-3 dm. Leafstalk $3-12 \mathrm{~cm}$; leaflets broadly obovate to elliptic-oblong, $0.8-2 \mathrm{~cm}$,
ca. 1.5-3 $r$. Flowers white, often apically lavender. Calyx tube 3.6-4.5 mm . Keel $7-8(-9.5) \mathrm{mm}$. Fruiting axis of raceme $1.5-4(-8) \mathrm{cm}$, relatively loose. Legumes obliquely ovoid, half-ovoid to subglobose, with nearly straight or incurved beak, bladdery-inflated, 1.5-2.5 (-3) $\mathrm{cm} \times 7-14 \mathrm{~mm}$; valves thinly (-stiffly) papery to membranous-papery, glabrous (-puberulent).

Transmontane OR, ne CA, s ID, across $n$ and e NV to sw UT; an outlier in sw WY and adjacent UT. Sandy, stony deserts with sagebrush, pinyon-juniper, ascending to yellow pine and aspen; abundant in s ID and adjacent OR, less frequent elsewhere. Ca. 7002450 m. (April-) May-June.

Var. salinus is a mostly northern variety with small, white flowers and usually thinly papery fruits. It is sympatric over part of its range with both vars. platyphyllidius and lentiginosus (which have coriaceous fruits), and while it is seemingly mostly genetically independent of them, the identification of plants with immature fruits may be uncertain. It is peripherally sympatric with the comparatively local vars. macrolobus (with subvillous pubescence) and floribundus (with tightly compact inflorescences) and merges with both of these. More wide-ranging than most varieties of Astragalus lentiginosus, var. salinus is correspondingly heterogeneous (Barneby, 1964), perhaps most conspicuously so in levels of pubescence.

Var. scorpionis Jones
Map 103
A. lentiginosus var. scorpionis Jones (1923); Cystium scorpionois (Jones) Rydb. (1929).
A. lentinginosus var. tremuletorum Barn. (1945).

Glabrate, decumbent perennial. Leafstalk $4-10 \mathrm{~cm}$; leaflets obovate to elliptic, 0.8-1.5 cm, ca. 1.5-4 $r$. Flowers white. Calyx tube 2.7-4.5 mm . Keel 6-9 (-10) mm. Fruiting axis of racemes $1.5-4 \mathrm{~cm}$. Legumes ovoid-acuminate, bladdery-inflated, $8-20(-25) \mathrm{mm} \times 5-12(-15) \mathrm{mm}$; valves papery, commonly mottled, glabrous.

E NV, of mt. ranges in s Elko, White Pine, w Nye and Lincoln cos., also w Juab Co., UT. Upper sagebrush slopes, mountain meadows and ridges, to timberline, mostly alkaline soils; locally common. Ca. 24503350 m. June-July (-Aug.).

Var. scorpionis resembles those forms of var. lentiginosus that have thinner-walled, well inflated pods, but is disjunct from that northern, lower elevation variety. Seemingly the only Astragalus lentiginosus of the ranges from which it is known-Ruby, Grant, Diamond, White Pine, Deep Creek (Deer Creek on some maps)-, it is contiguous to two usually purple-flowered montane varieties. Of these,
var. latus of the Schell Creek and Egan ranges, White Pine Co., resembles it in fruit except that the pod of var. latus is bilocular to the tip, i.e., including the beak. The purple-flowered var. toyabensis of the Wassuk, Toiyabe and Monitor ranges in n Nye and adjacent cos., is essentially indistinguishable from var. scorpionis in fruit.

Var. semotus Jepson (1936)
Map 96
Strigulose, caespitose or prostrate, caulescent perennial to 1.5 dm. Leafstalk $4-8 \mathrm{~cm}$; leaflets ca. 15-25, elliptic to oblanceolate, 2-9 $\mathrm{mm}, 2-4 r$, mostly folded. Flowers whitish, fading ochroleucous. Calyx tube $3.5-4 \mathrm{~mm}$. Keel $7.5-8.5 \mathrm{~mm}$. Fruiting axis of raceme $1-3 \mathrm{~cm}$. Legumes bladdery-inflated, ovoid-acuminate, $1-2(-2.4) \mathrm{cm} \times 8-12 \mathrm{~mm}$; valves papery, mottled, strigulose.

CA, nw Inyo and adjacent Mono cos., and Esmeralda Co., NV. White and Inyo mts.; clay flats, open meadows with pine and sagebrush; locally common. Ca. 2450-3350 m. June-Aug.

Var. semotus is a reduced, upper elevation plant with small, white flowers and bladdery pods. It is probably of parallel derivation with var. ineptus of the contiguous Sierra Nevada eastern slopes, which tends to have curved or spreading pubescence, and slightly smaller leaves with fewer leaflets. The evolutionary divergence of these two forms barely deserves varietal segregation. The relations of both probably lie with var. floribundus of lower altitudes.

Var. sesquimetralis (Rydb.) Barneby
Map 103
Cystium sesquimetrale Rydb. (1929); A. lentiginosus var. sesquimetralis (Rydb.) Barn. (1945).
Prostrate, strigulose perennial with stems to 8 dm . Leafstalk 2-5 dm; leaflets 9-15, oblanceolate, $6-18 \mathrm{~mm}$, flat or folded. Flowers purple. Calyx tube $5-5.5 \mathrm{~mm}$. Keel ca. $9-9.5 \mathrm{~mm}$. Raceme axis $1-2 \mathrm{~cm}$ in fruit. Legumes inflated, ovate or broadly lanceoloid, $1.5-2.5 \mathrm{~cm} \times$ $9-12 \mathrm{~cm}$, inconspicuously incurved-beaked; valves stiffly papery, mottled, strigulose.

NV, Mineral Co., Sodaville, and CA, n Inyo Co. (Barneby, 1977: "Sand Spring near head of Death Valley Wash"). Alkaline flats near springs. May-June.

Var. sesquimetralis was known (Barneby, 1964) from only the type collected in 1882 near Soda Springs (now Sodaville). After a gap of nearly a century, it has been rediscovered (Barneby, 1977) by Margaret Williams both from the original and the second named locality. The plants of the latter collection, though retaining the upturned pod beak (contrasting with the decurved beak of the similar
A. albifolius), have flowers that approach those of the var. albifolius in size. Possibly these two varieties represent isolated fragments of essentially the same taxon.

## Var. sierrae Jones

Map 98
A. lentiginosus var. sierrae Jones (1923); Cystium sierrae (Jones) Rydb. (1929); A. sierrae (Jones) Tidestr. (1937).
Prostrate, strigulose, usually greenish, mat-forming perennial. Leafstalk $2-5 \mathrm{~cm}$; leaflets obovate, $3-8 \mathrm{~mm}$, ca. 2-3.5 $r$, mostly folded and recurved. Flowers whitish (-pink-tinged). Calyx tube $4.5-5 \mathrm{~mm}$; teeth 0.5-1.3 mm. Keel 8-9 (-10) mm. Axis of raceme 1-3 cm in fruit. Legumes bladdery-inflated, plumply ovoid-acuminate, $1.5-2.5 \mathrm{~cm} \times 1$ 1.5 cm ; valves papery, commonly mottled, strigulose.

CA, sw San Bernardino Co., e margin of San Bernardino Mts. Meadows, talus, open pine woodland, adventive on road banks; local but common. Ca. 1850-2600 m. (May-) June-July.

Var. sierrae, unfortunately named, resembles var. ineptus (pubescence loose, longer calyx teeth) of the east slope of the Sierras, and var. antonius (cinereous) of the San Gabriel Mountains.

Var. stramineus (Rydberg) Barneby Map 102
Cystium stramineum Rydb. (1929); A. lentiginosus var. stramineus (Rydb.) Barn. (1945).
Evanescent, initially silvery, strigulose or subcanescent perennial or annual with ascending or erect stems, 1-3.5 dm. Leafstalk $4-12 \mathrm{~cm}$; leaflets obovate to broadly oblanceolate, ca. $8-15 \mathrm{~mm}, 1.5-3 r$, often glabrous above. Flowers pink-purple or bicolored. Calyx tube 4-4.5 mm ; teeth $1-2 \mathrm{~mm}$. Keel $10-10.5 \mathrm{~mm}$. Axis of fruiting racemes $5-12 \mathrm{~cm}$. Legumes bladdery-inflated, asymmetrically ovoid-acuminate, 1.5-2.5 $\mathrm{cm} \times 1-1.6 \mathrm{~mm}$; valves papery, usually mottled, strigulose to villosulous.

Confluence of AZ, NV, UT. West slopes of Beaverdam Mts., lower Virgin Valley; sandy deserts; locally common. Ca. 600-900 m. April-May.

Var. stramineus is a short-lived, initially cinereous, silvery plant with medium-sized purple flowers. Some specimens cannot be distinguished from the more western var. variabilis save by origin. They differ from the contiguous var. yuccanus in purple flower color, and from the glabrate var. vitreus in pubescence.

Var. toyabensis Barneby (1945)
Map 98
Glabrate, decumbent-ascending perennial with slender stems 1-3 dm . Leafstalk $3-15 \mathrm{~cm}$; leaflets obovate to oblanceolate, $0.6-1.8 \mathrm{~cm}$,
ca. 2-4 $r$. Flowers pink-purple (-white). Calyx tube 5-6.5 mm. Keel 9-12 mm . Axis of raceme in fruit $1-3(-5) \mathrm{cm}$. Legumes bladdery-inflated, subglobose to ovoid-acuminate, (0.6-) $1-2 \mathrm{~cm} \times 0.5-1 \mathrm{~cm}$; beak deltoid, unilocular; valves papery, glabrous (-puberulent).

C and w NV, n Nye and adjacent cos.; Wassuk, Monitor and Toiyabe ranges. Sagebrush slopes, with aspen, upwards to alpine slopes; locally frequent. (1850-) 2450-3350 m. June-July.

Vars. toyabensis, scorpionus, and latus, similar Nevada montane isolates, are briefly contrasted under var. scorpionus.

Plants of var. toyabensis from higher elevations may bear miniature pods less than 1 cm long. Pod shape seems somewhat individualistic for each range, i.e.: Wassuk, lanceoloid; Toiyabe, strongly inflated, ovoid-incurved; Monitor, subspheroid. At lower elevations, var. toyabensis is seemingly intergradient with var. araneosus, which has more stiffly papery or subcoriaceous pods.

Var. ursinus (Gray) Barneby (1945)
A. ursinus Gray (1878)

Seemingly similar to var. palans but with smaller flowers and fruits, and west of the range of that variety as presently known.

Astragalus ursinus, based on a plant collected in 1877 in "Bear Valley in south-central part of Utah," has not been found again. The locality being ambiguous, it is not mapped. It has been maintained as a variety of A. lentiginosus by both Barneby (1964) and Welsh (1978).

Var. variabilis Barneby
Map 104
Cystium pardalotum Rydb. (1929).
A. lentiginosus var. variabilis Barn. (1946).

Greenish or cinereous, or silvery or white, short-lived perennial of annual aspect with ascending or spreading stems 1-5 dm. Vesture diverse, thinly strigulose, villosulous, white-tomentose or sericeous. Leafstalk 4-10 cm; leaflets obovate to broadly oblanceolate, $0.6-2 \mathrm{~cm}$, ca. 1.5-3 $r$. Flowers purple (-ochroleucous), fading pale in drying. Calyx tube 3.5-5 mm; teeth 1-1.6 (-2) mm. Keel (8-)8.5-12 mm. Axis of fruiting raceme $4-15 \mathrm{~cm}$. Legumes inflated, bladdery or firm, asymmetrically ovoid-acuminate, $1.5-2.7 \mathrm{~cm} \times 8-15 \mathrm{~mm}$; valves thin to firmly papery, commonly mottled, thinly strigulose to canescent.

CA, primarily of San Bernardino Co., w in Kern and Los Angeles cos. to coastal ranges, slightly in other contiguous cos. and in Nye Co., NV. W and se Mohave Desert; sandy flats, dunes, alkali sinks, washes, most characteristically with creosote bush; roadsides; irrigation
ditches; common and abundant. (150-) 300-900 (-1500) m. MarchApril (-Oct.).

The two widespread and common varieties of Astragalus lentiginosus in the Mohave Desert are var. fremontii to the north and east, and the larger flowered var. variablilis to the south and west. Var. variabilis is conspicuously diverse in level of pubescence, pod shape, and flower size. In general the more canescent forms are of the northeast portion of the range. Variation has been detailed by Barneby (1964) who defined var. variabilis as including "all the heterogeneous populations of Astragalus lentiginosus (other than the halophytic albifolius) known to occur over the floor of that part of the Mohave Desert lying between the Transverse Ranges to the southward, the Inyo County line at the north, and the Sierra Foothills and the sink of the Mohave River to the west and east." The differentiation of var. variabilis from var. fremontii is subjective, and many plants have flowers of borderline dimensions. Passage into the var. nigricalycis of the Coast Ranges and the local var. coachellae in Riverside County is less extensive.

Var. variabilis is also known from several locations in Inyo County, California, and recent collections from Nye County, Nevada, extend it to that state. The latter, especially, are mostly white, canescent plants with sericeous or satiny foliage that closely resemble the variety micans Barneby, of local occurrence at the south end of Eureka Valley, Inyo County, California.

Var. vitreus Barneby (1945)
Map 105
Robust, glabrescent perennial with decumbent-ascending stems 2-5 dm. Leafstalk 5-10 cm; leaflets obovate or obovate-elliptic, ca. 0.8-2 $\mathrm{cm}, 1.5-3 r$. Flowers whitish to pink-purple. Calyx tube $4.5-5.5 \mathrm{~mm}$. Keel $10-12 \mathrm{~mm}$. Axis of fruiting raceme $4-8 \mathrm{~cm}$. Legumes bladderyinflated, ovoid-acuminate (-lunate-lanceoloid), $1.5-2.5 \mathrm{~cm} \times 1-1.5 \mathrm{~cm}$; valves membranous-papery, often glassy-diaphanous when immature, not mottled, glabrous.

Sw UT, Washington and Kane cos., and adjacent AZ (n Mohave and Coconino cos.); local, gravelly slopes and desert flats with sagebrush, pinyon-juniper, or creosote bush. Ca. 900-1900 m. April-May.

The immature fruits of var. vitreus are translucent and often glassy, this quality, however, disappearing with full maturity. The flowers range from white to pink-purple. The fruits alone distinguish it from any of its contiguous relatives except the pink-purple flowered var. wahweapensis of Kane County, Utah; see comparative observations under listing of that variety.

Variation in flower color is to some degree geographically oriented, i.e., Welsh (1978) said, "The flowers are very pale" but "southward and eastward become a bright pink-purple." However, I have seen a range of flower color from pale lilac to purple within a single colony. Purple-flowered plants without fruits may resemble both var. diphysus (usually shorter racemes and thicker walled pods) and var. palans (coriaceous, little inflated pods) that lie primarily to the east of var. vitreus.

Var. wahweapensis Welsh (1978)
Map 105
Glabrescent perennial with decumbent-ascending stems 2-5 dm. Leafstalk 3-8 cm; leaflets obovate to elliptic, ca. 1-1.5 cm, 1.5-3 $r$. Flowers pink-purple. Calyx tube ca. 5-6 mm. Keel $12-13 \mathrm{~mm}$. Axis of fruiting racemes (2-) 3-4 (-5) cm. Legumes bladdery-inflated, ovoidacuminate or lanceoloid-incurved, $2-2.5 \mathrm{~cm} \times 1-1.5 \mathrm{~cm}$; valves diaphanous when immature, becoming membranous or papery at maturity, not mottled, glabrous.

S UT, e Kane Co. Pinyon-juniper, red sandy soil. Ca. 1500-1900 m. May-June.

Immediately contiguous to the abundant var. araneosus, var. wahweapensis differs in its thinly papery pod, which, however, essentially duplicates that of var. vitreus slightly to the west. I am not sure the two are really different. There is, it is true, a slight geographic break between vars. wahweapensis and vitreus, and the latter has more strongly exserted racemes and (in Utah) usually paler flowers. Welsh (1978) stated that the flowers of var. vitreus are the larger, but my measurements do not verify this.

Var. wilsonii (Greene) Barneby
Map 106
A. wilsonii Greene (1897); Tium wilsonii (Greene) Rydb. (1929); A. lentiginosus var. wilsonii (Greene) Barn. (1945).

Decumbent to ascending, glabrate perennial with stems $2-5 \mathrm{dm}$. Leafstalk 2-15 cm; leaflets ovate to elliptic, $0.5-1.5 \mathrm{~cm}$, ca. 1.5-3 $r$. Flowers white, pink-tinged or pink-lavender, whitish when dried. Calyx tube $5.5-7.5 \mathrm{~mm}$. Keel $12-15 \mathrm{~mm}$. Axis of fruiting racemes 2-4 $(-6) \mathrm{cm}$. Legumes not inflated (-slightly so), oblong-lanceoloid, straight to slightly incurved, subterete to obcompressed, $2-3.5 \mathrm{~cm} \times 4-7(-9)$ mm ; valves subcoriaceous or stiffly papery, commonly mottled, glabrous (-puberulent).

C AZ, n Yavapai and adjacent Coconino and Gila cos. Sandy open banks, slopes, ledges with pinyon-juniper and oak, upwards with
yellow pine; locally abundant. Ca. 1000-1500 (-2150) m. (March-) April (-May).

This local variety differs from var. palans in its less strongly curved pods, lighter colored flowers, and usually compact racemes.

Var. yuccanus Jones
Map 106
A. lentiginosus var. yuccanus Jones (1898); Cystium yuccanum (Jones) Rydb. (1929); A. yuccanus (Jones) Tidestr. (1935); A. fremontii var. yuccanus (Jones) Tidestr. (1941).

Initially strigose or subcanescent and cinereous, robust annual or short-lived perennial with ascending or erect (-decumbent) stems 1.54 dm . Leafstalk ca. $5-15 \mathrm{~cm}$; leaflets obovate to elliptic, $0.6-2 \mathrm{~cm}, 1.8-3$ $r$, glabrous above. Flowers white or ochroleucous (towards pinkpurple). Calyx tube $4.5-5.5 \mathrm{~mm}$. Petals but slightly graduated; keel 10 12 mm . Axis of fruiting racemes $5-13 \mathrm{~cm}$. Legumes bladdery-inflated, subglobose to ovoid-acuminate, $1.5-2.2(-2.5) \mathrm{cm} \times 1-1.8 \mathrm{~cm}$; valves membranous-papery, subdiaphanous, glabrous (-strigulose).

W AZ, c Mohave to n Maricopa cos., disjunctly in Pima Co. Rocky or sandy desert slopes, washes, with Larrea, Yucca; abundant. Ca. 600-900 m. (Feb.-) March-April.

Var. yuccanus differs from var. australis primarily in flower color and shades towards the latter in the southern portion of its range. In its area, it is "sometimes the most abundant herbaceous species over hundreds of acres" (Barneby, 1964).

## Astragalus leptaleus Gray

Map 112
Phaca pauciflora Nutt. (1838); A. pauciflorus (Nutt.) Gray (1863) non Pall. (1800) nec Hook. (1831); A. leptaleus Gray (1864); P. leptalea (Gray) Rydb. (1913).

Rhizomatous, sparsely strigose perennial from branching, subterranean caudices with solitary but contiguous, usually numerous, slender, low or decumbent, frequently mat-forming stems $2-20 \mathrm{~cm}$. Leafstalk 2-5 ( -10 ) cm; leaflets $15-23$, elliptic, acute, $3-10(-15) \mathrm{mm}$, 3-4 r, glabrate above. Lower stipules connate. Racemes short, on filiform, flexuous, included or slightly exserted peduncles $1-4 \mathrm{~cm}$, bearing (1-) 2-3 (-5) ascending, then declined flowers 8-12 mm. Calyx tube campanulate, $2.5-3.5 \mathrm{~mm}$, usually black-pubescent; teeth $1-2 \mathrm{~mm}$. Corolla white, keel maculate. Ovules 6-10. Legumes deflexed, substipitate to $1(-1.5) \mathrm{mm}$, unilocular, persistent or slowly disarticulating with pedicel; body ellipsoid to ellipsoid-lanceoloid, nearly straight, slightly obcompressed-triquetrous, $7-14 \mathrm{~mm} \times$ 2.5-4 mm; dorsal surface flat or broadly sulcate; valves papery,
cross-reticulate or furrowed at maturity, black- or white-strigose; dehiscence distal. Astragalus.

CO Front Ranges, and scattered locations in ec ID, w MT, w WY. Sedge-rush meadows, moist soil near mountain streams; moist roadsides; infrequent but locally abundant. ?-2900 m. July-Aug.

Astragalus leptaleus, easily overlooked, is probably more frequent than the relatively few records indicate. Its rhizomatous mat-forming habit and 2-3 flowered inflorescences easily mark it within its range and habitat. It resembles the alpine central Colorado A. molybdenus and the local $A$. shultziorum of western Wyoming. The text of the latter species includes a key comparing these three kinds.

## Astragalus leptocarpus Torrey \& Gray (1838) <br> Map 110

A. leptocarpus T. \& G. (1838); Hamosa leptocarpa (T. \& G.) Rydb. ex Small (1903).
A. nuttallianus var. leptocarpoides Jones (1898); H. leptocarpoides (Jones) Rydb. (1927); A. leptocarpoides (Jones) Cory (1936).
Strigulose or glabrescent, diminutive or slender annual with simple and erect or basally branched, prostrate stems 0.5-2.5 dm. Leafstalk 1.5-6 cm; leaflets 11-19, cuneate-obovate to oblong, retuse or truncate, $3-10 \mathrm{~mm}, 1.5-3.5 r$, glabrate to lightly pilose. Stipules free. Racemes $\pm$ leaves or exserted with 3-7 (-10) subcapitate to contiguous, ascending-spreading flowers $8-13 \mathrm{~mm}$; axis $0-1(-1.5) \mathrm{cm}$ in fruit. Calyx tube $2-2.5 \mathrm{~mm}$; teeth $1-2 \mathrm{~mm}$. Corolla bicolored with maculate keel to purple or purple-blue; standard oeillate, keel acute to subporrect. Ovules ca. 20-30. Legumes spreading to deflexed (-upwardly curved), sessile to substipitate $0.5-1 \mathrm{~mm}$, bilocular, persistent, dehiscent; body narrowly oblong, nearly straight or gently falcate, subtriquetrous-compressed, $2-3.5 \mathrm{~cm} \times$ ca. $2-3$ (-3.5) mm , dorsally sulcate; valves thinly coriaceous, becoming dark at maturity, glabrous; dehiscence apical and ventral, ultimately semi-elastic. Leptocarpi: Leptocarpi.

E and c TX and LA. Post oak woodlands, open sandy banks, eroded slopes, adjacent to beaches in s; roadsides; locally abundant. March-April.

Among the Texas annual Astragalus horde, Astragalus leptocarpus is distinguished by its longer, straight or barely curved, glabrous pods, and acute to subporrect keel. There is a key to the Texas taxa of the $A$. nuttallianus-austrinus complex within the treatment of $A$. pleianthus.

## Astragalus leucolobus Watson ex Jones

Map 128
A. leucolobus Wats. ex Jones (1893); A. purshii var. leucolobus (Wats. ex Jones) Jones (1902); Phaca leucoloba (Wats. ex Jones) Heller (1905) quoad basionym; Xylophacos leucolobus (Wats. ex Jones) Rydb. (1925); A. inflexus var. leucolobus (Wats. ex Jones) Jeps. (1925).
Subacaulescent or shortly prostrate-caulescent, silvery-cinereous, pubescent perennial from a superficial caudex with a few leafstalk tatters. Pubescence villosulous-tomentose or pannose, of fine, sinuous, spreading or subsericeous, ultimately tangled hairs $\pm 1 \mathrm{~mm}$. Leafstalk (0.5-) 1-8 cm; leaflets 11-19, crowded, obovate to elliptic, $3-12 \mathrm{~mm}, 2-3$ $r$, acute or obtuse, flat or folded, villosulous-tomentose. Stipules free, mostly imbricate. Racemes usually $>$ leaves with $6-12$ subumbellate or spaced, ascending flowers $16-18 \mathrm{~mm}$, ultimately reclinate with axis elongating to $2-6 \mathrm{~cm}$. Calyx tube cylindric, $7-9 \mathrm{~mm}$; teeth $1.5-3 \mathrm{~mm}$. Corolla lavender to pink-purple, narrow, barely graduated. Ovules ca. 20-25. Legumes ascending-humistrate, sessile, bilocular or semibilocular with narrow septum, deciduous, dehiscent; body oblong to lanceoloid, somewhat incurved entire length, abruptly bent at apex, obcompressed, broadly obcordate to didymous in cross section, 14-20 (-25) mm $\times 5-8 \mathrm{~mm}$; dorsal and ventral faces both sulcate, the sutures thus contiguous; valves leathery, tomentose with hairs $0.8-1.5 \mathrm{~mm}$ that scarcely hide surface at maturity; dehiscence apical, both sutures. Argophylli: Eriocarpi.

S CA, coastal and interior mts.; San Gabriel, San Antonio, San Bernardino, and Santa Rosa mts., in Los Angeles, San Bernardino and Riverside cos. Rocky open hills and ridge tops with sagebrush or juniper, upwards to Jeffrey and yellow pine. Ca. 1850-2450 m. May-June.

Astragalus leucolobus, closely related to the ubiquitous Astragalus purshii, is distinguished from it in fruit by the much shorter legume pubescence that scarcely hides the surface. Lacking fruits, the less facile differences between $A$. leucolobus and contiguous or partially sympatric forms of $A$. purshii are as follows:

## From A. purshii var. var tinctus

1. Petals scarcely graduated; peduncles $>$ leaves; mt. ranges as listed above.
A. leucolobus
2. Petals plainly graduated or peduncles < leaves; n and nw of mts. occupied by $A$. leucolobus.
A. purshii var. tinctus

## From A. purshii var. lectulus

1. Calyx tube ca. $7-9 \mathrm{~mm}$; corolla $16-18 \mathrm{~mm}$.
A. leucolobus
2. Calyx tube ca. $4.5-7 \mathrm{~mm}$; corolla $10-15 \mathrm{~mm}$; sympatric with $A$. leucolobus in San Bernardino Mts. A. purshii var. lectulus

Astragalus subvestitus, further north in Kern and Inyo cos., resembles $A$. leucolobus in having pods that are tomentose with short hairs.

Astragalus limnocharis Barneby (1946) Map 112
Subacaulescent, puberulent, tufted perennial to 6 cm from superficial, slowly elongating and branching perennial, scarcely thatched caudices; annual growth 0.5-2 cm, stipule-enveloped. Leaves erect, clustered; leafstalk $2-4 \mathrm{~cm}$; leaflets $9-13$, ovate to oblanceolateoblong, obtuse, $3-7 \mathrm{~mm}, 2-4 \mathrm{r}$, usually involute, glabrate above. Stipules imbricate, connate. Racemes $2-4 \mathrm{~cm}, \pm$ or slightly $>$ foliage, reclinate in fruit, with 4-8 ascending-spreading, subumbellate flowers 6-8 mm. Calyx tube ca. 2 mm ; teeth $0.7-1 \mathrm{~mm}$. Corolla ochroleucous; standard recurved $60^{\circ}-80^{\circ}$; keel deltoid to subporrect, incurved $100^{\circ}+$. Ovules ca. 10. Legumes spreading, sessile, unilocular, deciduous with pedicels, dehiscent; body $1-1.5 \mathrm{~cm} \times 0.6-1 \mathrm{~cm}$, bladdery inflated, oblique-ovoid; valves membranous-papery, reddish-mottled, strigulose; dehiscence apical, both sutures, valves separating. Jejuni.

UT, local as indicated following.

Key to varieties of Astragalus limnocharis

1. Flowers ochroleucous, $6-8 \mathrm{~mm}$; calyx tube ca. 2 mm ; leaflet pubescence of sufficient length that margins appear ciliate; local, UT, Iron and Kane cos. var. limnocharis
2. Flowers pink-purple, white-tipped, $7-8 \mathrm{~mm}$; calyx tube $2.2-2.5$ mm ; leaflets not appearing marginally ciliate; local, UT, Sanpete Co.
var. montii

Var. limnocharis
Map 112
Var. limnocharis is known only from two localities, the shore of Navajo Lake, se Iron Co. and in adjacent Kane Co. a few miles away. I have seen it at the former location where it was abundant in scattered patches for perhaps half a mile on the south side of the lake. There, contrasting with the showier Oxytropis parryi, and background of Deschampsia, it is recognized by its habit, its little, ochroleucous-cream flowers and its painted, inflated pods.
A. montii Welsh (1978).

UT, Sanpete Co., Wasatch Plateau, 17 miles $w$ of Ferron on "Flagstaff limestone, marly barrens." 3350 m. June-July.

Vars. limnocharis and montii are variants on the same pattern that differ by the characters listed in the key.

## Astragalus lindheimeri Engelmann ex Gray <br> Map 110

A. lindheimeri Engelm. ex Gray (1852); Hamosa lindheimeri (Engelm. ex Gray) Rydb. ex Small (1903).
A. lindheimeri var. bellus Shinners (1957).

Sparsely strigulose, small or robust annual with simple or basally branched, ascending-incurved to erect stems 0.5-4 dm. Leafstalk 2-6 cm ; leaflets 15-21, obovate-cuneate to oblong, truncate or retuse, 2-12 mm , ca. 1.5-4 r, glabrate above. Stipules free. Racemes included to shortly exserted with 4-7 (-9) subcapitate or short-racemose, erect to spreading flowers $12-18 \mathrm{~mm}$ on axis $0.3-1 \mathrm{~cm}$. Calyx tube $2-3 \mathrm{~mm}$; teeth 2-3 (-5) mm, subulate to setiform-flexuous or recurved. Corolla bicolored, purple or blue and white; standard usually purplemargined and white oeillate; wings white-tipped, keel obtuse or rightangle tipped. Style apically barbate. Ovules $8-12$. Legumes spreading to deflexed-upcurved, stipitate $1-2.5 \mathrm{~mm}$, bilocular, persistent, dehiscent; body oblong, straight or curved, angled at juncture with stipe, laterally compressed or triquetrous, $1.5-2 \mathrm{~cm} \times$ ca. $4-6 \mathrm{~mm}$, dorsally sulcate; valves thickly papery, glabrous, finely cross-rugose, brown, turning black at full maturity; dehiscence apical, both sutures. Leptocarpi: Leptocarpi.

Nc TX and adjacent OK, also disjunct in s Texas. Prairies, rocky slopes, often with mesquite; roadsides and disturbed and ruderal sites; most frequently in calcareous soils; abundant and conspicuous. March-May.

Astragalus lindheimeri, the most attractive of the Texas annual Astragalus, is recognized by its large flowers. The fruit is broader and more strongly stipitate than that of $A$. nuttallianus with which it is largely sympatric.

Astragalus linifolius Osterhout (1928)
Map 112
Ephedroid perennial from a slightly subterranean caudex with erect, bushy-branched, slightly strigulose stems $3-6 \mathrm{~cm}$. Leaves 4-12 cm , reduced to a filiform leafstalk except for the lowermost, which have 1-2 confluent, linear-involute leaflets. Stipules connate. Racemes exserted, the axis elongate with $7-12$ loosely spaced, ascending
flowers ca. 15 mm . Calyx tube ca. 5 mm ; teeth $1.5-2 \mathrm{~mm}$. Corolla white. Legumes ascending-erect, sessile, unilocular, persistent, dehiscent; body ellipsoid-oblong, laterally compressed but turgid, $1.2-1.7 \mathrm{~cm}$ $\times 4.5-6 \mathrm{~mm}$; sutures carinate; valves thick, becoming woody, glabrous; dehiscence apical, both sutures. Pectinati: Pectinati.

W CO, Mesa, Delta and Montrose cos. Gullied hills, canyons, with pinyon-juniper. Ca. 1500 m . May.

Astragalus linifolius resembles the widely distributed Great Basin A. toanus, from which it differs in its more reduced leaves and fewer white flowers. For nearly 50 years, it was known from only two collections from Mesa County, Colorado. It has recently been rediscovered, and its known range expanded, by Weber and colleagues.

## Astragalus loanus Barneby

Map 112
A. newberryi var. wardianus Barn. (1947); A. loanus Barn. (1964).

Acaulescent, tufted, dwarf, sericeous perennial from clustered, heavily thatched, superficial crowns. Pubescence subdolabriform. Leaflets 3-9, elliptic to rhombic-oblanceolate, $5-15 \mathrm{~mm}, 3.5-6 r$. Stipules free, imbricate. Racemes $<$ foliage in flower, and subcapitate in fruit, then exserted and declinate; flowers 2-7, ascending, narrow, 20-22 mm. Calyx tube cylindric, 8.5-10.5 mm, mixed-pubescent; teeth 1.7-3.5 mm. Corolla white or lavender-tinged. Ovules ca. 30. Legumes humistrate, sessile, unilocular, deciduous, tardily dehiscent; body plumply incurved-ovoid to obliquely lanceoloid, obcompressed, subinflated, $2-4 \mathrm{~cm} \times 1-2 \mathrm{~cm}$, ventrally sulcate; valves initially subfleshy, becoming coriaceous or heavily papery, densely hirsute-villous with hairs 1-2 mm, but the pubescence not concealing surface; dehiscence on ground, apical, both sutures. Argophylli: Newberryani.

Sc UT, Sevier to Garfield cos. Gravelly sagebrush and pinyon slopes; igneous soils, locally frequent. 2150-2450 m. May-June.

Astragalus loanus has the acaulescent habit and the thatch of persistent petioles of $A$. newberryi. It differs in its weakly dolabriform pubescence, white flowers, and the thinly walled, but rigid pods in which the vesture does not conceal the surface. Welsh (1978) said the species "apparently consists of two phases, separable inter alia by leaflet shape."

Scarcely or evidently rhizomatous, cinerous or greenish, strigulose perennial from a subterranean or almost superficial crown, often of shrubby appearance, with solitary or usually clustered, robust and
fistulose to slender and solid, basally leafless, erect or ascending, branched stems 3-9 dm. Leafstalk 3-12 cm; leaves foliose but reduced upwards in number of leaflets, some phyllodial; leaflets (0-) 3-9, commonly distant, filiform-involute or folded and linear, $5-25 \mathrm{~mm} \times 1$ $\mathrm{mm}, 10-30 r$; or flat, oblong to linear, $2-3 \mathrm{~mm}$ wide, $5-15 r$; or (var. hamiltonii) oblong-elliptic or oblanceolate, flat, 4-6 mm wide, 5-6 r; terminal leaflet confluent. Stipules free. Racemes exserted, closely floriferous, often secund, loosening in fruit, the axis then 1-2 dm, with 10-many, quickly declined flowers $13-20(-23) \mathrm{mm}$. Fruiting pedicels to 4 mm . Calyx tube broadly cylindric, $6-8 \mathrm{~mm}$, loosely strigulose; teeth 1-2 (-2.5) mm. Corolla white, (-faint lavender cast) turning ochroleucous and dull orange in age. Ovules 15-25. Legumes pendulous, included- or usually exserted-stipitate $4-12 \mathrm{~mm}$, unilocular, persistent, dehiscent; body narrowly oblong to slightly oblanceolate, straight or nearly so, obcompressed, $2.5-4 \mathrm{~cm} \times 3.5-6 \mathrm{~mm}$; valves thinly coriaceous, rugulose, sometimes mottled, glabrous (-puberulent); dehiscence apical, ventral, the valves then spreading. Lonchocarpi: Lonchocarpi.

N NM, CO, UT, and e NV. Open hillsides, bluffs, eroded banks, canyons, badlands; characteristically of alkaline-clay soils, but also sand and shale; usually with pinyon-juniper and shadscale, infrequently to yellow pine zone; common on roadsides, often in dense stands; frequent and abundant. 1350-2300 (-2450) m. May-June (-July).

Astragalus lonchocarpus, characteristic of barren, eroded sites, is usually a robust, feathery-foliaged plant with filiform (locally broader) leaflets, and pendent, initially white flowers, which are followed by stipitate obcompressed pods.

## Key to varieties of Astragalus lonchocarpus

1. Leaflets inrolled-filiform to flat and oblong, 1-3 mm wide, 5-30 r; flowers $14-21 \mathrm{~mm}$; range of species, except as below.
var. lonchocarpus
2. Leaflets oblong-oblanceolate, $4-6 \mathrm{~mm}$ wide, $5-6 r$; flowers $20-23$ mm; Uintah Co., UT.
var. hamiltonii

Var. hamiltonii (C. L. Porter) Isely Map 111
Astragalus hamiltonii C. L. Porter (1952); A. lonchocarpus var. hamiltonii (Porter) Isely (1983).
Range as given in key. Red clay hills with pinyon-juniper; "Duchesne River and Wasatch formations" (Welsh, 1978). Ca. 15001600 m . May.

Var. hamiltonii represents local populations in the vicinity of Vernal, Utah, that have formerly been treated as a separate species. But they seemingly differ from typical $A$. lonchocarpus in no fundamental character. Though the leaflets are strikingly broader than usual $A$. lonchocarpus, their proportions are approached by plants throughout the range of the typical variety.

## Var. lonchocarpus

Map 111
Phaca macrocarpa Gray (1849) non A. macrocarpus Pall. (1776); Astragalus lonchocarpus Torr. (1857); Homalobus macrocarpus (Gray) Rydb. (1906); Lonchophaca macrocarpa (Gray) Rydb. (1929).
A. macer Nels. (1913); Lonchophaca macra (Nels.) Rydb. (1929).

Range, habitat et al. as species.
The commonly rank, fistulose forms of Astragalus lonchocarpus contrast with the more delicate, solid-stemmed type, the basis of Nelson's A. macer.

Astragalus lotiflorus Hooker
Map 113
A. lotiflorus Hook. (1831); Phaca lotiflora (Hook.) T. \& G. (1838); A. lotiflorus fma. pedunculosus Gray (1864); Cystopora lotiflora (Hook.) Lunell (1916); Batidophaca lotiflora (Hook.) Rydb. (1929).
P. cretacea Buckl. (1861); B. cretacea (Buckl.) Rydb. (1929); A. lotiflorus var. cretaceus (Buckl.) Gates (1940).
A. lotiflorus fma. brachypus Gray (1864); A. elatiocarpus Sheld. (1894); A. ammolatus Greene (1895); A. lotiflorus var. elatiocarpus (Sheld.) Rydb. (1900); P. elatiocarpa (Sheld.) Rydb. (1905); C. elatiocarpa(Sheld.) Lunell (1916).
A. reverchonii Gray (1883); P. reverchonii (Gray) Rydb. ex Small (1903).
A. lotiflorus var. nebraskensis Bates (1895); A. nebraskensis (Bates) Bates (1905); B. nebraskensis (Bates) Rydb. (1929).
A. batesii Nels. (1912).

Tufted, subacaulescent or caulescent, pubescent, often cinereous, short-lived perennial (-annual) from a taproot or superficial or slightly subterranean caudex, with prostrate to ascending stems 0.3-8 $(-10) \mathrm{cm}$. Pubescence evidently or obscurely dolabriform, the hairs appressed and straight, or spreading and sinuous. Leafstalk $4-10 \mathrm{~cm}$; leaflets (5-) 7-15, elliptic, oblanceolate to oblong, $0.5-2 \mathrm{~cm}, 2-4 r$, flat or folded, sometimes glabrate above. Stipules free. Infloresences either (1) of racemes that are pedunculate, included or exserted, subcapitate
to ovoid with $3-15$ (-20) ascending, then spreading, normally chasmogamous flowers $8-14 \mathrm{~mm}$, somewhat elongating and usually reclinate at maturity; or (2) reduced, subsessile racemes from basal nodes with 2-4 cleistogamous, obscurely petaloid flowers that produce radical fruits immersed among or hidden by basal leaves (see qualifications in discussion). Of the racemed chasmogamous flowers: Calyx tube $3-4.5 \mathrm{~mm}$; teeth 2-3.5 ( -5 ) mm; corolla ochroleucous or whitish and lavender-suffused, or bicolored or purple. Of the radical, cleistogamous flowers: Peduncles $0.1-1(-2) \mathrm{cm}$; flowers ca. 4-7 mm; calyx similar to above but commonly smaller; corolla white, remaining closed, commonly < calyx. Ovules $30+$. Legumes ascending or humis-trate-spreading, sessile, unilocular, deciduous, tardily dehiscent; body ovoid-acuminate, ellipsoid or oblong-lanceolate, straight or slightly incurved, variably obcompressed or subterete (1.2-) 1.5-3 (-4) cm $\times$ (5-) 6-8 mm with conspicuous beak, dorsally sulcate or not; valves initially fleshy, thinly coriaceous, villosulous; dehiscence apical, then ventral. Lotiflori.

S Canada to TX. W MT, s to TX, n to ND; also along Missouri River in IA and $n$ MO, occasionally $e$ in $M N$ and IA in prairie remnants. Plains and prairies, usually barren or eroded, rocky and sandy hillsides, bluffs and shale slopes; with yucca and grass in s; upwards to pine in $w$; various soil types but commonly limestone; though widely distributed, usually not common in $n$, more frequent s. 2001850 m. S: (March-) April; n: May-June.

Astragalus lotiflorus with radical pods resembles nothing else. Plants with pedunculate racemes are commonly confused with $A$. missouriensis, which usually has pink-purple, longer and narrower flowers, and a cylindric calyx tube with proportionately shorter teeth.

Regional variation within Astragalus lotiflorus is considerable and has been variously interpreted. In general, the northwest forms tend to have longer, spreading pubescence and either cleistogamous flowers or whitish chasmogamous flowers, and short pods (usually $1.5-2.5 \mathrm{~cm}$ ) that are commonly radical. Pubescence of the southern kinds is predominantly shorter and subappressed; the inflorescences are usually of bright-colored, chasmogamous flowers and the pods are $2-3.5 \mathrm{~cm}$. In a state-to-state sorting, going north from Texas, one first finds radical flowers and fruits in significant numbers in Nebraska, and the proportion increases northward. But there is only irregular correlation between the plant characters and geography; e.g., cleistogamous flowers are occasional in Texas material; most Wyoming specimens fail the formula in having pedunculate racemes with short pubescence; those of the leoss-bluff Iowa populations in the northeast
portion of the range are similar in their chasmogamous racemes, but have loose pubescence. I have rethreshed several, large suites of specimen and can only verify the conclusions of Welsh (1960) and Barneby (1964) that the species does not contain useful subspecific categories.

Observations concerning the alternative or simultaneous production of the two kinds of pods have differed. Welsh (1960) stated that the pedunculate racemes are produced first and frequently do not set fruit, whereas the subsessile ones, coming later, are usually fertile. Barneby (1964, p. 998) said, "Exceptionally both sorts of racemes arise on one plant, and in them developed peduncles appear in the spring followed by the cleistogamous type in the summer." I have seen fruit development from the chasmogamous flowers many times, and herbaria amply document fruit set from these flowers, at least part of the time. But I have seen no specimen bearing both pedunculate and sessile fruits, though a few specimens bear racemes that seem intermediate between the two basic types.

## Astragalus lutosus Jones (1910)

Map 115
Diminutive, shortly rhizomatous, mat-forming, cinereous, pubescent perennial from a subterranean caudex with prostrate stems 2-6 cm . Leafstalk 1-3 (-4) cm; leaflets (11-) 15-25, smaller upward on rachis, contiguous or somewhat imbricate, obovate or elliptic, 2-7 (-9) mm , ca. 1.5-3 $r$, sometimes glabrescent above. Stipules free on aboveground portion of stem, amplexicaul-campanulate and almost connate below. Racemes to $3 \mathrm{~cm}, \pm$ foliage with 1-4 ascending flowers $8-16$ mm . Calyx tube $4-7 \mathrm{~mm}$, white- or black-pubescent; teeth $1-3 \mathrm{~mm}$. Corolla white or pinkish with maculate keel. Ovules ca. 25-30. Legumes humistrate (ascending or divergent on specimens), stipitate by gynophore $1-4 \mathrm{~mm}$, unilocular with a ventral flange, deciduous, tardily dehiscent; body bladdery-inflated, ellipsoid, $1.5-3.5 \mathrm{~cm} \times 8$-15 mm ; sutures superficial or ventral depressed; valves thick-papery, strigulose; dehiscence on raceme or ground, apical and then ventral. Lutosi.

Nw CO, Rio Blanco and Garfield cos., and adjacent UT, Uintah and Wasatch cos. White shale barrens, clay hills, ridges, knolls, bluffs; local. Ca. 1600-2100 m. June.

Astragalus lutosus is characterized by deep subterranean origin, tiny leaves with crowded leaflets and a unilocular, bladdery-inflated pod borne on a gynophore.
A. lyallii Gray (1864); Phaca lyallii (Gray) Piper (1906).

Cinereous, villous or sericeous perennial from a superficial caudex with clustered, diffusely spreading stems 1-4 dm that are similarly pubescent above and below. Leafstalk 3-9 cm; leaflets 11-19, elliptic-oblong to lanceolate, acute, $5-15(-18) \mathrm{mm}, 3-4 r$, sometimes folded and appearing narrower. Lower stipules free (or if intermediates with $A$. caricinus, subconnate). Peduncles arising from medial as well as upper nodes. Racemes exserted, quickly loosening with ca. $10-20$, ascending to soon spreading or deflexed flowers $5-8 \mathrm{~mm}$; axis to 1 dm in fruit. Flowering pedicels $0.5-1 \mathrm{~mm}$. Calyx tube $1.5-2.5 \mathrm{~cm}$; teeth $1.5-3.5 \mathrm{~mm}$, commonly curved and sinuous, and $>$ tube. Corolla white to lavender in life, ochroleucous-striate on specimens; keel acute to subporrect. Ovules 4-8. Legumes declined, substipitate, bilocular or semibilocular, slowly deciduous with pedicel, tardily dehiscent; body exserted from calyx about half of length, ellipsoidoblong or ovoid, acute, compressed-triquetrous, $5-9 \mathrm{~mm} \times 2.5-3.5 \mathrm{~mm}$, narrowly sulcate dorsally; valves villous to tomentose, thickly papery; dehiscence on ground. Chaetodontes: Lyalli.

C WA, especially Kittitas Co., s (including putative intermediates with $A$. caricinus) to Benton Co. Sagebrush, "scabland," hills and plains, sandy basaltic soils. 250-600 m. May-June.

Astragalus lyallii, A. caricinus, and A. lentiformis are similar species with loose inflorescences, tiny, flattened, ellipsoid, bilocular pods, and small flowers. A. lyallii is of Washigton; A. caricinus is primarily of the Snake River Valley in Idaho but disjunctly extending into the range of $A$. lyallii, and A. lentiformis is of northeastern California.

Astragalus caricinus, described as a variety of $A$. lyallii by Jones (1923), was elevated to a species by Barneby (1956b). Hitchcock (1961) subsequently reiterated the varietal relationship between the two, while Barneby (1964) maintained A. caricinus and A. lyallii at the specific level. Barneby also plausibly suggested that $A$. lyallii may be of hybrid derivation from $A$. caricinus and $A$. spaldingii.

Astragalus lyallii of Washington and A. caricinus of Idaho are distinguishable on the basis of several small characters: A. caricinus has connate stipules, usually erect stems with shortened, densely white, lower internodes, and sessile pods, these features contrasting with those listed for $A$. lyallii in the description above. But plants with some $A$. caricinus characters are also found within the range of A. lyallii in Washington. Barneby identified these populations with A. caricinus presumably because the stipules, in varying degrees, are
connate. But the specimens are otherwise intermediate in various character combinations. Although this supports Barneby's phyletic theory, it negates a sharp morphological definition of the taxa and suggests that formal classification as two species is dubious. I have arbitrarily maintained them at the specific level because the thread of intermediates is thin, and the two kinds, in their largely independent ranges, are quite different on a multiple character basis. The putative intermediates are designated on the map.

Astragalus macilentus (Small) Cory Map 111
Hamosa macilenta Small (1903); A. macilentus (Small) Cory (1936); A. nuttallianus var. macilentus (Small) Barn. ex Turner (1959).
Strigulose-pilosulous annual with usually erect or ascending stems 1-3 (-4) dm. Leafstalk $3-9 \mathrm{~cm}$; leaflets $9-23$, obovate to oblongoblanceolate, $4-15 \mathrm{~mm}, 1.5-4 r$, commonly glabrate above, various in shape at apex, commonly all obtuse-truncate or, conversely, obtuseacute, or sometimes dimorphic, those of the lower leaves being truncate-emarginate while those of the upper are obtuse-acute. Stipules free. Racemes with 4-20, loosely disposed (-subcapitate), ascending-spreading flowers ( $7-$ ) $8-13 \mathrm{~mm}$; axis elongating to ( $0.5-$ ) $1-3 \mathrm{~cm}$ in fruit. Calyx tube $2-3 \mathrm{~mm}$, black- or white-strigulose; teeth $1-2.5 \mathrm{~mm}$. Corolla light-purple or bicolored; keel bluntly deltoid with a broad-angled (-obtuse) tip. Ovules ca. 10-20. Legumes incurvedascending or spreading, substipitate, bilocular, persistent, dehiscent; body narrowly oblong, initially triquetrous-compressed, ultimately turgid, $1.2-2.5 \mathrm{~cm} \times 2-2.5 \mathrm{~mm}$, curved entire length or primarily at base, dorsally sulcate; valves glabrous; dehiscence terminal, both sutures. Leptocarpi: Leptocarpi.

Sc TX, from Travis and contiguous cos. w across the Edwards Plateau to trans-Pecos TX. Rocky hillsides, along dry stream beds, common in secondary habitats, "dominant for many miles edge of paved road west of Llano, Texas" (Ledingham 4626, herbarium ticket; NY) March-May.

Astragalus macilentus has been treated as a variety of $A$. nuttallianus by recent authors (e.g., Barneby, 1964). The reasons for departing from contemporary tradition are presented in general terms under $A$. nuttallianus. Specifically, $A$. macilentus differs from A. nuttallianus in its elongating inflorescence, larger flowers, substipitate pods, obtuse keel, and although partially sympatric with that species is not intergradient with it.

Astragalus macilentus is plainly variable in plant and flower size, and leaflet shape. Populations from the eastern portion of the range are predominantly the larger-flowered kinds and have conspicuously elongating racemes; on the average, plant and flower size dwindles to the west. The leaflets of plants from the Edwards Plateau are mostly truncate-retuse, only those of the uppermost being rounded.

Lacking mature fruit, small forms of Astragalus macilentus may be confused with $A$. emoryanus because both tend to have elongating inflorescences and more or less obtuse keels. The two species overlap in distribution only in trans-Pecos Texas where the latter differs from A. macilentus in its sessile and deciduous pods. The flower size of $A$. macilentus is similar to that of $A$. leptocarpus, but the last-named has an acutely triangular keel, the leaflets are all truncate or retuse, and the pod is usually nearly straight.

Astragalus macrodon (Hooker \& Arnott) Gray
Map 128
Phaca macrodon H. \& A. (1838); A. macrodon (H. \& A.) Gray 1864. A. holosericeus Jones (1895).

Pubescent perennial from a superficial crown with clustered, decumbent and assurgent stems 1.5-4 dm. Pubescence of ascending or incurved hairs. Leafstalk $5-12 \mathrm{~cm}$; leaflets $17-25$, narrowly elliptic to oblanceolate, $0.7-2 \mathrm{~cm}, 2-4 r$, often thinly pubescent or glabrate in age. Stipules free. Racemes ascending, $\pm$ or $>$ foliage with (5-) 10-20 spreading and deflexed flowers $8-11 \mathrm{~mm}$; axis elongating in fruit to $3-12 \mathrm{~cm}$. Calyx tube $3.5-4.5 \mathrm{~mm}$ with curly hairs; teeth $2.5-3.5 \mathrm{~mm}$. Corolla ochroleucous to yellow, moderately upswept, graduated; standard commonly dark-striate. Ovules 30+. Legumes declined or humistrate, sessile, unilocular with a ventral flange, deciduous, dehiscent; body bladdery-inflated, ellipsoid, subterete to slightly obcompressed, $2-4 \mathrm{~cm} \times 1.5-2 \mathrm{~cm}$; valves papery, inconspicuously villosulous; dehiscence apical. Inflati: Inflati.

Cismontane CA, inner South Coast Ranges, San Benito to w Kern and n Santa Barbara cos. Exposed, open, sterile, eroded, clay or sandy soil in foothill grassland or chaparral; a habitat-specialized species of local occurrence. Ca. 300-950 m. April-May (-June).

Astragalus macrodon, probably a derivative of the more widely distributed and variable $A$. douglasii differs (slightly) from the latter species in its more abundant pubescence of incurved to spreading hairs, and usually smaller pods. The pubescence of $A$. douglasii, at least in forms geographically sympatric with $A$. macrodon, is of straight, usually appressed hairs. Barneby (1964) discussed the ecological specificity of $A$. macrodon.

Map 128
Silvery or white, sericeous or canescent, sparsely foliose, annual or perennial from a taproot or superficial crown; stems 2-9 dm, solitary or clustered, irregularly branched, erect to irregularly sprawling. Leafstalk $2-15 \mathrm{~cm}$; leaflets reduced and distant, 3-15, the lateral 2-8 mm, stubby-oblong or oblong-lanceolate, 3-5 $r$, commonly folded and appearing narrower than the leafstalk, the terminal confluent. Stipules free. Racemes $\pm$ foliage or exserted with 5-20 ascending-spreading flowers $10-14 \mathrm{~mm}$, the axis $2.5-6 \mathrm{~cm}$ in fruit. Flowering pedicels $<1 \mathrm{~mm}$, in fruit to 1.5 mm . Calyx tube $3.5-4 \mathrm{~mm}$; teeth $1-2.5 \mathrm{~mm}$. Corolla pink-purple (-white tipped), drying bluepurple; standard oeillate. Ovules ca. 10-15. Legumes spreading, sessile, unilocular, deciduous, slowly dehiscent; body bladdery-inflated, ovoidacuminate to half-ellipsoid, subterete, $2-3.5 \mathrm{~cm} \times 1-2 \mathrm{~cm}$; valves papery, strigulose; dehiscence on ground, apical. Inflati: Proriferi.

S CA, Baja California and Sonora, three varieties. We have the following to which the above description refers:

Var. peirsonii (Munz \& McBurney) Barneby
A. peirsonii Munz \& McBurney (1932); A. magdalenae var. peirsonii (Munz \& McBurney) Barn. (1958).
S CA: Imperial Co., sandhills w of Yuma, and Borrego Valley in San Diego Co. Colorado desert; sand dunes, usually on lee side; locally abundant. Ca. 50-250 m. Jan.-April.

This is the only U.S. species of the Inflati with reduced foliage and decurrent terminal leaflets. The seeds, to 5 mm , are the largest of any U.S. Astragalus (Barneby, 1964).

## Astragalus malacoides Barneby (1964)

Map 114
Shortly rhizomatous, hirsutulous perennial from a subterranean caudex and heavy taproot, with clustered, prostrate, apically assurgent stems 1.5-2.5 dm. Leafstalk 6-14 cm; leaflets 15-27, cuneateobovate to elliptic, 1.5-2 $r$, flat or folded, glabrate above. Stipules free, dimorphic, those of rhizomes conspicuous, amplexicaul and cupshaped, the upper narrow. Racemes exserted, initially ascending and compact, with $10-20$, soon declined flowers $17-20 \mathrm{~mm}$, ultimately lax and reclinate. Calyx tube cylindric, ca. 7-11 mm, mixed-villosulous; teeth 3-4 mm. Corolla dull lavender or purple. Ovules 20-30. Legumes declined or divergent (-humistrate), stipitate (1-) $2-3 \mathrm{~mm}$, bilocular, slowly deciduous with pedicels, probably tardily dehiscent; body oblong-incurved $90^{\circ}-180^{\circ}$, laterally compressed with carinate sutures, $3-4 \mathrm{~cm} \times 5-6 \mathrm{~mm}$; valves subcoriaceous or heavily papery, hirsutulous; dehiscence not known, presumably on ground. Malaci: Ensiformes.

UT, Kane and Garfield cos.: ne and s side Kaiparowits Plateau. Barren sandstone country, washes, pinyon-juniper; local. Ca. 13501500 m . April-May.

Astragalus malacoides is recognized by its conspicuous, short rhizomes with well spaced, large stipules, hirsutulous pubescence, large flowers and falcate-subhamate, laterally compressed, bilocular pods.

## Astragalus malacus Gray

Map 114
A. malacus Gray (1867); Hamosa malaca (Gray) Rydb. (1917).
A. obfalcatus Nels. (1912); A. malacus var. obfalcatus (Nels.) Jones (1923).
Pilose perennial from superficial, branched caudices with clustered, decumbent to ascending stems 0.5-3 (-4) dm; lower internodes very short, the distal ones elongating. Pubescence of stiff, minutely bulbousased hairs 0.5-2 mm. Leafstalk 4-12 cm; leaflets 11-17 (-19), obovate, ovate, or elliptic-oblong, obtuse, $5-15 \mathrm{~mm}, 1.8-3 \mathrm{r}$, sometimes glabrescent above. Stipules free, to 1 cm , the lowermost imbricate. Racemes exserted, initially compact with 10-20 initially ascending, then spreading or deflexed flowers $14-19 \mathrm{~mm}$; axis elongating to $3-9 \mathrm{~cm}$ in fruit; bract tatters persistent and conspicuous after fall of pods. Calyx tube cylindric, (6-) 7-9 mm; teeth ca. 2-4 mm. Corolla red-purple to bicolored; standard with a pale oeil. Ovules ca. 15-25. Legumes reflexed but distally upcurved, stipitate (0.7-) 1-1.5 (-3) mm, bilocular, deciduous with pedicels, tardily dehiscent; body oblong, incurved $90^{\circ}$ $160^{\circ}$, triquetrous-compressed, $2-3.5(-4) \mathrm{cm} \times 5-6 \mathrm{~mm}$, dorsally sulcate; valves mottled or reddish when immature, becoming papery, pustulate-pilose; dehiscence on ground, apical, ventral. Malaci: Malaci.

Sw ID, se OR, $s$ in w NV and slightly in adjacent CA. Bluffs, ledges, canyons, desert flats, mesa tops; mostly heavy, basaltic-derived soils; with Atriplex, sagebrush, and pinyon-juniper, upwards to timbered slopes. (750-) 1050-2350 m. April-May (-June).

The conspicuous characters of Astragalus malacus include the almost shaggy pilosity, long stipules, narrow, red-purple, deflexed flowers and pilose, sulcate, bilocular, deflexed but upcurved pods. Immature fruits on specimens without restoration by soaking commonly appear laterally compressed.

> Astragalus marianus (Rydberg) Barneby ${ }^{20}$
> Map 114
> Xylophacos marianus Rydb. (1925); A. marianus (Rydb.) Barn. (1944).

[^3]Acaulescent to shortly caulescent, strigose or subsericeous, silvery or cinereous perennial from superficial or aerial, sometimes slightly thatched caudex with tufted or prostrate stems $0-5(-8) \mathrm{cm}$ with contiguous nodes. Leafstalk $2-8 \mathrm{~cm}$; leaflets $11-15$ ( -17 ), obovate or elliptic, 3-8 mm, 2-3 $r$, flat or some folded. Stipules free, the lower subimbricate. Racemes $\pm$ leaves, mostly less than 1 dm , umbellate to shortly racemose, reclining in age, with 3-8 narrow, ascending flowers 18-23 mm. Calyx tube cylindric, often purplish, $7.5-9.5 \mathrm{~mm}$, black- or mixed-pubescent; teeth $2-3 \mathrm{~mm}$. Corolla pink-purple or pale lavender, becoming pallid-ochroleucous in age, slightly graduated. Ovules ca. 25$30+$. Legumes ascending or humistrate, sessile to substipitate by a gynophore, unilocular, deciduous, tardily dehiscent; body half-ovoid, upwardly acuminate at tip, or plumply lanceolate-incurved, obcompressed, 1-2 (-2.5) cm $\times 7-12 \mathrm{~mm}$; ventral face slightly depressed; valves fleshy, becoming coriaceous, the surface hidden by densely villous and tomentulose pubescence of which the longer hairs are 2-3 mm; dehiscence on ground, apical. Argophylli: Argophylli.

E NV and sw UT. Canyons, rocky slopes with sagebrush, juniper, pinyon, upwards to pine and aspen; locally common. Ca. 1700-2150 (-3050) m. May-June.

Astragalus marianus is a pretty little representative of the Argophylli with the combination of stiffly subsericeous leaf pubescence and "cotton-ball" pods. It is closely related to A. argophyllus from which (as to $A$. argophyllus var. martinii) it is scarcely distinguishable in flower.

Astragalus massiliensis (Mill.) Lam.
Caespitose, armed, pubescent subshrub. Pubescence dolabriform. Leaflets ca. $7-25$, elliptic, $4-6 \mathrm{~mm}, 2-4 r$; rachis persistent as a spine. Racemes intercalary, mostly included, with $3-8$, ascending-spreading flowers 13-17 mm; calyx teeth ca. 1 mm ; corolla white. Legumes ascending, bilocular (?), dehiscent, deciduous from receptacle, oblongnaviculate, subterete, $9-12 \mathrm{~mm}$; valves coriaceous, separating at apex. Sw Europe. Rehder (1940). No U.S. material seen.

## Astragalus megacarpus (Nuttall) Gray

Map 115
Phaca megacarpa Nutt. (1838); A. megacarpus (Nutt.) Gray (1864).
A. megacarpus var. parryi Gray ex Wats. (1876); A. megacarpus var. prodigus Sheld. (1894).
Tufted, acaulescent or subacaulescent, glabrate or strigulose perennial from superficial, slightly or evidently thatched, branched
caudices with clustered leaves and annual growth $0.5-5 \mathrm{~cm}$. Leafstalk $5-15 \mathrm{~mm}$; leaflets $9-17$, broadly obovate to elliptic, $5-15 \mathrm{~mm}, 1.2-2 r$. Stipules loosely imbricate, amplexicaul but free, commonly purplish. Racemes appearing before full expansion of leaves, subsequently included, 1-3 (-5) cm with 2-5 (-7) clustered, erect, narrow flowers $17-22 \mathrm{~mm}$; peduncles elongating and declinate in fruit. Pedicels in flower $3-5 \mathrm{~mm}$, in fruit $5-8 \mathrm{~mm}$. Calyx tube cylindric, strigulose, 6-8 $(-10) \mathrm{mm}$; teeth $1.5-3(-5) \mathrm{mm}$. Corolla white, bicolored or pinkpurple, drying violet. Ovules $30^{+}$. Legumes ascending and humistrate, stipitate by a gynophore $1.5-4 \mathrm{~mm}$, unilocular, deciduous, tardily dehiscent; body bladdery-inflated, ovoid-ellipsoid or -lanceoloid, slightly asymmetric, subterete, $4-8 \mathrm{~cm} \times 1.5-3 \mathrm{~cm}$ (to 4 cm wide on some pressed specimens); valves frequently mottled, diaphanous, strigulose to glabrate; dehiscence on ground, apical. Megacarpi: Megacarpi.

From s UT, ne to sw WY and contiguous nw CO; disjunctly in Converse Co., WY, and s Elko and adjacent Eureka cos., NV. Hillsides, ridges, canyons, badlands, mostly in gravelly clays or eroded shale, usually with sage and pinyon-juniper, upwards to pine. Ca. 1500-2150 m. April-May (-June).

The "great bladdery milk-vetch" is unmistakable by the combination of its subacaulescent habit and mammoth, usually mottled, diaphanous pods.

Astragalus melilotoides Pall.
Tall, branched, strigose perennial with Melilotus aspect. Leaves conspicuously petioled, oblong-lanceolate; leaflets $3-5$, those of upper leaves mostly 3 and palmate; stipules free. Racemes elongate and loose with $20+$ flowers $4-5 \mathrm{~mm}$; corolla pink with maculate keel. Legumes ascending, substipitate, deciduous, ovoid to obcordate, ca. $3-4 \mathrm{~mm} \times 2 \mathrm{~mm}$, bilocular, ventrally carinate, dorsally sulcate, papery, reticulate, glabrous. N Asia.

Two old PIs (NA).

## Astragalus michauxii (Kuntze) Hermann

Map 116
A. glaber Michx. (1803) non Lam. (1783); Tragacantha michauxii Kuntze (1891); A. apilosus Sheld. (1894); Tium apilosum (Sheld.) Rydb. ex Small (1903); T. michauxii (Kuntze) Rydb. (1929); A. michauxii (Kuntze) Hermann (1948).

Glabrate or strigulose perennial from a subterranean crown with solitary or few, ascending or erect, usually simple, glabrate stems 3-10 dm. Leafstalk $8-15 \mathrm{~cm}$; leaflets 21-31, often not paired, elliptic to
oblong, 6-25 mm, 3.5-8 r. Stipules free. Racemes exserted, elongate, with $10-20+$, loosely disposed, ultimately spreading or declined flowers $12-18 \mathrm{~mm}$. Calyx tube $5-6 \mathrm{~mm}$, with a fringe of pubescence about orifice; teeth ca. 1-2 mm. Corolla white-striate to pinkish-lavender, faded on specimens. Ovules $30+$. Legumes upcurved-ascending, sessile to substipitate, semibilocular, persistent, dehiscent; body oblongfalcate to straight, subterete-cordate, $2-3 \mathrm{~cm} \times 4-6 \mathrm{~mm}$, dorsally sulcate; valves coriaceous, cross-striate, glabrous; dehiscence apical, ventral or both sutures. Michauxiani.

Se NC and adjacent SC; sc GA and contiguous SC. Coastal Plain and Piedmont; pine woods, turkey oak scrub, sand hills with wire grass; common. (March-) April-May.

This is the only tall Astragalus of the southeast, save A. canadensis of the North Carolina mountains, which has connate stipules and much smaller pods. The known distribution falls into the two discrete areas as described. A disjunct Florida station (Barneby, 1964) is based on a Schallert specimen that probably came from North Carolina and should be disregarded.

Astragalus microcephalus Willd.
Villous-canescent shrub; leafstalk $1.5-2.5 \mathrm{~cm}$, persistent, spinetipped. Leaflets ca. 9-13, oblong, ca. 5-15 mm, mucronate, commonly folded; stipules connate. Racemes foliose, intercalary or terminal; flowers sessile, 2-3 per axil; calyx glabrous at base, villous above; teeth $>$ tube; corolla yellow, $8-11 \mathrm{~mm}$. Legume ca. 4 mm , included within marcescent corolla, unilocular, 1 -seeded. W Asia.

An old PI voucher (NA), lacking flowers, is probably this species.

## Astragalus microcymbus Barneby (1949)

Map 130
Rhizomatous, pubescent perennial from a subterranean crown with contiguous, prostrate to ascending, branched stems $3-6 \mathrm{dm}$. Leaves divaricate or descending; leafstalk 2-3.4 cm; leaflets (9-) 11-13 $(-15)$, obovate to oblong, $4-9 \mathrm{~mm}$, ca. $3-4 r$, folded, glabrate above. Lower stipules connate. Racemes intercalary, usually unequally paired, elongating in fruit, bearing 7-12, diffuse, soon spreading and declined flowers $5-6 \mathrm{~mm}$. Pedicels ca. 0.5 mm , elongating to $1-1.5 \mathrm{~mm}$ in fruit. Calyx tube campanulate, $1.5-2 \mathrm{~mm}$; teeth ca. 0.5 mm , Corolla whitish to faint lavender with dully maculate keel. Ovules ca. 5. Legumes deflexed, incipiently stipitate, unilocular or with a negligible septum, briefly persistent, dehiscent; body ellipsoid, straight or slightly decurved, obcompressed, $6-9 \mathrm{~mm} \times$ ca. 3 mm , dorsally sulcate; valves stiffly papery, puberulent; dehiscence apical, ventral. Strigulosi.

CO, Gunnison Co. Locally endemic; habitats as listed below. Ca. 2300-2400 m. June-July.

Astragalus microcymbus, with a strongly developed rhizome system, connate stipules, paired racemes, tiny flowers, and small, nearly unilocular pods, is unique in its region. It was discovered by Barneby in 1945 on the roadside of U.S. highway 50 about four miles west of Gunnison ("at the western limit of the floodplain of the Gunnison River just before it enters the canyon at Hierro"; Barrell, 1969), and recollected at the same spot by Weber ten years later. Despite search by both of these individuals, the plant was not found elsewhere. The fact that the presumed nearest relatives are Mexican leads to speculation (Barneby, 1964; Weber, pers. comm., 1980) that A. microymbus might be an introduction from an unknown native origin. Barrell (1969), however, triumphantly announced its discovery at the base of a "low cliff of granite in the drainage of South Beaver Creek." This locality has since been verified by colleagues of Weber and another one was discovered: "Powderhorn Valley, along Deldorado Creek, vicinity of old cow pens." Presumably then, the plant is a native, but out of the three population sites one is ruderal and a second has been strongly disturbed.

## Astragalus microcystis Gray

Map 117
A. microcystis Gray (1864); Phaca microcystis (Gray) Rydb. (1900).
A. miser auct.

Pubescent perennial from a superficial caudex with numerous, branched, trailing to ascending stems 1.5-3 (-4) dm. Leafstalk 2-6 cm; leaflets 11-15 (-17), elliptic to oblong, 4-10 (-15) mm, 3-5.5 $r$, usually glabrate above. Stipules mostly connate. Racemes included to shortexserted with 6-12 (-15), laxly spaced, ascending, ultimately declined flowers $5-8 \mathrm{~mm}$. Calyx tube $1.5-2 \mathrm{~mm}$; teeth $1-2 \mathrm{~mm}$. Corolla pinklavender or whitish, pink-striate or -tipped; keel acute to subporrect. Ovules 6-8. Legumes spreading or declined, sessile, unilocular, deciduous, tardily dehiscent; body bladdery-inflated, plumply obovoid or short-ellipsoid, symmetric or approaching half-ovoid, subterete, 9-12 $\mathrm{mm} \times$ ca. 5 ( -7 ) mm; valves papery, strigulose or villosulous; dehiscence presumably on ground. Ervoidei: Microcystei.

Upper Columbia Basin, w MT to ne WA. Open rocky areas or woodlands, channels and bars near rivers, lake shores; locally common. Ca. 350-1850 m. (April-) May-Aug.

This species has the characteristic features of the Ervoidei, superficial origin, connate stipules, modest flowers, few ovules and
seeds, but uniquely, an inflated pod. It is a sibling of Astragalus vexilliflexus in the sense that it and the caulescent phases of the latter are scarcely distinguishable before fruiting.

Astragalus micromerius Barneby (1948)
Map 113.
Hosackia nana Wats. (1885); Lotus nanus (Wats.) Heller (1898); Syrmatium nanum (Wats.) Heller (1913); non Astragalus nanus DC. (1802).
Diminutive, villous-cinereous, mat-forming perennial from superficial, branched caudices $0.5-3 \mathrm{~cm}$. Leafstalk ca. 0.5-1 (-2) cm; leaflets contiguously pinnate to subpalmate, 5-7 (-9), elliptic, mostly involute or folded, 1-3 (-5) mm, 2-4 $r$. Stipules connate, conspicuously cuplike on stems. Racemes pedunculate $4-10 \mathrm{~mm}$, submerged or slightly exserted with 1-3 flowers $5-6 \mathrm{~mm}$. Flowering pedicels $<1 \mathrm{~mm}$. Calyx tube $1.5-2.5 \mathrm{~mm}$; teeth ca. 1 mm . Corolla white or faintly lavender; keel maculate. Ovules 4. Legumes humistrate, sessile, unilocular, deciduous, probably tardily dehiscent; body ovoid or asymmetricincurved, obcompressed, $4-5 \times 2.5-3 \mathrm{~mm}$; dorsal face shallowly sulcate; valves papery, villosulous; dehiscence presumably on ground, apical. Humistrati: Micromeri.

Nw NM (San Juan, Rio Arriba, and McKinley cos.). Ledges, sandstone cliffs, or talus; pinyon-juniper. Ca. 2000-2200 m. Infrequent (or inevident) and local. July-Aug.

Astragalus micromerius, an inhabitant of a "singularly bleak and waterless country" (Barneby, 1964), is a miniature plant with subpalmate leaves. Its aspect, especially of the leaves, resembles that of a starved Symatium-Lotus, which resulted in its first description as a Hosackia.

## Astragalus miguelensis Greene <br> Map 129

A. miguelenis Greene (1887); Phaca miguelensis (Greene) Rydb. (1929); A. vestitus var. miguelensis (Greene) Jeps. (1936).

Cinereous or white, tomentose-pannose prostrate or moundforming perennial from superficial or aerial, sometimes thatched caudices with branched, decumbent to ascending stems to 3 dm . Leafstalk usually curved, $4-10 \mathrm{~cm}$; leaflets $17-25$, elliptic or obovate, obtuse or retuse, $5-15 \mathrm{~mm}$, 1.5-3 $r$. Stipules connate, often obscurely so. Racemes $\pm$ leaves with (5-) 10-20, crowded, ascending to spreading flowers $12-16 \mathrm{~mm}$; axis little elongating in fruit. Calyx tube $4-5 \mathrm{~mm}$; teeth $1-1.5 \mathrm{~mm}$. Corolla white or ochroleucous, wings $\pm$, or $>$ standard. Ovules $25-30+$. Legumes ascending or spreading, sessile, unilocular or subunilocular, deciduous, tardily dehiscent; body
bladdery-inflated, ovoid, subterete to slightly obcompressed, 1.5-3 $(-3.5) \mathrm{cm} \times 1-2 \mathrm{~cm}$; dorsal and ventral faces slightly sulcate or not; valves papery, villosulous, the pubescence thinning, and valves finally glabrate; dehiscence after falling, apical, then ventral, or only by weathering. Anemophili.

CA, Channel Islands, San Miguel s to San Clemente. Dunes, bluffs, beaches mostly adjacent to the ocean and comon. April-July.

This is the only insular Astragalus with inflated, sessile pods. In flower it resembles $A$. nevinii and $A$. traskiae, but these species have free stipules and usually smaller leaflets.

## Astragalus minthorniae (Rydberg) Jepson

Maps 118,119
Villous or strigulose perennial from a superficial or sightly subterranean caudex with clustered, erect (-decumbent to ascending), usually scarcely branched stems 1-3 (-4) dm; lower nodes crowded, only 2-3 internodes elongating. Leafstalk $5-15 \mathrm{~cm}$; leaflets (9-) 11-19, obovate to elliptic, obtuse, $6-20(-25) \mathrm{mm}, 1.5-2(-3) r$. Stipules free, dimorphic; the lower clustered, conspicuous, amplexicaul, woolly in one variety, the upper narrow. Racemes exserted, usually longer than foliose stems with $6-20+$, loosely spaced, ascending or spreading flowers $12-18 \mathrm{~mm}$. Calyx tube subcylindric, $4-6 \mathrm{~mm}$; teeth $1.3-2.5 \mathrm{~mm}$. Corolla ochroleucous and maculate to dull purplish or bicolored. Ovules ca. 20-30+. Legumes ascending or irregularly spreading (-deflexed), sometimes humistrate, subsessile to stipitate $0.5-1.5 \mathrm{~mm}$, bilocular, persistent or slowly deciduous with pedicel, slowly dehiscent; body oblong (-oblanceolate), straight or curved $20^{\circ}-80^{\circ}$, subterete when immature, ultimately laterally compressed but turgid, $1.5-2.3 \mathrm{~cm}$ $\times 4-6 \mathrm{~mm}$; valves initially fleshy, sometimes mottled, becoming coriaceous, black- to white-villous or strigose; dehiscence apical, both sutures. Malaci: Ensiformes.

E and s NV and adjacent CA; w UT and nw AZ.
Astragalus minthorniae has conspicuous, dimorphic stipules, and persistent, coriaceous, bilocular, finally turgid but laterally compressed pods, which, except for variation in var. gracilior, are usually nearly straight and ascending. Its closest relative is probably A. malacoides, (Utah, Kane, and Garfield cos.), which has similar, but strongly curved and distinctly stipitate pods, and larger flowers.

The interpretation of var. gracilior, differing from that of previous authors (Barneby, 1964, Welsh, 1978), is explained under text of that variety.

Key to varieties of Astragalus minthorniae

1. Lower internodes and lower stipules woolly with hairs mostly $>1$ mm ; leaves subappressed-villous or canescent, usually cinerous; intergradient with var. minthorniae following; NV, primarily Clark Co. (records also, Nye and Esmeralda cos.); also adjacent CA. var. villosus
2. Stems and foliage strigose with hairs $<1 \mathrm{~mm}$, cinereous or green; stipules glabrate.
3. Legumes (2-) $2.5-3 \mathrm{~cm}$, curved $20^{\circ}-80^{\circ}$; Washington Co., UT, and contiguous AZ. var. gracilior
4. Legumes $1.5-2.5 \mathrm{~cm}$, nearly straight; NV, White Pine and Lincoln cos.
var. minthorniae

Var. gracilior (Barneby) Barneby
Map 119
A. ensiformis Jones (1923); Hamosa ensiformis (Jones) Rydb. (1927); A. ensiformis var. typicus Barn. (1944).
A. ensiformis var. gracilior Barn. (1944); A. minthorniae var. gracilior (Barn.) Barn. (1956).
A. ursinus auct.

Range as given in key. Sagebrush, pinyon-juniper, blackbrush, sandy or clay soils. Ca. 1150-2150 m. April-May.

Barneby (1964) distinguished Astragalus ensiformis, known to him from two collections from the type area in northern Mohave Co, Arizona, from A. minthorniae var. gracilior of contiguous Washington Co., Utah, on the basis of its slightly subterranean origin, decumbent to ascending (rather than erect) habit, and more spreading or declined (rather that ascending) pods. Welsh (1978), who had the opportunity to see additional collections, believed the differences to be those of individual variant populations and unsubstantial taxonomically. He, therefore, took up $A$. ensiformis inclusive of $A$. minthorniae var. gracilior as a single taxon, A. ensiformis. I am accepting Welsh's view regarding the probable unity of this group, but am regarding it as yet another segregate of $A$. minthorniae. Thus, $A$. minthorniae var. gracilior herein is A. minthorniae var. gracilior of Barneby plus his $A$. ensiformis.

I wonder if the variation among representatives of this variety might not be due to past hybridization with Astragalus malacoides (of adjacent Kane Co.) which has curved pods.

Var. minthorniae
Map 118
Hamosa minthorniae Rydb. (1927); A. minthorniae (Rydb.) Jeps. (1936) quoad basionym.

Range as given in key. Stony slopes with sagebrush, pinyonjuniper. Ca. 1850-2150 m. April-May.

Although the stems and foliage are inconspicuously strigulose, the calyces and pods are villous.

## Var. villosus Barneby (1950)

Map 118
Range as summarized in key, more explicitly: common, NV, in Charleston Mts. and adjacent San Bernardino Co., CA; also NV, Esmeralda Co., and adjacent Inyo Co., CA; also San Bernardino Mts., sw San Bernardino Co., CA. Desert mts., gravelly slopes and washes, pinyon-juniper, sagebrush, limestone soils; locally abundant. Ca. 13502300 m. April-June.

These plants range in habit from erect, clustered-caespitose with a subacaulescent aspect to robust-sprawling with about three welldeveloped internodes and long racemes. Pubescence variation weakens the morphological distinction between this variety and var. minthorniae, and some specimens are assigned to the respective varieties primarily on the basis of origin.

Astragalus miser Douglas ex Hooker (1831)
Maps 120-124
Subacaulescent or caulescent, tufted or diffuse, cinereous or greenish, pubescent perennial from a taproot and usually ascending, superficial, or partly subterranean caudices bearing both sterile, basal leaf tufts and clustered, scarcely elongating, or evident decumbent to erect stems 0.3-4 dm. Pubescence basifixed or partly or mostly dolabriform, abundant or scant, usually strigose. Leaves commonly subradical; leafstalk $1.5-15 \mathrm{~cm}$; leaflets (5-) $7-19$, broadly elliptic to linear, 13-20 mm; (2-) 3-15 (-18) $r$, flat, folded, or inrolled, pubescent or glabrate above; terminal leaflet articulate or continuous with rachis. Lower stipules connate, commonly imbricate. Racemes incurvedascending to erect, included or usually exserted, compact or loose in fruit, with $5-10(-20)$ ascending to spreading flowers $6-12 \mathrm{~mm}$. Calyx tube $2-5 \mathrm{~mm}$; teeth (0.5-) 1-2 (-2.5) mm. Corolla white or ochroleucous, faintly pinkish to pink-purple, often striate; keel maculate and conspicuous, $>$ or $\pm$ wings, upcurved into a lanceolate or porrect tip. Ovules 5-20. Legumes irregularly spreading to pendulous, sessile or rarely substipitate to 0.7 mm , unilocular, persistent, dehiscent; body linear to oblanceolate, straight or slightly curved, laterally compressed but turgid, (1-) $1.5-2.5 \mathrm{~cm} \times(2-) 3(-4) \mathrm{mm}$; valves stiffly papery, usually pubescent (-glabrous); dehiscence distal, both sutures, somewhat elastic. Genistoidei.

Rocky Mts. and adjacent provinces, S Canada to e NV, AZ and CO. WA to w MT, s to e NV (-AZ), w to CO, disjunct in SD (Black Hills). Arid grasslands, sagebrush, coniferous forest to upper elevation ridges and slopes. (May-) June-Aug.

Astragalus miser is one of the truly common and abundant species of Astragalus throughout most of the Rocky Mountains. It is said to be poisonous and is regarded as a range weed. Among those of superficially similar aspect, e.g., A. flexuosus, A. tenellus, it is most quickly recognized by its conspicuous, exserted keel. It is otherwise characterized by its superficial origin, basal leaf tufts, and usually sessile, oblong, turgidly compressed legumes. Plants range from caespitose-tufted to strongly caulescent.

Members of the Astragalus miser group at one time passed under several binomials in different states or regions. Prior authors who have interpreted it as a single multiracial complex include Cronquist (1943) and Barneby (1956b; 1964). The following lists seven somewhat confluent varieties.

## Key to varieties of Astragalus miser

1. Leaflets glabrate above, or pubescent marginally or slightly so along the midrib, some or most flat so that upper surface is visible; pubescence basifixed.
2. N and c Wa (-w MT); leaflets mostly narrow, 5-15 $r$; ovules $7-10$; robust plants with stems $1-3(-4)$ dm; flowers white to pink-purple var. serotinus
3. Not of WA; leaflets mostly ca. $5 r$ or ovules $13-18$; stems mostly 1-2 (-3) dm; flowers ochroleucous and maculate.
4. Ovary and legume glabrous (-strigulose); plants often appearing subacaulescent; flowers $7-13 \mathrm{~mm}$; w MT (-ID), nw WY, disjunct in SD (Black Hills). var. hylophilus
5. Ovary and legume pubescent (-glabrate); plants usually plainly caulescent; flowers $6.5-10 \mathrm{~mm}$; CO and UT, se WY (Carbon and Albany cos.), w to White Pine Co., NV and scattered stations in AZ.
var. oblongifolius.
6. Leaflets pubescent above but often inrolled so that upper surface is not visible; pubescence basifixed or largely dolabriform.
7. Flowers ochroleucous to pinkish; leaflets 7-13 or if more, pubescence partially filmy- or crisped-villosulous.
8. Pubescence appressed; leaflets inrolled, appearing linear, usually 7-13; w MT and adjacent ID, w to Custer Co.; s to ne NV, n UT and w border of WY.
var. tenuifolius
9. Pubescence partly or mostly spreading, sinuous and twisted; leaflets not inrolled, 11-17; Lemhi and Custer cos., ID, and Beaverhead Co., MT.
var. crispatus
10. Flowers usually pink-purple (-white); leaflets $9-19$; pubescence strigose.
11. Leaflets elliptic to oblanceolate, 3-5 (-8) r, with cinereous, subdolabriform or dolabriform pubescence; s MT (Carbon Co. and vicinity) and WY. var. decumbens
12. Leaflets elliptic to linear, 3-10 $r$; pubescence basifixed; ne WA to w MT.
var. miser

In the following descriptions, the leaflets are understood to be flat and the keel maculate unless otherwise stated.

Var. crispatus (Jones) Cronquist
Maps 120,121
A. campestris var. crispatus Jones (1923). A. decumbens var. crispatus (Jones) Cronq. \& Barn. (1947); A. miser var. crispatus (Jones) Cronq. (1953).
Low, cinereous, tufted plants to 1.5 dm with partly or mostly sinuous, twisted, villosulous subdolabriform (difficult to discern) pubescence. Leaflets 11-17, elliptic to oblong, ca. 5-7 $r$, pubescent both sides, the terminal confluent or not. Flowers ochroleucous to pinkish, $9-10.5 \mathrm{~mm}$. Ovules 6-12. Legumes crisped-villosulous.

Range as given in key. Open coniferous forests, rocky or shale slopes or ridges, talus, sage deserts; locally common. July.

This local variant is uniquely characterized by its pubescence. It is geographically peripheral to var. tenuifolius, and some material is intergradient.

Var. decumbens (Nuttall) Cronquist
Maps 120,124
Homalobus decumbens Nutt. (1838); Astragalus decumbens (Nutt.) Gray (1864); Phaca decumbens (Nutt.) Piper (1906); A. campestris var. decumbens (Nutt.) Jones (1923); A. miser var. decumbens (Nutt.) Cronquist (1953).
P. parvifolia Nutt. (1838).
A. divergens Blankinship (1905); H. divergens (Blankinship) Rydb. (1907).
H. camporum Rydb. (1906)

Usually low or diminutive, tufted (-strongly caulescent), subdolabriform or evidently dolabriform-strigose, cinereous plants to 1.5 (-2) dm. Leaflets 9-15, elliptic to oblong, 5-12 (-15) mm, 3-6 r, often appearing narrower due to folding, pubescent both sides; terminal
leaflet usually $\pm$ upper lateral ones and contiguous to them, jointed with rachis or confluent. Racemes compact (-loose). Corolla 7-9.5 mm, purple to lavender (white in the Big Horn Mts., n WY and in n Albany Co., Wy; probably elsewhere). Ovules 12-18. Legumes strigose

Range as given in key. Dry grassy or sagebrush slopes and plains, streams, bluffs; most characteristic of open areas of high plateaus dominated by sagebrush but somewhat upwards in open pine woods; common. Ca. 1700-2900 m. June-July.

Var. decumbens, characteristically of little, grey plants, with bright flowers, is one of the more attractive forms of $A$. miser. Some western Wyoming material, with paler flowers, and narrow and confluent, terminal leaflets, seemingly merges with the adjacent var. tenuifolius. Some Idaho specimens, conveniently called var. tenuifolius have some attributes of var. decumbens. One Fremont Co., Wyoming, collection has somewhat crisped pubescence.

Some recent gatherings from Nevada have been identified as var. decumbens, probably because they have some dolabriform pubescence. But the leaflets are glabrous above, the ovary is glabrous, and the origin is far disjunct from var. decumbens otherwise. The material is more reasonably referred to var. oblongifolius, which is otherwise known in eastern Nevada Mountains.

Var. hylophilus (Rydberg) Barneby
Maps 120,121
Homalobus hylophilus Rydb. (1900); A. hylophilus (Rydb.) Nels. (1909); A. campestris var. hylophilus (Rydb.) Jones (1923); A. convallarius var. hylophilus (Rydb.) Tidest. (1937); A. miser var. hylophilus (Rydb.) Barn. (1956).
Low, often subacaulescent plants to $1.5(-2) \mathrm{dm}$, with basifixed pubescence. Leaflets 9-12, elliptic to lanceolate, $5-20(-25) \mathrm{cm}, 2-4.5 r$, glabrate above; terminal leaflet usually articulate with rachis, adjacent to distal pair or distant. Flowers ochroleucous, 7-13 mm. Ovules 7-11. Legumes glabrous (-puberulent).

Range as given in key. Dry to mesophytic coniferous forest, meadows to open subalpine slopes, less frequently with sagebrush; common. (1000-) 1700-3050 m. May-June.

Var. hylophilus, a major phase of $A$. miser, is a neat little tufted plant with large, ochroleucous-maculate flowers and glabrous fruit. At the western edge of its range, it seemingly phases towards var. serotinus; at the southern margin, material with some pod puberulence possibly suggests a gradient towards var. oblongifolius. Var. hylophilus is not, however, in geographical contact with either of these varieties. It is, instead, sympatric in part with vars. crispatus,
decumbens, miser, and tenuifolius. Its virtue is possibly maintained by ecological isolation, the other varieties being xerophytes while var. hylophilus favors mesophytic habitats. With above-green, glabrate leaflets, var. hylophilus may be distinguished from the first three of these listed by their usually cinerous pubescence on both leaf surfaces. It also differs from vars. decumbens and miser by flower color. Var. tenuifolius has narow, inrolled leaflets and a pubescent pod.

Maps 120, 123
Astragalus miser Dougl. ex Hook. (1831); Phaca misera (Dougl. ex Hook.) Piper (1906) quoad basionym; Tium miserum (Dougl. ex Hook.) Rydb. (1929) quoad basionym.
A. strigosus Coult. \& Fisher (1893); A. griseopubescens Sheld. (1894); Homalobus strigosus (Coult. \& Fisher) Rydb. (1913); A. serotinus var. strigosus (Coult. \& Fisher) Macbr. (1922).

Range as given in key. With sagebrush or grass, less frequently in coniferous forests, occasionally of disturbed or ruderal areas, e.g., roadside banks. 350-1350 m. May-July.

Tufted to strongly caulescent plants, 1-3.5 dm, with basifixed, strigose pubescence. Leaflets ca. 9-19, elliptic to linear, 5-25 mm, 3-10 $r$, pubescent both surfaces, the terminal one continuous with rachis and distinctly raised above distal pair. Inflorescences usually loose; corolla pink-purple, 9-12 mm. Ovules 8-15. Legumes pubescent.

This showy variety is usually tufted with narrow leaflets and elongate racemes. It grades into its plainer neighbor, var. serotinus, in Washington.

Var. oblongifolius (Rydberg) Cronquist
Maps 120,122
Homalobus oblongifolius Rydb. (1907); A. hylophilus var. oblongifolius (Rydb.) Macbr. (1922); A. decumbens var. oblongifolius (Rydb.) Cronq. (1943); A. miser var. oblongifolius (Rydb.) Cronq. (1953).
H. decurrens Rydb. (1904); A. rydbergii Macbr. (1922); A. decumbens var. decurrens (Rydb.) Cronq. (1943); A. miser var. decurrens (Rydb.) Cronq. (1953).
H. microcarpus Rydb. (1907).
H. humilus Rydb. (1907); A. carltonii Macbr. (1922).
H. hitchcockii Rydb. (1929).

Plants often robust and caulescent, 1-2 (-3) dm, dwarfed in alpine or arid habitats, with basifixed pubescence (partly dolabriform in some NV material). Leaflets usually oblong and large, but to elliptic or
linear, 5-25 (-40) mm, 2.5-10 $r$, flat or folded, glabrous above; terminal leaflets various. Flowers $6.5-10 \mathrm{~mm}$, ochroleucous. Ovules ca. 13-18. Legumes pubescent (-glabrate), oblong-oblanceolate.

Range as given in key. With sagebrush, juniper, oak brush; upwards to dry or moist woods, pine, spruce, aspen, meadows, shale slopes, alpine ridges; common and abundant. Ca. 2000-3200 m. JuneJuly (-Aug.).

Var. oblongifolius, forming conspicuous and extensive carpets, is a typical sight of middle elevation Colorado and Utah forests where it is the only representative of $A$. miser. It is the most variable of the varieties, and its multiracial features have been described by Barneby (1956b, 1964). It approaches var. hylophilus, which lies to the north, and some plants in flower are essentially indistinguishable from that variety except for the ovary pubescence of var. oblongifolius. Dwarfed forms with folded leaflets look like var. tenuifolius.

Var. serotinus (Gray ex Cooper) Barneby
Maps 120,123
Astragalus serotinus Gray ex Cooper (1859); Phaca serotina (Gray ex Cooper) Piper (1906); A. decumbens var. serotinus (Gray ex Cooper) Jones (1902); A. campestris var. serotinus (Gray ex Cooper) Jones (1923); A. miser var. serotinus (Gray ex Cooper) Barn. (1956).
A. palliseri Gray (1864); Homalobus palliseri (Gray) Rydb. (1900).

Robust, usually caulescent, (1-) 1.5-3 (-4) dm, plants with basifixed pubescence. Leaflets typically large, elliptic-oblong, varying to linear-oblanceolate, $5-30 \mathrm{~mm}, 5-15 r$, usually flat, sometimes folded, glabrous and green above; terminal leaflet usually elevated and confluent with rachis. Racemes elongate; flowers white, pink, or purple, $7-10 \mathrm{~mm}$. Ovules 7-10. Legumes glabrous or strigulose.

Range as given in key; the disjunct w MT location is in the Kootenai Mts. Abundant n in Alberta and British Columbia. Grassy slopes and open areas in pine and fir forests. Ca. 200-1350 m. June-July.

Var. serotinus is contiguous to the purple-flowered var. miser and the two blend. Without knowing origin, I also find it difficult to distinguish some material of vars. serotinus and hylophilus.

Maps 120,124
Homalobus tenuifolius Nutt. (1838); A. miser var. tenuifolius (Nutt.) Barn. (1954).
H. paucijugus Rydb. (1907) non A. paucijugus Schrenk. (1843); A. garrettii Macbr. (1922).
A. miser var. praeteritus Barneby (1956).

Plants low-tufted (-evidently caulescent), commonly wispy, 0.4-2 dm, cinereous-strigose, the hairs dolabriform, often obscurely so, or partially or largely basifixed. Leaflets $7-13$, inrolled and appearing linear or linear-filiform, 3-15 (-20) mm, (5-) 8-18 $r$, pubescent both sides; terminal leaflets continuous with leafstalk and elevated. Racemes usually slender. Flowers white, ochroleucous or dull-striate, $6-9 \mathrm{~mm}$. Ovules 7-12. Legumes strigose.

Range as given in key. Grassland or with sagebrush or sagejuniper in open basaltic country; upwards to open pine and aspen and crests of mts.; locally common. Ca. 1500-2450 (-3350) m. JuneJuly (-Aug.).

Within its range, var. tenuifolius is easily recognized by its usually tufted aspect and narrow, involute leaflets. It possibly merges with the contiguous var. crispatus-a few plants have some spreading flexuous pubescence. It is partly sympatric with var. hylophilus from which it is usually isolated by habitat, the latter being characteristic of more mesic sites.

Var. tenuifolius herein includes both vars. tenuifolius and praeteritus of Barneby (1964), the latter representing the more northern aspects of the variety and said to be (wholly or in part) characterized by dolabriform pubescence, while that of var. tenuifolius is basifixed. I have not been successful in correlating pubescence variation with range. Barneby (1964) discussing the differences between the two varieties said, "the var. praeteritus is . . . often separable from var. tenuifolius by the form of the hairs alone, and the dolabriform hairs themselves are sometimes few and scattered, and moreover, affixed close to the lower end, so that in effect there is in this variety, a gradual transition from one type of vesture to the other."

Astragalus missouriensis Nuttall (1818)
Maps 125, 126
Subacaulescent to shortly caulescent, tufted or prostrate, cinereous, strigose perennial from superficial origin; caudices of older plants branched, clustered, and often elongate; young plants arising from a tap root; stems $0.1-1(-2) \mathrm{dm}$. Pubescence dolabriform. Leafstalk ca. $5-14 \mathrm{~cm}$; leaflets (7-) 11-19, obovate or elliptic, acute to obtuse, $5-15 \mathrm{~mm}, 2-3(-3.5) r$. Stipules free (-lower connate in var. humistratus). Racemes $\pm$ foliage, subscapose or evidently axillary, to $1(-1.5) \mathrm{dm}$, subumbellate with $3-10(-13)$, ascending or spreading, narrow flowers (7.5-) 14-25 (-30) mm, reclinate, somewhat elongating in fruit. Calyx tube cylindric (-campanulate), often dark-pigmented (3.5-) 6-9 (-10) mm, teeth (1-) 1.5-4 mm. Corolla pink-purple (-pale).

Ovules ca. (20-) $30^{+}$. Legumes ascending, divergent or humistrate, sessile, unilocular or subunilocular, persistent, dehiscent; body (broadly ovoid-) ovoid-ellipsoid to oblong-lanceolate, straight, or slightly incurved (-sharply incurved in local var. amphibolus), subterete or obcompressed or, at full maturity, laterally compressed to somewhat quadrangular, (10-) $12-25$ (-28) $\mathrm{mm} \times(4-) 6-9 \mathrm{~mm}$, usually abruptly straight-beaked; sutures conspicuous; valves initially fleshy and often dull-reddish, strigulose, becoming coriaceous, crossribbed, brown to black, strigulose or glabrate; dehiscence apical, both sutures and downwards, the valves slightly elastic. Argophylli: Missourienses.

S Canada to w TX. W MN and IA, w to MT, s to NM and TX. Primarily high plains and e slope of Rockies, moderately into Colorado and Rio Grande drainage; common. Introduced in hort. (Bailey Hort., 1976).

In most of its vast range, Astragalus missouriensis is, except for A. lotiflorus, the only subscapose Astragalus with few subumbelliform flowers and dolabriform pubescence; the latter species has a smaller, proportionately broader flower and campanulate calyx.

Astragalus missouriensis includes a single widespread variety and four local forms of ponderable affiliation.

## Key to varieties of Astragalus missouriensis

1. Flowers large, i.e., calyx $8 \mathrm{~mm}+$ and standard usually $15 \mathrm{~mm}+$; fruits $12-25 \mathrm{~mm}$; range of species except for c and w N.
2. Legumes straight, laterally compressed to quadrangular at maturity; stipules free; plants subacaulescent to shortly caulescent; stems $0-2(-8) \mathrm{cm}$; range of species except partly replaced by var. amphibolus in sw CO, and contiguous UT. var. missouriensis.
3. Legumes incurved-beaked or lower stipules connate; stems usually 2-4 (-20) cm; sw CO and adjacent UT.
4. Plants short-caulescent, the stems to $5(-10) \mathrm{cm}$; flowers 4-8; stipules free; Garfield to La Plata and Montezuma cos., CO, and Grand and San Juan cos., UT.
var. amphibolus
5. Plant strongly caulescent, the stems 1-1.5 (-2) dm; flowers $9-12$; some of lower stipules connate; Archuleta Co., CO. var. humistratus
6. Flowers small, i.e., calyx $4-6 \mathrm{~mm}$ and standard $7-11 \mathrm{~mm}$; fruits ca. 15 mm ; local, c and w NM.
7. Calyx 4.5-5 mm; corolla ochroleucous or lavender-tinged, to 9 mm ; standard reflexed ca. $90^{\circ}$; keel incurved $110^{\circ}-120^{\circ}$; McKinley and Catron cos., NM.
var. accumbens
8. Calyx 5-6 mm; corolla pink-purple, $9.5-11.5 \mathrm{~mm}$; standard reflexed ca. $45^{\circ}$; keel incurved ca. $90^{\circ}$; Valencia and Socorro cos., NM.
var. mimetes

Var. accumbens (Sheldon) Isely
Map 126
A. procumbens Wats. (1885) non Mill. (1768); A. accumbens Sheld. (1894); Batidophaca accumbens (Sheld.) Rydb. (1929); A. missouriensis var. accumbens (Sheld.) Isely (1983).

Range as given in key. Locally common in the Zuni and Datil mts.; canyons, banks, knolls. Ca. 2300 m. May.

Var accumbens differs from typical A. missouriensis in both size and conformation of the flowers, the calyx being comparatively broader and the shortly clawed petals more upswept. Decision as to whether it should or should not be classified as a separate species is subjective. See Barneby (1964) for the former view. I have referred it to A. missouriensis because the pod, though small and with fewer ovules, is essentially identical to that of var. missouriensis. Var. accumbens is similar in flower size to the contiguous var. mimetes from which it may have been derived.

Var. amphibolus Barneby (1947)
Map 126
Range as given in key. Oak-juniper-pinyon or sagebrush on sandstone or igneous soils. Ca. 1850-2450 m. May-June.

Except for the fruit, this plant looks like var. missouriensis, differing somewhat in the commonly emergent and branched stems, and perhaps fewer leaflets, mostly 7-13 (-15). But the pods, usually abruptly upturned at the tip and sometimes deciduous, technically suggest those of the more turgid forms of $A$. amphioxys. It is possible (Barneby, 1947, 1964) that these populations represent derivatives of hybridization between $A$. amphioxys and $A$. missouriensis.

Var. humistratus Isely (1983)
Map 126
Strongly caulescent with prostrate stems to 2 dm . Lower stipules slightly connate. Leaflets narrowly elliptic, ca. $3.5 r$, greenish to cinereous. Racemes robust with 9-12 flowers. Corolla pink-purple, fading light, wing-tips white. Legumes straight and persistent, as those of var. missouriensis but obcompressed to maturity.

CO, Archuleta Co. Clay knolls, shale; locally abundant. Ca. 20002200 m. May-June.

Var. humistratus is the "remarkable form" of A. missouriensis, briefly described by Barneby (1964) without nomenclatural decision. As more collections accumulated, he later (in herb.) referred specimens seen to var. amphibolus, with which they should perhaps be maintained-the two forms are of similar aspect and contiguous geographically. But var. humistratus is anomalous both in its strongly caulescent habit and the connate (slightly or evidently) lower stipules. Barneby (1964) suggested the possibility of hybrid origin between $A$. missouriensis and $A$. humistratus.

Var. mimetes Barneby (1964)
Map 126
A. accumbens auct. pro parte.

NM, w Soccoro and adjacent Valencia cos. Washes and banks. Ca. 1350-1700 m. April-May.

Var. mimetes differs from var. missouriensis in its smaller flowers and fruits. In these quantitative features, it resembles the var. accumbens, which in addition has proportionately modified flowers.

## Var. missouriensis

Map 125
A. melanocarpus Nutt. (1813; nom. nud.)
A. missouriensis Nutt. (1818); Xylophacos missouriensis (Nutt.) Rydb. ex Small (1903); A. missouriensis var. typicus Barn. (1947).
A. missouriensis var. [beta] T. \& G. (1838).
A. missouriensis fma. longipes Gand. (1902).
A. missouriensis fma. microphyllus Gand. (1902).
A. missouriensis fma. leucophaeus Gand. (1902).

Range of species except where replaced by varieties as related in key. Habitat and associates various dependent on origin. Prairies and plains: range grassland, knolls, outcrops, bluffs, washes, badlands, stream banks. W portion of range: with pinyon and sagebrush, cedar "woodlands," at higher elevations with pine. Most frequently in calcareous soils. Common and locally abundant. $350-2600 \mathrm{~m}$. (S, March-) April-June (-July).

Var. missouriensis is variable in flower size, vigor, level of caulescence, and legume size and shape. There is an irregular cline from smallest flowers in the north to largest in the south. Strongly caulescent forms seem to be most common in the southern part of the range. Observed diversity of the form of the pods is to some extent a function of maturity.
A. moencoppensis Jones (1891); Cnemidophacos moencoppensis (Jones) Rydb. (1929).

Seleniferous, tufted, sparsely foliose, strigulose, greenish perennial from a superficial caudex with clustered, branched, erect stems to 2.5 dm . Leafstalk $5-12 \mathrm{~cm}$; leaflets $9-11$ ( -13 ), distant, easily deciduous, oblong or linear, $5-20 \mathrm{~mm}, 6-20 r$, flat or involute-rolled, the terminal usually confluent. Lower stipules connate. Racemes elongate, exserted and spiciform, with villous axis and 10-many, ascending to spreading flowers $8-11 \mathrm{~mm}$. Pedicels $<1 \mathrm{~mm}$. Calyx tube villous, $3-4 \mathrm{~mm}$; teeth $2-3 \mathrm{~mm}$. Corolla purple to dull lilac, marcescent; keel upcurved ca. $100^{\circ}-110^{\circ}$. Ovules $4-6$. Legumes spreading or declined, sessile, unilocular, slowly deciduous with pedicel, tardily dehiscent; body largely included within calyx and persistent corolla, ovoid to ellipsoid, obcompressed, $6-7 \mathrm{~mm} \times 2.5-3.5 \mathrm{~mm}$, cuspidatebeaked; dorsal face flat; ventral suture salient; valves puberulous, thickly papery; dehiscence after falling, apical, the valves ultimately separating. Ocreati: Moencoppenses.

Se UT and adjacent AZ. Arid clay or sandy slopes, banks, talus, ledges, washes, with pinyon-juniper, shadscale, blackbrush; locally abundant. 1500-1750 m. (April-) May-July.

This species is marked by its greenish, ultimately semi-junceous facies, and slender racemes bearing villous calyces that, with the marcescent petals, largely enclose the tiny pods. It is allied to Astragalus sophoroides that, in turn, relates to the more widely distributed A. flavus.

Astragalus mohavensis Watson (1885)
Map 127
Cinereous or white-silvery annual or evanescent perennial from a tap root; stems few or numerous and untidily bushy-branched, (0.5-) $1.5-4 \mathrm{dm}$, white-strigulose. Leafstalk $3-12 \mathrm{~cm}$; leaflets $5-11$, obovate to elliptic, $5-15 \mathrm{~mm}, 1.3-2.5 r$. Stipules free. Racemes $\pm$ or $>$ leaves with $4-15$ loosely disposed, soon spreading to declined flowers $8-13 \mathrm{~mm}$. Flowering pedicels $0.5-1 \mathrm{~mm}$. Calyx tube $2.5-4.5 \mathrm{~mm}$, white- or mixedstrigulose; teeth $1.5-2.5 \mathrm{~mm}$. Corolla pink-purple; wings inconspicuously emarginate or erose; keel $\pm$ wings. Ovules 20-30. Legumes declined or humistrate, sessile or substipitate by gynophore 0.1-0.5 mm , semibilocular or subunilocular, deciduous, tardily dehiscent; body oblong to oblanceolate, nearly straight to gently incurved (or lunate to hamate), initally plump or subterete (scale-like when pressed), ultimately laterally compressed or triquetrous, $1.5-3 \mathrm{~cm} \times 3-8$ $(-10) \mathrm{mm}$, conspicuously beaked; sutures salient, the ventral raised on a thick flange; dorsal face depressed in one form; valves initially fleshy, becoming coriaceous, strigose to minutely hirsutulous; dehiscence
from raceme or on ground, apical and downwards, both sutures. Leptocarpi: Mohavenses.

Se CA and adjacent NV; $n$ Mohave desert and contiguous mountains.

This species is a cinereous-silvery (-greenish-cinereous), earlyflowering desert perennial with broad leaflets and pink-purple flowers (often faded on specimens but retaining the maculate keel). It is distinctive in fruit by its broad, laterally compressed, ventrally crested, coriaceous pods. Within the ventral flange, long funiculi extend downward, bearing the ovules and seeds in the cavity below. The two forms of Astragalus mohavensis cannot be distinguished save in fruit; their ambiguous relationships to one another and allied species have been reviewed by Barneby (1964).

## Key to varieties of $A$. mohavensis

1. Legumes straight or moderately incurved, laterally compressed or somewhat trigonous; sutures superficial and the ventral strongly carinate; dorsal face sulcate; range of species. var. mohavensis
2. Legumes curved to $180^{\circ}$, triquetrous and the dorsal face sulcate; local, Charleston Mts., Clark Co., NV, and ranges immediately w of Death Valley, Inyo Co., CA. var. hemigyrus

Map 127
A. hemigyrus Clokey (1942); A. mohavensis var. hemigyrus (Clokey) Barn. (1950).
Bicentric as given in key. Desert mts. with Larrea; rock ledges and gravelly slopes; local. Ca. 1200-1500 m. April-May.

It is not possible clearly to assert whether var. hemigyrus consists of fragments of one biological entity, or whether it represents two independent parallel extremes.

Var. mohavensis
Map 127
A. mohavensis Wats. (1885); Brachyphragma mohavense (Wats.) Rydb. (1929).
Range of species. Desert flats and mountain foothills, washes, dunes, canyons, with greasewood to pinyon-juniper; locally abundant. Ca. 900-2300 m. (March-) April-May.
A. mokiacensis Gray (1878); A. lentiginosus var. mokiacensis (Gray) Jones (1923); Tium mokiacense (Gray) Rydb. (1929).

Perennial from a superficial crown with erect, branching, glabrate or slightly pubescent stems 2-4 dm. Leafstalk 5-12 cm; leaflets 7-19, broadly obovate to ovate, rounded or emarginate, $6-20 \mathrm{~mm}, 1-2 r$. Stipules free. Racemes exserted with 10-20+, soon loosely disposed, ascending-spreading flowers $16-18 \mathrm{~mm}$; axis becoming $5-12 \mathrm{~cm}$ in fruit. Calyx tube $5-7 \mathrm{~mm}$; teeth ca. $1.5-2.5 \mathrm{~mm}$. Corolla purple. Ovules ca. 25-30+. Legumes ascending or spreading, sessile, semibilocular or nearly bilocular, persistent, dehiscent; body turgidly ellipsoid or broadly lanceoloid, straight or slightly incurved, subterete, moderately inflated, filiform-cuspidate tipped, $1.5-3 \mathrm{~cm} \times 5-7 \mathrm{~mm}$; dorsal face sulcate; valves initially fleshy, at maturity subcoriaceous, glabrate or puberulent; dehiscence presumably apical. Preussiani: Preussiani.

AZ, n Mohave Co., and adjacent Clark Co., NV. Bluffs, badlands, washes along Colorado and Virgin rivers; creosote bush to pinyonjuniper; locally common. April-June.

Astragulus mokiacensis, with seemingly persistent bilocular pods, consists of a few local populations that combine characters of the Preussiani and Diphysi. The enduring confusion about their relationships and identification has been detailed by Barneby (1964).

Five kinds of Astragalus of similar appearance are sympatric with Astragalus mokiacensis or contiguous to its area, and mature fruits are required for determination. The following key briefly distinguishes them.

1. Legumes bilocular or nearly so.
2. Legumes persistent, moderately inflated, $5-7 \mathrm{~mm}$ diam., glabrate or barely puberulent, straight or slightly curved, ascending. A. mokiacensis
3. Legumes deciduous, not otherwise with the above combination of characters.
4. Legumes strongly inflated, ca. 9-12 mm diam., glabrous, scarcely curved, ascending. A. lentiginosus var. ambiguus
5. Legumes scarcely inflated or moderately so, ca. 4-7 mm diam., puberulent or glabrous, commonly elongate and strongly curved, sometimes descending.
A. lentiginosus var. palans
6. Fruits unilocular.
7. Racemes loose, to 20 cm in fruit; legumes sessile or substipitate.
A. preussii var. laxiflorus
8. Racemes dense, axes 1-7 cm in fruit; legumes stipitate $2-7 \mathrm{~mm}$.
A. preussii var. preussii

Astragalus mollissimus Torrey (1827)
Maps 131, 132
Tufted, subacaulescent to short-caulescent, tomentose perennial from a superficial, branched caudex; the stems, when developed, clustered, $1.5-15 \mathrm{~cm}$, shorter than peduncles, prostrate-ascending. Pubescence initially whitish or cinereous, turning tawny, densely villous-tomentose with both short, curly, and longer sinuous hairs, the latter 1-3 mm, most conspicuous on leaf rachises. Leafstalk 5-20 (-25) cm; leaflets 15-33 (-35), obovate, ovate, elliptic or rhombic, subacute, 1-3 (-3.5) mm, 1.5-3 r. Stipules free, imbricate, often large, to 1.5 cm and attenuate-tipped. Racemes $\pm$ or $>$ leaves, usually ascending, oblong, dense or loose, with 16-many, ascending or spreading flowers $12-20 \mathrm{~mm}$; usually reclinate in fruit with axis elongating or not, 2-15 cm . Calyx tube cylindric or subcylindric, $5-10 \mathrm{~mm}$; teeth $2-5 \mathrm{~mm}$. Corolla purple, bicolored (white-tipped), or ochroleucous. Ovules ca. 25-30+. Legumes ascending or spreading, sessile, bilocular, but beak unilocular, quickly deciduous, dehiscent; body plump-ellipsoid, oblongellipsoid or lanceoloid, slightly bent or incurved to $90^{\circ}$, obcompressed to subterete, with short, conical beak, $10-25 \mathrm{~mm} \times 4-8(-9) \mathrm{mm}$; dorsal and ventral faces both depressed; valves glabrous or puberulenttipped (-puberulent entire surface with hairs $<1 \mathrm{~mm}$, w extremity of range), coriaceous to woody; dehiscence initiating on racemes or on ground, apical. Mollissimi: Mollissimi.

SD, s into Mexico; Mississippi and Rio Grande drainage. From SD (-ND), s across e WY and c and w NE to e NM and w TX.

In the high plains, Astragalus mollissimus is a common semiweedy locoweed, easily recognized by its tomentose, subacaulescent aspect, bright flowers and the glabrous, often plump, bilocular, sulcate pods. The pods are quickly deciduous, leaving the divergent to reclinate peduncles messy with the persistent calyx and bract remnants.

The Astragalus mollissimus complex has been variously interpreted as one to five species. I include three species (A. mollissimus, A. bigelovii, A. thompsonae). This view differs from that of Barneby (1964), who treats the group as one species with several varieties, in that I feel that the critical mass of each of the widely distributed, geographically vicariant groups outweighs negligible peripheral intermediacy. A. mollissimus and A. bigelovii are sympatric only in west Texas and immediately contiguous New Mexico, where they can be distinguished by the long pubescence and the 2 -celled beak of the pods of $A$. bigelovii. Also, the calyx pubescence of $A$. mollissimus tends to be appressed whereas that of $A$. bigelovii is longer and villous. I have seen no intermediates, and Barneby mentions none. A. mollissimus
and $A$. thompsonae are entirely allopatric, and there are no intermediates. The A. thompsonae-A. bigelovii interface, indeed ambiguous, is discussed under A. bigelovii.

Astragalus mollissimus is one of the most abundant "locoweeds." Its poisonous nature is not due to the accumulation of selenium, but to the presence of a physiologically active substance, locoine.

## Key to varieties of Astragalus mollissimus

1. Petals cream-colored to ochroleucous; local, w Edwards Plateau, sc to sw Texas (Sterling, Reagan, Upton, Crockett cos.). var. coryi
2. 3. Petals purple to lavender or bicolored (-ochroleucous or white); not sympatric with above.
1. Legumes glabrous or slightly pubescent at apex, often 15-20 (-25) mm; calyx tube usually exceeding 3 mm diam. at apex; keel $14-18 \mathrm{~mm}$ (these flower dimensions various in Texas Panhandle, see text); range of species except for most of trans-Pecos Texas and the Edwards Plateau, intergradient with the following in Texas Panhandle. var. mollissimus
2. Legumes shortly villosulous (-glabrate), often not exceeding 15 mm ; calyx tube slender, $2-3 \mathrm{~mm}$ diam.; keel $9-13 \mathrm{~mm}$; trans-Pecos Texas.
var. earlei
Var. coryi Tidestrom
Map 132
A. argillophilus Cory (1930); A. mollissimus var. coryi Tidestr. (1937).

Range as given in key. Habitat probably similar to that of var. mollissimus. March-May.

Var. coryi differs from var. mollissimus in flower color, and often has larger, greener leaflets. It is vicariant with respect to the other varieties and there are no intermediates. Collectors have not recorded habitat data.

Var. earlei (Greene ex Rydberg) Tidestrom
Map 132
A. earlei Greene ex Rydb. (1929); A. mollissimus var. earlei (Rydb.) Tidestr. (1935).
A. pervelutinus Rydb. (1929).

Range as given in key; s into Mexico. Canyons, gravel bars, rocky hillsides, desert grassland, roadsides; usually igneous or limestone soils; locally abundant. Ca. 1050-1850 m. March-June.
"Ideal" var. earlei with pubescent pods and small, narrow flowers is restricted to trans-Pecos Texas. Populations are not entirely consistent, and a few have the glabrous pods or larger flowers of var.
mollissimus, or the ochroleucous flowers of var. coryi. The change from var. earlei in west Texas to var. mollissimus to the north in the Panhandle is clinal. Material from the Panhandle with the glabrous pods of var. mollissimus but the smaller flowers of var. earlei, was appropriately mapped by Barneby (1964) as intermediate. I have arbitarily defined var. earlei as inclusive only of those plants with both pubescent pods (sometimes with but a trace of hairs) and small flowers that are limited to trans-Pecos Texas. I am calling all of the glabrous-fruited Panhandle material var. mollissimus, with the acknowledgement that it is variable in flower size in this peripheral part of its range.

Var. mollissimus
Map 132
A. mollissimus Torr. (1827).

Phaca villosa James ex Wats. (1878) in syn.
A. simulans Cockerell (1902).
A. mollissimus fma. flavus McGregor (1960).

Range as given in key. Plains and prairie remnants, overgrazed range, knolls, upward to open woodland in NM; roadsides; various soil types, common and abundant (a herb label: "grows everywhere"). 5001850 (-2150) m. S: April-May, N: May-June.

Flower color of var. mollissimus, from pale lavender (-ochroleucous) to bright or sordid red-violet, varies both between regions and within single populations.

The confluent varieties mollissimus and earlei are delimited as indicated in the key and amplified in the discussion of the latter variety. A few southern New Mexico populations include both glabrous and slightly pubescent pods.

Astragalus molybdenus Barneby (1950)
Map 132
A. plumbeus Barn. (1949) non Gontsch. (1946)

Rhizomatous-stoloniferous, mat-forming, slightly pubescent perennial from subterranean caudices; stems solitary but contiguous, often subcaespitose, decumbent to ascending, 1-6 (-10) cm , glabrate to strigose. Leafstalk 1-7 cm; leaflets (9-) 13-19 (-25), ovate to ovateoblong, often folded or involute, $3-9 \mathrm{~mm}, 1.4-3 r$, cinereous-strigose or pilosulous, or glabrate above. Stipules connate. Racemes 1-2, short, ascending, reclinate in fruit, subcapitate with 2-4 (-5) ascending flowers $10-12 \mathrm{~mm}$; axis scarcely elongating. Pedicels ca. 1 cm . Calyx tube black-strigose, $3-4 \mathrm{~mm}$; teeth $1.5-2 \mathrm{~mm}$. Corolla pink-purple or whitish and striate; petals graduated. Ovules ca. 6-7. Legumes (rarely seen on specimens) ascending-humistrate, sessile to incipiently stipitate,
essentially unilocular, persistent, tardily dehiscent; body obliquely ellipsoid, slightly incurved, somewhat triquetrously compressed, 7-10 $\mathrm{mm} \times 3-4 \mathrm{~mm}$, beaked; valves chartaceous and black-strigose. Minerales.

C CO, and disjunctly MT, Teton Co. Alpine tundra; rocky turf and bare areas; locally abundant. 3500-4000 m. July.

Astragalus molybdenus, with the habit of $A$. alpinus and $A$. leptaleus, is limited, to present knowledge, to alpine tundra within a small area of Colorado. It differs from both of the above-named species in its ascending pods; it differs from $A$. alpinus (which occasionally ascends to the tundra) in its graduated petals, and from A. leptaleus, of much lower elevations, in its cinereous foliage and usually more numerous, purple flowers. It is compared with the recently described $A$. shultziorum of Lincoln County, Wyoming, under text of that species.

Astragalus monoensis Barneby (1944)
Map 137
Rhizomatous, strigulose or villosulous, cinereous perennial from an underground crown with clustered, prostrate stems 0.3-1 (-1.5) dm. Leafstalk $0.5-3 \mathrm{~cm}$; leaflets $7-15$, suborbicular, obovate or elliptic, 3-8 mm, 1.8-2.5 r, commonly folded. Lower stipules connate. Racemes subcapitate, $\pm$ or $>$ foliage with $3-12$ spreading flowers $5-12 \mathrm{~mm}$, little elongating in fruit. Flowering pedicels $0.5-1 \mathrm{~mm}$. Calyx tube 2.54.5 mm ; teeth $0.5-1.5 \mathrm{~mm}$. Corolla white to lilac; keel incurved $100^{\circ}-125^{\circ}$. Ovules ca. $15-30$. Legumes spreading or humistrate, sessile, semibilocular or subunilocular with septum $0.3-2 \mathrm{~mm}$, slowly deciduous with pedicel or from receptacle, dehiscent; body asymmetricovoid to oblong-lanceolate, straight or lunate, obcompressed, $0.8-2 \mathrm{~cm}$ $\times 5-8 \mathrm{~mm}$; dorsal face sulcate, ventral depressed or not, the suture carinate; valves papery, cross-rugulose, villosulous or strigulose; dehiscence apical, both sutures. Monoenses.

CA, local in Sierra Nevada in Mono, Fresno, and Inyo cos.
Astragalus monoensis is a rare, rhizomatous, mat-forming plant with tiny, cinereous leaves and small, obcompressed, incompletely two-celled pods. The differences between the two varieties are quantitative.

## Key to varieties of Astragalus monoensis

1. Racemes 6-12 flowered; calyx tube $3-4.5 \mathrm{~mm}$; standard $10-13 \mathrm{~mm}$; legume septum ca. 1-2 mm wide; Mono Co.
var. monoensis
2. Racemes 3-6 flowered; calyx tube $2.5-3.3 \mathrm{~mm}$; standard ca. $5.5-8.5$ mm ; legume septum ca. $0.3-1 \mathrm{~mm}$ wide; Fresno and Inyo cos. at Sawmill Pass.
var. ravenii

Var. monoensis
Map 137
A. monoensis Barneby (1944).

Range as given in key; e slope of Sierra Nevada, upper drainage of Owens River. In sand or pumice. Ca. 2300-2900 m. June-Aug.

Var. ravenii (Barneby) Isely
Map 137
A. ravenii Barneby (1958); A. monoensis var. ravenii (Barn.) Isely (1983).
Range as given in key; Sawmill Pass at Fresno-Inyo Co. line; known only from type locality. Crest of Sierra Nevada at ca. 3400 m . July-Aug.

Var. ravenii is an upper elevation dwarf that seemingly differs from var. monoensis only in its smaller dimensions and more nearly unilocular pod.

Astragalus monspessulanus L.
Acaulescent, inconspicuously strigulose, perennial herb; pubescence dolabriform; leaflets 21-41, broadly to narrowly elliptic, glabrous above; racemes radical, exserted with showy, ascending, narrow, pinkpurple flowers $2-3 \mathrm{~cm}$; calyx $1-1.5 \mathrm{~mm}$, teeth $<$ tube; legumes ascending, oblong, falcate, laterally compressed or turgid, $3-5 \mathrm{~cm} \times \mathrm{ca}$. 3-4 mm, bilocular; valves thick-papery, strigulose. Europe.

Bailey and Bailey (1941); Bailey (1949); Bailey Hort. (1976). An old (1932) California specimen (CAS); also Canadian introductions.

Astragalus monumentalis Barneby (1953)
Map 133
Subacaulescent or short-creeping caulescent, tufted, strigulosevillosulous perennial of superficial or aerial origin from branched and slightly thatched caudices; annual growth 1-2 cm, the short internodes concealed by stipules. Leafstalk wiry, curved, $1.5-6 \mathrm{~cm}$; leaflets 9-15 (-19), obovate to oblong, 2-10 mm, 2-4 $r$, flat or folded. Stipules conspicuous, imbricate, amplexicaul but not connate. Racemes divergent or reclinate, slightly or much exserted, 2-15 cm, subcapitate to racemose, with $3-12$ ascending-spreading flowers $8-16 \mathrm{~mm}$; fruiting axis short or elongating to 1 dm . Pedicels ca. 1 mm . Calyx tube 3-6.5 mm ; teeth $1-2 \mathrm{~mm}$. Corolla pink-purple, striate; standard often oeillate; ovules ca. 15-30. Legumes ascending or spreading, then humistrate, sessile or with a short gynophore, semibilocular or almost bilocular, deciduous, tardily dehiscent; body oblong to lanceolateattenuate, straight or strongly falcate, triquetrous-compressed, attenuatebeaked, $1.5-3 \mathrm{~cm} \times 2.5-4.5 \mathrm{~mm}$; dorsal face narrowly sulcate; valves
thinly coriaceous, mottled, strigulose; dehiscence said to be on ground both apical and basal. Desperati: Naturitenses.

Se UT, San Juan and Garfield cos., and $n$ Navajo Co., AZ. Streambeds, washes, terraces, mesas, ledges, usually in pockets or crevices in sandstone, associated with juniper-pinyon, blackbrush. Ca. 1200-1850 m. April-June.

Within its range, Astragalus monumentalis is diacritic in its often miniature, tufted habit, abortive stems shingled with stipules, and lanceolate-attenuate, usually nearly 2 -celled pods. $A$. desperatus that may resemble it has essentially unilocular pods. Populations of $A$. monumentalis differ regionally in plant and flower size.

## Key to varieties of Astragalus monumentalis

1. Calyx tube cylindric, ca. $4.5-5.4 \mathrm{~mm}$; flowers $11-16 \mathrm{~mm}$; c San Juan Co., UT, San Juan Co., NM, and n Navajo Co., AZ. var. cottamii
2. Calyx tube campanulate, $3-3.5 \mathrm{~mm}$; flowers $8-10 \mathrm{~mm}$; w San Juan Co. and slightly into Garfield Co. at Hite, UT. var. monumentalis

Var. cottamii (Welsh) Isely
Map 133
A. cottamii Welsh (1970); A. monumentalis var. cottamii (Welsh) Isely (1983).
Range as given in key. Ledges, rimrock, canyons, sandy washes; pinyon-juniper, blackbrush. Ca. 1500 m . April-May.

I am listing Astragalus cottamii as a well-marked geographic variety of $A$. monumentalis because the differences between these taxa are of a quantitative nature not in context with the sharply qualitative differences between $A$. monumentalis and its other relatives, $A$. deterior and $A$. naturitensis.

In addition to the flower size difference given in the key, var. cottamii usually, but not invariably, has longer and more curved pods than var. monumentalis.

## Var. monumentalis

Map 133
A. monumentalis Barn. (1953).

Range as given in key. Pinyon-juniper; sandy ledges and depressions, dry stream beds; along banks of Colorado River. April-May.

Astragalus mulfordae Jones
Map 136
A. mulfordae Jones (1898); Onix mulfordae (Jones) Rydb. (1913).

Slightly strigulose (-canescent lower nodes) perennial from a superficial, sometimes slightly thatched caudex with clustered,
prostrate to ascending stems to 2 dm . Leafstalk $4-10 \mathrm{~cm}$; usually wiry, leaflets $15-23$, distant, easily deciduous, oblong to linear, 3-8 (-10) mm, 4-8 $r$, glabrate above, the terminal jointed or confluent. Lower stipules connate. Racemes $\pm$ foliage; axis lax, commonly $>$ peduncles with $6-15$, ascending-spreading, then deflexed flowers $6-8 \mathrm{~mm}$. Calyx tube 2-3 mm; teeth ca. 1 mm . Corolla white or lavender-tinged, drying ochroleucous; wings $\pm$ standard which is recurved ca. $90^{\circ}$; keel incurved $90^{\circ}-130^{\circ}$. Ovules ca. 10-15. Legumes divergent-reflexed, stipitate or exserted-stipitate $3-5 \mathrm{~mm}$, nearly bilocular, deciduous with pedicels, slowly dehiscent; body half-elliptic or slightly incurved, equilaterally triquetrous to slightly obcompressed, 9-12 (-15?) $\mathrm{mm} \times$ $3-4.5 \mathrm{~mm}$; dorsal face sulcate; valves papery, sublustrous, strigose; dehiscence from racemes or on ground, apical, ventral. Neonix.

Sw ID and barely into OR. Bluffs, sandy knolls, and foothills adjacent to Snake River and affluents; locally common. Ca. 700-900 m. May-June.

Astragalus mulfordae is recognized by its small white flowers, connate stipules, and small, pendulous, equally trigonous, papery, essentially bilocular pods. It most closely resembles $A$. oniciformis of higher elevations in Blaine Co., Idaho, which has free stipules and villosulous or curly pubescence.

Astragalus musimonum Barneby (1944)
Map 108
Strigose, silvery, subacaulescent, and tufted or prostratecaulescent perennial from superficial origin. Pubescence dolabriform. Leafstalk 3-7 cm; leaflets 11-17, obovate to oblong, 4-10 mm, 2-4 r, flat or folded. Stipules free. Peduncles 4-10 (-15) cm, ascending, ultimately reclinate; racemes subumbellate to racemose with $5-10$ flowers $10-13$ mm . Pedicels 1 mm . Calyx tube campanulate, ca. 3.5-4 mm; teeth 2-2.5 mm . Corolla pink-purple; standard with a conspicuous oeil; petals short-clawed; keel $\pm$ wings. Ovules $30+$. Legumes ascending-spreading or humistrate, sessile, unilocular, deciduous, tardily dehiscent; body lanceolate, crescentic, abruptly incurved at tip, medially obcompressed, acuminate and laterally compressed at both ends, $1.5-2 \mathrm{~cm} \times$ $4-6 \mathrm{~mm}$; dorsal face medially depressed; ventral suture carinate; valves initially fleshy, then coriaceous, reticulate, strigulose; dehiscence on ground, apical. Argophylli: Missourienses.

NV, Clark Co., Sheep Mts.; AZ, n Mohave Co., s of St. George, UT. Desert foothills, calcareous soil with pinyon-juniper; local and rare. 1350-1700 m. April-May.

In its short history, the presumptive status and alleged distribution of Astragalus musimonum has had a checkered career
(Barneby, 1944, 1947, 1956a, 1960, 1964). It seemingly is related to $A$. amphioxys, differing from A. amphioxys var. modestus and from small-flowered forms of var. amphioxys primarily in the slightly modified architecture of the flower, i.e., the short calyx and short petal claws. I might regard it as another peripheral form of $A$. amphioxys if it were not that the characteristic pod, with its sharply curved tip, is not matched by any of the forms of the latter species.

## Astragalus musiniensis Jones

Map 133
A. musiniensis Jones (1895); Xylophacos musiniensis (Jones) Rydb. (1912).
A. musiniensis var. newberryoides Jones (1923).

Acaulescent, low, to 1 dm , strigulose perennial from superficial or aerial, clustered, thatched caudices. Pubescence basifixed (-subdolabriform). Leafstalk $2-5 \mathrm{~cm}$; leaflets (1-) 3-5, elliptic, rhombic to oblanceolate, 1-2 (-3) cm, 2.5-5 $r$, readily deciduous. Stipules clustered, free. Racemes erect, shorter than or exceeding leaves with 2-4 (-6), subumbellate, ascending flowers $20-25 \mathrm{~cm}$; reclinate in fruit. Calyx tube cylindric, 9-12 mm, usually dark-pubescent; teeth 2-3 mm. Corolla lilac to purple; standard oeillate. Ovules $30+$. Legumes ascending-humistrate, sessile, unilocular, deciduous, tardily dehiscent; body broadly ovoid-lanceoloid or ellipsoid, acuminate-incurved, obcompressed, $2-3.5 \mathrm{~cm} \times 1-1.5 \mathrm{~cm}$; ventral face broadly sulcate; valves initially fleshy, thinly pilose with hairs $0.5-1.5 \mathrm{~mm}$, at maturity thickwalled (ca. 2 mm ), spongy and several-layered; dehiscence on ground, apical, both sutures. Argophylli: Newberryani.

E and c UT to w CO (Mesa Co.). Eroded washes, sandy or clay hills, bluffs and shale ridgetops, usually with pinyon-juniper. 14502150 m . April-May.

With an acaulescent, thatched habit, 3-5 leaflets, and thick, spongy pods, Astragalus musiniensis is unique in its region. In flower it resembles the very local (Nevada) A. uncialis and forms of $A$. newberryi (especially of southwestern Utah) with a reduced number of leaflets. The pods, however, are more like those of the partly sympatric $A$. chamaeleuce, which has several leaflets.

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[^1]:    ${ }^{19} \mathrm{Text}$ for this recently described species was added after publication of the keys to the species (Isely, 1983a); hence it is not in the key. It might key out in Group V, Key 2 under second lead \#6, or possibly also Group V, Key 7, under second lead \#6.

[^2]:    ${ }^{18}$ Astragalus lentiginosus of Utah has been treated by Schoener (1974, 1975).

[^3]:    ${ }^{20}$ Note in press. Mabberley (1985) has found the validly published name Astragalus marianus Huber ( $?=$ A. adsurgens Pall var. robustior Hook.) that, published in 1872, antedates A. marianus (Rydb.) Barneby of 1944. Mabberley proposes "Astragalus piutensis Barneby \& Mabberley nomen novum" for this species. A. marianus is maintained in the listing above to match that in the prior published keys (Isely, 1983a).

