

UNIVERSITY OF ARIZONA



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**THE SPECIES OF ASTRAGALUS
OCCURRING IN ARIZONA**

GEORGE W. SKORA

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The Species of Astragalus Occurring
in Arizona

by

George W. Skora

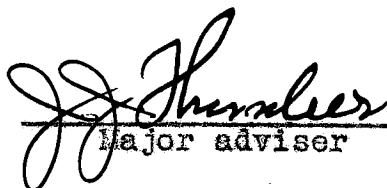
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G. W. S.

INTRODUCTION

A preliminary study of the genus Astragalus brought some misgivings concerning the advisability of attempting to work out this difficult North American genus. A full year's work only convinces me that much yet remains to be done before a satisfactory classification of the species in Arizona can be brought forth, before a suitable and accurate key can be offered for all species in the state. Such a study would involve field trips over the entire state, careful descriptions written while the material was still in the fresh state, as well as a careful study of more literature concerning the genus. A considerable portion of the material from the herbarium was fragmentary, and the literature was inadequate to an entirely satisfactory study. Such fresh specimens as were available were each examined, descriptions made, and the data incorporated into the thesis. Where herbarium material was available and in good condition, description were written from it.

But in a number of cases, where neither herbarium nor fresh material was available it was necessary

to accept the descriptions of other authors together with my own observations, and to use these in the thesis.

An attempt has been made to formulate a satisfactory key to the species of the genus, as well as to the varieties. Within the author's studies, at least, no satisfactory key to the genus has been developed. This fact is not without reason, since, apparently, the group of plants is still in flux, and seems rather sensitive to small environmental changes. Often two plants of the same species, one grown in the shade, and one in the sun, will be of quite different appearance. Then, too, changes in the type of soil, in slope, altitude, and widely different locations will produce differences in the appearance of two plants of the same species. It is for this reason that many inaccuracies appear in the work of authors; a species already named and published may receive a new name, even though it already has one, on the basis of minute differences readily attributable to the factors mentioned above. Hence the large number of synonyms which some species have, and also the number of varieties within some species.

It is on the basis of pod and flower characters

that most of the species are divided, since these are the most constant characters. Where other distinct characters were available, such as pubescence, leaf shape, and other factors of a similar nature, these are mentioned or used both in the description and in the key.

A study of as large a number of species as is herein described is not a simple task. The magnitude of the problem, as I have come to realize, possibly justifies its study for a doctor's dissertation. However, an attempt has been made to make the thesis as accurate as is possible with the time at hand.

Numerous attempts have been made by various authors to revise the genus Astragalus, but none has been entirely successful. These include the revision of de Candolle, who attempted to arrange the species of the world under four heads according to the color of the flower and presence of "spines". Obviously the attempt failed since often a single species will have flowers varying from ochroleucous to purple in color. Torrey and Gray in their Flora of North America, and Hooker in his Flora copied the system of de Candolle with little success. Subsequently Dr. Asa

Gray compiled a revision using the principle of one and two-celled pods, dividing the genus into Astragalus proper and Phaca. Each of these were further divided into subgenera. Only insofar as the making of two genera was concerned did the work of Gray prove valuable.

Watson's revision is perhaps the best up to his time; he utilized the genera Phaca and Astragalus of Gray, and corrected a good many of Gray's errors.

Rydberg's work with the genus Astragalus has been accurate so far as his descriptions are concerned, but his attempts to subdivide it into a number of genera on the basis of supposedly constant characters was a failure. Often, I have discovered that the characters given as differentiating two genera are not constant, and even if constant are not nearly so marked as those existing between the species under any one of his genera. So far as the genus Astragalus itself is concerned, it is rather well-defined, approaching in detailed characters only the genus Oxytropis. Most attempts to subdivide it have been on inconstant characters.

For the reason that Marcus E. Jones was the only man who actually examined all the types in this country,

and also photographed them all, besides making a careful description of each, and since his is the only system which holds up under careful scrutiny and study, I have followed his revision for the genus, and the key to the subgenera, which is contained in the thesis, is modified entirely from his work. His basis for subdivision follows genetic, morphological, and ecological relationships, which after all seem most logical and consistent and which moreover do not collapse when one attempts to classify the species. For these reasons, his subgenera and a modification of some of his species to fit my own observations, are used, where no actual plant material was available.

I would like to take this opportunity to thank Prof. J. J. Thornber for his valuable assistance and kind advice at all times, Mr. L. N. Goodding for his suggestions, Prof. Carl Pistor for data on the poisonous and forage qualities of the genus, Mr. Rudolph Gjelsness for bibliographical assistance, and all other persons who assisted me directly or indirectly in collecting, finding references, and all tasks of a similar nature.

Respectfully submitted,

George Skora

THE GENUS ASTRAGALUS

The genus Astragalus comprises one of the 550 genera of the Family Leguminosae and contributes over a thousand of its twelve thousand species. In this family belong many important crop and forage plants, peas, beans, lentils, alfalfa, sweet clover, vetch, vetchling, peanut, and lupine. Astragalus runs the gamut of forage value, A. nuttallianus proving a very valuable food, and such species as A. allochrous being poisonous to the extreme.

The genus itself comprises some eleven hundred species, world-wide in distribution, but concentrated in northern Asia and in western North America. Of the plant, it might be said that it has in general a typical legume flower, although the size, coloring, and other characteristics vary quite widely. The flowers are butterfly-shaped, with a more or less tubular calyx, five stamens united below, the petals five and clawed. The upper petal is called the banner, has various shapes and sizes, but is always notched. The two side

petals known as the wings are narrower than the banner, and are generally obliquely set. The two lower petals are united along their lower edges into a canoe-shaped body known as a keel. On the basis of the rather weak evidence that in Oxytropis this keel is elongated into a beak, and in Astragalus it is not, these two genera are separated. However, it appears that some species of Astragalus may have this keel elongated into a beak-like projection.

The fruits are legumes, formed of two valves, united by edges called sutures; the upper suture is called the ventral and bears the seeds, the lower is the dorsal and usually is merely a line. These pods or legumes vary widely in shape, and may be inflated, as when the cavity is larger than the mature seeds, or not inflated. In general, these legumes may be wholly one-celled, neither suture intruded into the pod, partially one-celled, either or both sutures intruded into the pod, or completely two-celled, by intrusion of either or both sutures completely across the cavity.

Of the herbage, it can be said that the plants are generally annuals, biennials, or

woody perennials; the leaves are usually varyingly pinnate and alternate. Concerning the pubescence, it is usually composed of straight, short, and tapering hairs fixed by the base, but these may vary to flat and broad hairs closely appressed, to delicate, kinked hairs which are matted, to pick-shaped hairs tapering to each end and fixed in the middle. The plants almost invariably have stipules of different sizes and shapes.

A KEY TO THE SUBGENERA OF ASTRACALUS

- A. Pods wholly one-celled, neither suture intruded, although they may be grooved.
- B. Pods narrow usually, not more than 4 mm. in cross-section, not inflated nor fleshy.
 - C. Pods oblong to oval, obcompressed, ventrally bisulcate; pods erect, sessile.
 - 1. Ocreati
 - 2C. Pods generally narrow, laterally flattened, not ventrally bisulcate; pods not erect, stipitate.
 - 2. Homalobi
 - 2B. Pods narrow, 2-3 mm. in cross-section; generally fleshy or rigid, conspicuously inflated.
 - 3. Reventi-Arrecti
 - 3B. Pods broad, 4-10 mm. in cross-section, firm but not fleshy, somewhat inflated.
 - 4. Flexuosi
- 2A. Pods partially two-celled by intrusion of either or both sutures, sometimes almost completely two-celled.
 - B. Dorsal suture a raised line within or a bit intruded, ventral seldom produced at all.
 - C. Walls fleshy or rigid; pods usually stipitate, ascending to erect, not usually inflated.
 - 3. Reventi-Arrecti

2C. Walls fleshy to cartiliginous; pods sessile, ascending or reflexed, usually not inflated.

5. Argophylli

3C. Walls membranaceous to thick-coriaceous; pods stipitate, reflexed, ascending to erect, inflated.

6. Preussii

2B. Dorsal suture neither raised nor intruded; ventral suture intruded somewhat in middle.

7. Inflati

3A. Pods wholly or nearly two-celled by intrusion of sutures. als

B. Pods with ventral suture slightly if at all intruded; dorsal suture intruded to middle.

C. Pods seemingly inverted by the ventral suture being the more arched.

8. Strigulosi

2C. Pods with ventral suture not the more arched.

D. Flowers not small; stems erect.

9. Malaci

2D. Flowers small; plants low.

10. Lotiflori

2B. Pods wholly two-celled except at tips, both sutures intruded.

C. Pods not small, rarely narrow, not 3-angled, not cross-ribbed.

D. Pods fleshy, plum-shaped.

11. Sarcocarpi

2D. Pods leathery, narrowly oblong to oval.

12. Mollissimi

2C. Pods small or narrow, 2 or 3-angled or parted, cross-ribbed, very rarely.

D. Perennials; flowers not extremely small.

E. Flowers medium-sized, plants of temperate zones.

13. Hamosi

2E. Flowers small, tropical plants.

14. Micranthi

2D. Annuals; flowers very small.

15. Leptocarpi

3C. Pods small, twin or kidney-shaped in section, always cross-ribbed.

A KEY TO THE SPECIES OF ASTRAGALUSHomalobi

- A. Pods membranaceous; pedicels straight or nearly so.
 - B. Leaflets truncate, 6-12 in number; pods smooth; flowers purple or purple-tinged.
 - 1. A. wingatanus
 - 2B. Leaflets various, not truncate, 12 or more in number usually; pods not smooth; flowers ochroleucous or purple.
 - C. Leaflets acute to obtuse, 12-38 in number; pods not upright; pubescence not pick-shaped.
 - 2. A. tenellus
 - 2C. Leaflets almost acuminate, 12-14 (6) in number; pods upright; pubescence pick-shaped.
 - 3. A. campestris
- 2A. Pods more rigid; pedicels various.
 - B. Pods nearly straight.
 - C. Pedicels straight so that pods are not inverted; banner of flower with eight prominent white lines; stems many.
 - 4. A. episcopus
 - 2C. Pedicels twisted so that pods are inverted; banner lacking eight prominent white lines; stems few.
 - 5. A. junceus

2B. Pods definitely curved.

C. Plants not caespitose, not decumbent nor prostrate.

D. Calyx teeth obsolescent; petioles very thick; plants without snake-like odor; leaflets 2-4, rigid.

6. A. episcopus

2D. Calyx teeth as long as tube; petioles not thick plants with snake-like odor; leaflets 2-6, leathery.

7. A. woodruffii

2C. Plants caespitose, decumbent or prostrate.

D. Plants caulescent.

E. Stems soft, dense; leaflets about linear; pods oblanceolate-falcate, not hoary, pubescence not attached near middle.

8. A. sesquiflorus

2E. Stems rigid, not dense; leaflets linear-subulate; pods ovate, hoary; pubescence attached near middle.

9. A. viridis

2D. Plants acaulescent or nearly so.

E. Leaflets jointed to the rachis.

F. Leaflets linear to linear-oblong.

G. Pods falcate, ventral suture raised, dorsally sulcate; leaflets linear-oblong.

10. A. humistratus

2G. Pods lunate, ventral suture usually not raised, not dorsally sulcate; leaflets linear.

11. A. humistratus
var. sonorae

2F. Leaflets elliptical to oval.

G. Pods ovate, not arcuate; leaflets nearly smooth on upper side, elliptical.

12. A. humistratus
var. hosackiae

2G. Pods oblong, somewhat arcuate; leaflets nearly smooth both sides, elliptical to ovate.

13. A. humistratus
var. tenerrimus

2E. Leaflets not jointed to the rachis.

F. Pods hoary, ovate, 4 mm. long or less, calyx teeth black, one-third as long as the tube.

14. A. humillimus

2F. Pods stiff-hoary, half-oval, 5 mm. long, calyx teeth not black, as long as the tube.

15. A. gilensis

Inflati

A. Pods with one exception about completely one-celled.

B. Calyx teeth as long as tube or shorter.

C. Pods glabrous or nearly so.

D. Pods oval to ovate.

E. Stipe minute; flowers white; calyx tube nigrescent, 2 mm. long; pods about oval.

16. A. wardii

2E. Stipe as long as calyx; flowers cream-colored; calyx tube and teeth not nigrescent; pods oval-ovate.

17. A. artipes

2D. Pods deltoid-acute to half-oval.

18. A. palmeri

2C. Pods puberulent to villous.

D. Pods 5-15 mm. long.

E. Flowers purplish to ochroleucous; pods papery but not translucent, not sulcate ventrally, faintly sulcate dorsally, minutely pubescent, 5-8 mm. long, leaflets oblong.

19. A. thurberi

2E. Flowers light purple; pods papery and translucent, sulcate ventrally, not sulcate dorsally, loose-villous, 15 mm. long, leaflets linear.

20. A. pictus

2D. Pods 2-5 cm. long.

E. Pods 2-3 cm. long, half-oval; flowers usually purple.

21. A. allochrous

2E. Pods 3-5 cm. long, lunate;
flowers whitish-ochroleucous.

22. A. allochrous var.
wootoni

2B. Calyx teeth longer than the tube.

C. Pods arcuate to nearly straight, short-shaggy, ventral suture raised and thick, oblong-ovate to half-oval; leaflets 8-12.

23. A. sabulonum

2C. Pods various, villous, ventral suture neither raised nor thickened, ovate-acuminate; leaflets 20-30; possibly no plants in Arizona.

24. A. hornii

2A. Pods slightly two-celled by intrusion of the dorsal suture.

B. Pods oblong-acuminate, -24 cm. long; flowers cream-colored, faintly purple-veined; calyx nigrescent; leaflets 12-24.

25. A. beckwithii

3A. Pods completely 2-celled (except in A. lentiginosus var. mokiakensis.)

B. Flowers capitate; perennials.

C. Pods membranaceous, usually translucent.

D. Stems prostrate, often elongate; pods long-acuminate, ovate to linear.

26. A. lentiginosus

2D. Stems ascending, sometimes erect; pods globose, flat-tipped.

27. A. lentiginosus var.
macdougali

2C. Pods cardboard-like, not translucent.

28. A. lentiginosus
var. diphysus

2B. Flowers in racemes, generally; biennials or winter annuals.

C. Pods lanceolate-acuminate, little or not inflated, in long racemes.

29. A. lentiginosus
var. mokiakensis

2C. Pods ovate-inflated, in short racemes.

D. Calyx teeth half as long to as long as the tube.

30. A. lentiginosus
var. coulteri

2D. Calyx teeth less than half as long as the tube.

E. Calyx tube not reddish-suffused; pods glabrous; flowers whitish; pods membranous.

31. A. lentiginosus
var. yuccanus

2E. Calyx tube reddish-suffused; pods glabrate; flowers lavender; pods papery-chartaceous.

32. A. lentiginosus
var. fremontii

Reventi-Arrecti

A. Stipe shorter than the calyx; flowers white to ochroleucous; leaflets 12-30.

33. A. arrectus

- 2A. Stipe longer than the calyx; flowers ochroleucous to purple; leaflets about 20.

34. A. eremiticus

Lotiflori

- A. Pods 1-2 cm. long, puberulent; calyx nigrescent; teeth one-fourth to one-half as long as the tube; leaflets 10-14; plant appressed-hairy.

35. A. accumbens

Strigulosi

- A. Pods narrow, linear; leaflets mostly linear or at least narrow.

36. A. rusbyi

- 2A. Pods oblong to oval; leaflets various.

- B. Flowers not more than 4 mm. long; leaflets about 10, folded, appearing filiform, 1-2 cm. long.

37. A. brandegei

- 2B. Flowers 5-7 mm. long; leaflets 12-20, not folded, oval, 5-10 mm. long.

38. A. cobrensis

Flexuosi

- A. Pods oblong-oval to ovate; calyx-tube inserted at right angles to the pedicel, the teeth rudimentary; tube 5-7 mm. long; flowers bright purple.

39. A. famelicus

- 2A. Pods oblong-oval to globose; calyx tube not inserted at right angles to the pedicel, teeth not rudimentary; tube 2 mm. long; flowers cream-colored, sometimes purple at the base.

40. A. sileranus

Argophylli

- A. Leaflets generally 3-10.

- B. Leaflets 3-4; petioles sometimes longer than the rachis but often sessile; calyx teeth half as long as tube.

41. A. newberryi

- 2B. Leaflets about 10; petioles usually twice as long as the rachis; calyx teeth more than half as long as the tube.

42. A. newberryi
var. watsonianus

- 2A. Leaflets 10-40.

- B. Petiole twice the length of the rachis.

- C. Leaflets 10-40 (8); calyx teeth as long or shorter than the tube, which is reddish-suffused.

43. A. desperatus

- 2B. Petioles as long as or shorter than the rachis, seldom longer.

- C. Calyx tube 1 cm. long; pods villous or puberulent; plants not stout.

- D. Pods not inflated, puberulent.

44. A. shortianus

- 2D. Pods inflated, villous.

- E. Pods about 1.5 cm. long.

F. Petiole half as long as the rachis; leaflets 5-12 mm. long.

45. A. argophyllus

2F. Petioles often as long as the rachis; leaflets never more than 7 mm. long, usually less.

46. A. argophyllus
var. castanaeformis

2E. Pods 2.5 cm. long.

47. A. argophyllus
var. pephragmenus

2C. Calyx tube 6-7 mm. long; pods generally glabrous; plants stout perennials.

48. A. remulcus

Preussii

A. Leaflets glaucous; pods 1.5-2 cm. long.

B. Pods oval to narrowly oblong, conspicuously inflated; 1.5-2 cm. long.

49. A. preussii

2B. Pods oval, plum-like, a bit inflated; 1.5 cm. long.

50. A. pattersoni
var. praelongus

2A. Leaflets not glaucous; pods 2-2.5 cm. long.

B. Pods sessile, thin and soft, with pseudo-stipe; leaflets 10-16; plants with no odor.

51. A. limatus *

* Does not appear in descriptions.

- 2B. Pods not sessile, coriaceous, with a stout stipe; leaflets 20-24; plants with musk-like odor.

52. A. pattersoni

Malaci

- A. Pods curved to one-third circle, tip stoutly mucronate; leaflets smooth above, hoary below.

53. A. ensiformis

- 2A. Pods curved often to a complete circle, long acuminate; leaflets appressed-villous both faces.

54. A. layneae

Sarcocarpi

- A. Pods 1.5 cm. long, oval-ovate, ventrally sulcate, straight, obcompressed; calyx tube oblong, 5 mm. long; teeth half as long as the tube.

55. A. plattensis

Mollissimi

- A. Calyx pink in color; pods oblong-oval to ovate; leaflets yellow-hairy; flowers in loose spikes.

56. A. bigelovii

- B. Pods 1.5 cm. long, chestnut-shaped, as wide as long.

57. A. bigelovii
var. matthewsii

2B. Pods 1-3.5 cm. long, falcate, longer than wide.

58. A. bigelovii
var. thompsonae

2A. Calyx not pink; pods cylindrical-linear to oblong; leaflets silvery-silky to yellowish-hairy.

B. Pods 2 cm. long, teeth half as long as the calyx tube or less; leaflets 20-30.

C. Calyx tube 7 mm. long, obliquely attached; leaflets silvery-silky.

59. A. intermedius

2C. Calyx tube 5 mm. long, not obliquely attached; leaflets yellow-hairy.

60. A. mollissimus

2B. Pods 7-15 mm. long, teeth more than half as long as the tube; leaflets about 40.

61. A. humboldtii

Ocreati

A. Pubescence versatily attached.

B. Peduncles of flowers 1 cm. long or none; leaflets linear-oblong to oblong.

62. A. sophoroides

2B. Peduncles of flowers 7-9 cm. long; leaflets linear.

63. A. confertiflorus

2A. Pubescence not versatily attached.

- B. Pods oblong-oval; calyx teeth conspicuously shorter than the tube, which is 3 mm. long; leaflets 10; stems densely tufted; leaflets 2.5 cm. long.

64. A. moencoppensis

- 2B. Pods oblong; calyx teeth as long as the tube; calyx tube 4 mm. long; leaflets 12-16; stems almost none; leaflets 1 cm. long.

65. A. troglodytes

Hamosi

- A. Pods slightly arcuate to definitely curved, 8-40 mm. long.

- B. Pods 7-25 mm. long, oblong to linear; leaflets 2-6; stipules not brown; flowers white to red-purple.

66. A. calycosus

- 2B. Pods 20-40 mm. long, linear; leaflets 8-14; stipules brown; flowers dirty-white edged with purple.

67. A. arizonicus

- 2A. Pods straight, 1 cm. long.

68. A. calycosus var. scaposus

Leptocarpi

- A. Pods pubescent except when old; calyx tube 1-2 mm. long, teeth unequal, as long as tube; leaflets strigose both faces.

- B. Stems and other herbage glabrate to strigose.

69. A. nuttallianus

2B. Stems and other herbage long-villous.

70. A. nuttallianus
var. trichocarpus

2A. Pods smooth or nearly so; calyx tube 3-4 mm. long, teeth unequal, but about half as long as tube; leaflets strigillose beneath only.

71. A. nothoxys

Micranthi

A. Leaflets 8-12; calyx tube 2 mm. long, turbinate.

72. A. hypoxylus

2A. Leaflets 12-20; calyx tube 1 mm. long, narrowly campanulate.

73. A. vaccarum

Didymocarpi

A. Pods oval to deltoid-ovate, 3-4 mm. long; flowers purple; calyx shaggy, white in color; internodes very long; plant light tan in color.

74. A. dispermus

Homalobi

1. Astragalus wingatensis Wats. Proc. Am. Acad. 18:192,
1883.

Plants white-hoary throughout with closely appressed, flat, rather sparse hairs; stems wide-spread, rather few in number; leaves rather few, not sessile, the plants two feet high from a woody root; leaflets 6-13, narrowly elliptical to linear, truncate, glabrate; calyx about 2 mm. long, the teeth about 1 mm. long, the pedicels straight; corolla purplish, 6 mm. long, the flowers occurring in a rather open raceme; pods straight, membranaceous, flat, sessile, apex rather acute, about 1.5 cm. long, glabrate to black-hairy, occasionally smooth or mottled. Blooms in May. Description from Jones, since no material was available.

2. Astragalus tenellus Pursh. Fl. Am. Sept. 2:473,
1814.

Plants perennial, about glabrous, the stems several, branched, and 2 or more dm. high; stipules dark; leaflets acute to obtuse, 12-38 in number, not truncate, linear to narrowly oblong, 7-12 mm. long; flowers in racemes, few, ochroleucous and purple-tipped, the peduncles not exceeding the leaves; calyx tube campanulate, about 2 mm. long,

the lower teeth longer, but not longer than the tube; pods flattened, sometimes compressed, straight, margined with the narrow, nerve-like sutures, reflexed, about 1 cm. long, and few-seeded. Pubescence throughout not pick-shaped.

Description from fresh material gathered near Yuma.

3. Astragalus junceus (Nutt.) Gray Proc. Am. Acad. 6: 230, 1864.

Plants grayish, minutely strigose; stems mostly decumbent, rather long, often two feet high or less; leaves with short, flattened petioles, the leaflets 2-10, filiform, the terminal leaflets also usually filiform; corolla yellow-orange; calyx short-campanulate, 4-5 mm. long, teeth less than 1 mm. long; pods narrowly linear-acuminate, straight to rather falcate, about 1.5 cm. long (sometimes 3-5 cm. long), inverted on a slender, twisted pedicel; stems characteristically few.

Description from dried material gathered near Willcox, Arizona.

4. Astragalus campestris (Nutt.) Gray Proc. Am. Acad. 6:229, 1864.

Plants with stems prostrate on the ground, the crown of the woody root bearing them; leaves short,

but with elongated peduncles and the flowers in capitate racemes; leaflets narrowly linear, acuminate, minute, grayish-strigillose; calyx tube campanulate, the teeth slender and slightly shorter than the tube; pubescence pick-shaped, attached near but not at the end; stems generally diffuse, slightly flexuose, slender, sometimes two feet long; leaflets vary widely but are generally 12-14 (6); pods mostly straight, 1.2-3 cm. long, linear to broadly so, rigid, mostly reflexed.

Description modified from Jones; no material available.

5. Astragalus episcopus Wats. Proc. Am. Acad. 10:346, 1875.

Plants perennial with woody roots and rather rigid, flexuose, much branched stems and rather conspicuous ochroleucous or purple flowers; petioles about as thick as the stems; leaflets 2-4 (9), 1-2 cm. long, rather ashy puberulent, the terminal one often lacking; stipules hyaline, small; peduncles with rather open, racemose inflorescence; calyx campanulate, strigose, 3 mm. long, with very short triangular-subulate teeth; banner marked with eight prominent white lines; pods half-elliptical to oblong, 1.5-3 cm. long, 6 mm. wide, glabrous, shining,

flat.

Description modified from Jones and other sources since no plant material was obtainable.

6. Astragalus woodruffii Jones Rev. N. W. Sp. Astrag. 76, 1923.

Plants with strong snake-like odor; whole plant leathery, the stems coarse and deeply sulcate, often 1 cm. thick, erect, 1-2 feet high, from thick, fleshy, erect root; leaves often 6-7 cm. long, small and inconspicuous, with 2-6 filiform, leathery, channeled leaflets which are 1-2 cm. long and not jointed to the rachis; stipules large, leathery, rigid, acute; calyx campanulate, 3 mm. long, the teeth lax, subulate, and as long as the tube; flowers pink-purple, very conspicuous, in dense spikes; pods broadly linear, about 2 cm. long and 4 mm. high, flat, ashy, cartilaginous, erect, appressed, sessile, arcuate, sutures prominent, and equally arched, the ventral one concave.

Description modified from Jones, who lists this as a new species.

7. Astragalus viridis (Nutt.) Sheld. Bull. Geol. & Nat. Hist Minn. 9:118, 1894.

Type with rigid stems, caulescent but rather

prostrate, spreading, rather densely branched, with short, silky pubescence which is characteristically attached near the middle; leaves rigid, nearly sessile, the leaflets stiff, spiny, channelled, linear-subulate, 5-7 in number, 5-10 mm. long; flowers only 1-3, sessile in leaf axils, generally livid and purple-tipped; calyx campanulate, tube 2 mm. long, attached obliquely, teeth subulate and as long as the tube; pods ovate, short-acuminate, with a somewhat villous pubescence covering them, incurved, generally with one seed, and about 4 mm. long.

From herbarium material collected by: C. T. Vorhies, Navajo Reservation, 7/12; J. J. Thornber, Grand Canyon, 8/12/16.

8. Astragalus humistratus Gray Pl. Wr. 2:43, 1853.

Plants acaulescent perennials with nearly free stipules and perfect flowers in racemes; stems matted-branched close to the woody root and straggling over the ground, about 2 feet long; leaves with leaflets glabrous below, glabrate above, 13-17 in number, jointed to the rachis, ashy-pubescent, about 1 cm. long, acute, linear-oblong; calyx campanulate, the subulate teeth about as long as the tube; flowers dull purple to dirty-white;

peduncles longer than the leaves; pods in short racemes, about oblong, tapering to both ends, stipitate, rather falcate and rigid-membranaceous, 1-celled, obcordate in section, falcate in outline, the lower suture sulcate, the ventral raised, and the seeds numerous, smooth and rather shiny to villous-pubescent; leaves, at least the upper ones, almost without petioles.

Description from fresh material gathered east of Tucson. Herbarium material collected by L. N. Gooding, Bisbee, 7/31/12.

Astragalus humistratus var. sonorae (Gray) Jones
Cont. 10:58, 1902.

Petioles present, even above; leaflets line-like, 1 cm. or more long, jointed to the rachis, acute, rather densely villous-hairy; peduncles not longer than the leaves; pods crescent-shaped, 1 cm. long or less, incurved, obcompressed below, not dorsally sulcate; plants shorter, the stems persistent.

Drawn mostly from Jones and herbarium material collected by: J. W. Tounay, Grand Canyon, 7/10/92; A. Conrad, Flagstaff, 7/15; M. E. Jones, Flagstaff, 8/1/84; W. Irish, Flagstaff, 8/9/10; J. J. Thornber, Grand Canyon, 8/12/16; Alice Eastwood, Grand Canyon, 9/21/13.

Astragalus humistratus var. tenerrimus Jones Cont.
7:649, 1895.

Stems many, slender, lying flat on the ground; leaflets 8-12, jointed to the rachis, ovate to rounded, puberulent both sides; flowers few, in loose-spicate racemes, rather dirty-white in color; calyx teeth filiform, longer than the tube, pods oblong, often arcuate, as in the variety above.

Description drawn from Jones; no material available.

Astragalus humistratus var. hosackiae (Greene)
Jones Cont. 10:58, 1902.

Plants puberulent; leaves glabrous above, rather hoary below; leaflets elliptical, about 1 cm. long; leaves sessile and short; pods ovate-acute, 6 mm. long, inflated but not conspicuously so, arcuate, kidney-shaped in cross-section, the dorsal suture raised; flowers in short racemes; otherwise similar to type.

Description taken mostly from Jones; no plant material obtainable.

9. Astragalus sesquiflorus Wats. Proc. Am. Acad. 10:
346, 1875.

Plants perennials growing in tufts, villous-hairy with the exception of the pods; stems only a few inches long, soft, dense, the stipules long-

acuminate and often surpassing the internodes in length; leaves shorter than the filiform, rigid peduncles, the leaflets 5-11, linear-elliptical to lanceolate, rather strigillose, 5-8 mm. long; flowers 1-2 to a raceme, calyx tube 2.5 mm. or less long, conic-campanulate, the teeth 3 mm. long and subulate; pods oblanceolate-falcate and rather broad, strigillose, mottled, somewhat curved, 1-celled, membranaceous, seeds many. Plant has rather striking purple flowers.

Description from herbarium material collected by: C. T. Vorhies, Navajo Reservation, 8/16.

10. Astragalus humillimus Gray Brandeg. Rep. San Juan 234, 1876.

Plants growing in dense tufts with innumerable small, practically acaulescent stems, the crown very woody; leaves about 1 cm. long, the slender petiole about half as long as the entire leaf; leaflets 6-10, not jointed to the rachis, folded, rather thick, silvery-pubescent, 2 mm. long; peduncles a little longer than the leaves; flowers racemose, 1-3 in number, 5 mm. long, light-purple, on slender pedicels; calyx obconic, a little more than 2 mm. long, the teeth triangular, black, and equal to about one-third the whole; pods hoary, ovate, 4 mm. or less long, 1-seeded, not sulcate.

Plants separated from A. viridis on the basis that the leaflets are not jointed to the rachis.

Description from Jones; no material at hand.

11. Astragalus gilensis Greene Torr. Bull. 8:97, 1881.

Plants with leaves tending to spread out on the ground and with many short stems from the crown of a rather woody root, and conspicuous stipules which overlap the short stems to some extent; leaves 5-8 cm. long; leaflets about 16, acute, 5-7 mm. long, the hairs throughout the plant attached somewhat near the middle; flowers in racemes, blue-purple, about 7 mm. long; calyx tube 3 mm. long, campanulate, the teeth subulate and nearly as long as the tube; pods about 5 mm. long, half-oval, dorsal suture straight, the ventral arched, thickened, not inflated, apiculate, rigid and stiff-hoary with appressed hairs.

Description taken mostly from Jones; no plant material available.

Inflat

12. Astragalus sabulonum Gray Proc. Am. Acad. 13:368, 1878.

Plants annual, diffusely branched from a rather woody base, half a foot to about two feet high, and ashy-pubescent throughout; leaves 5-9

cm. long, with petioles about 3 cm. long or less; leaflets 8-17, elliptical to narrowly obovate, 8-14 mm. long; flowers in racemes with 2-10 flowers each; calyx tube about 5-6 mm. long, the subulate lobes equalling or longer than the tube; corolla pearly-white, 5-6 mm. long; pod ovoid, reflexed, 1-1.5 cm. long, about 8 mm. wide, sessile, short-villous, 1-celled, ventral suture raised. Whole plant short to long hairy. Blooms in April.

Description drawn mostly from Jones; no herbarium material.

13. Astragalus thurberi Gray Pl. Thurber. 312, 1855.

Plants biennial or perennial, minutely pubescent throughout, with appressed-villous hairs; stems numerous, spreading, rather rigid, about 2.5 dm. long, very leafy; branched appressed below; leaves very many, somewhat appressed, with petioles one-half or more the whole; leaflets 9-15, 5 or more mm. long, almost linear, obtuse, retuse; flowers many, purplish to ochroleucous, 7 mm. long or less; calyx tube campanulate, teeth subulate, 2 mm. long, and about as long as the tube; pods puberulent, 8 mm. long, membranaceous to papery, rounded at the base, divaricate, jointed to a

boss-like stipe. Blooms in April.

Description made from herbarium material collected by the following: H. Brown, Yuma, 5/05; D. Griffiths; J. W. Toumey, San Francisco Mts. 9/8/94; J. J. Thornber, Rosemont, 6/3/15, Pantano, 5/7/02, Ft. Lowell, 4/30/05; J. C. Reed, Cochise, 4/16/16.

14. Astragalus hornii Gray Proc. Am. Acad. 7:398, 1868.

Plants widely branched, rather filiform-stemmed annuals, the stems mostly prostrate; leaves wide-spread, about 1 dm. long; leaflets linear to oblong-ovate, long-petiolulate, about smooth, 2 cm. long or less, obtuse, 20-30 in number; most of the internodes shorter than the leaves; calyx campanulate, 2 mm. long, occasionally 3 mm.; teeth triangular, almost as long as the tube; flowers in racemes, about white, 5-12 mm. long; pods ovate-acuminate, 1.5-2 cm. long, 1 cm. wide, about round, inflated, papery, sparsely villous-pubescent when young, many in raceme. Plants blooming in March or April.

Description drawn mostly from Jones since only fragmentary material was available.

15. Astragalus wardii Gray Proc. Am. Acad. 12:55,
1876.

Plants with ascending stems about one foot high, the stems numerous and usually unbranched; leaves sometimes a foot long or more, the upper about sessile; leaflets 16-20, almost linear, obtuse or retuse, long-petiolulate, 1-1.5 cm. long, thin, glabrous; flowers white, often purple-tipped; calyx tube campanulate, 2 mm. long, lower side straight, the upper side arcuate, with scattered black hairs, teeth linear to triangular, as long as the tube; pods about oval, deltoid-acute at the ends, glabrate to glabrous, often mottled, sessile, with a false stipe. Plants blooming in May.

Description drawn mostly from Jones, since no herbarium material was available.

15. Astragalus pictus Gray Pl. Fendl. 37, 1849.

Plants with green, phyllodia-like stems, leaves, and peduncles; lower leaves small, with 6 oval leaflets 6 mm. long; upper leaves larger with linear leaflets 2-5 cm. long; flowers dirty-purple or lavender, short, 1 cm. long; calyx tube about campanulate, 2 mm. long, teeth filiform-subulate, a little shorter than the tube; pods oval, acute, 2-3.5 cm. long, almost as wide, with stipe about 2 mm. long, sometimes pendent, seeds few or solitary;

plants generally have zig-zag stems which are slender, weak, and about one foot long; usually plant has rootstocks.

17. Astragalus artipes Gray Proc. Am. Acad. 13:370,
1878.

Plants mostly glabrous throughout, the stems growing from the crown of a woody root; stems in rather dense tufts, flexuose, about one foot long, slender; leaves mostly about one dm. long, petioles shorter than the rachis; leaflets 11-17, narrowly oblong to oval, about 8 mm. long; flowers few, in rather crowded racemes, peduncles shorter than the leaves, the corollas about cream-colored; calyx campanulate, teeth subulate, as long as the tube which is 4 mm. long; pods almost ovate, much inflated, mostly papery but sometimes leathery, purple-mottled, narrowing at the attached end to a slender stipe which is jointed and 4-8 mm. long. Blooms rather early in the spring.

Description from material collected by: M. E. Jones, Hackberry, 5/26/84.

18. Astragalus beckwithii T. & G. Pac. Rail. Rep. 3:
120, 1854.

Plants with rather densely tufted stems growing from a woody root, the stems 4-28 inches high, ascending to almost decumbent, branched below;

leaves with petioles never as long as the rachis, rachis and peduncles deeply striate; leaflets 12-24, broadly oval to elliptical, short petiolulate, obtuse, emarginate, varying quite widely in length; calyx campanulate, 4-7 mm. long, black-hairy, teeth deltoid, and usually about as long as the tube; pods mostly oblong, acuminate, 2.5-4 cm. long, ventrally bisulcate, usually sparsely black-hairy, stipe about 6 mm. long; flowers ordinarily ochroleucous, in short racemes. Blooming in April.

Description drawn mostly from Jones, who did much work with the species.

19. Astragalus lentiginosus Dougl. in Hook. Fl. Bor. Am. 1:151, 1834.

Plants with stems branching from the base, stems and leaves strigillose to glabrate; perennial, the flowers occurring in head-like racemes; leaflets 11-21, narrowly oblong to ovate or obovate, 4-9 mm. long, the pubescence strigillose, the peduncles shorter than the leaves; flowers white or purplish, about 7-9 mm. long; calyx tube 2-3 mm. long, the teeth subulate, one-half to nearly as long as the tube; pods long-acuminate, ovate, flattened, membranaceous, reflexed,

shiny, sulcate along both sutures, 2-celled except at the apex, sometimes purplish-mottled. Stems often elongate.

Description from fresh material gathered at Fort Grant. Herbarium material collected by: J. J. Thornber, Thatcher, 4/14/05; J. J. Thornber, University Farm, 3/13/18; J. J. Thornber, Bowie, 4/4/15.

Astragalus lentiginosus var. diphysus (Gray) Jones
Cont. 7:673, 1895.

Stems in tufts from the crown of a rather fleshy root, somewhat spreading, 1-2 feet high, puberulent; leaves never sessile; leaflets 16-21, rather thick, obovate, to oblong or narrowly so, 1-2 cm. long, often a bit retuse; peduncles as long as the leaves, the flowers in capitate racemes, the corollas blue to almost white; calyx cuneate-cylindric, teeth shorter than the tube; pods membranaceous, much inflated, papery sometimes, ovate-acuminate, 2-2.5 cm. long, incurved, somewhat shiny.

Description mostly from Jones since only fragmentary herbarium material was available.

Astragalus lentiginosus var. macdougali (Sheld.)
Jones Cont. 7:673, 1895.

Stems almost erect, a foot long, branched be-

low; leaves 5-7 mm. long; leaflets about 20, 1 cm. long, glabrous, oval to elliptical; pods in dense heads, short pointed, globose, about 1 cm. long, on short, stout pedicels which are as long as the leaves.

Description drawn mostly from herbarium material collected by: J. J. Thornber, Holbrook, 6/16/17; J. J. Thornber, Chino Valley, 8/20/16; D. T. MacDougal, Flagstaff, 6/18/08; A. C. Shinn, Chin Lee, 8/30/15; C. B. Carter, near Phoenix, 2/20/27.

Astragalus lentiginosus var. mokiakensis Gray Proc. Am. Acad. 13:367, 1878.

Plants with erect, thick, slightly flexuose stems from a fleshy root; leaves with petioles below, about sessile above; leaflets 11-15, obovate, emarginate, about 1 cm. long, puberulent to glabrous; flowers in spikes, pink-purple to blue in color; calyx tube campanulate, often reddish, 3 mm. long, upper teeth triangular, much shorter than the tube, the lower filiform to subulate, about twice as long as the upper ones; pods about 2 cm. long, oblong, terete, slightly curved, coriaceous, varying somewhat in shape.

Description from material collected by Mr. Riordan, north of Tucson, 6/17.

Astragalus lentiginosus var. coulteri (Benth.)
Jones Cont. 8:4, 1898.

Plants annuals or biennials, the stems several from a rather woody base, divaricately branched, the entire plant silky-villous; leaflets 2 cm. long, 11-15 in number, obtuse or notched, oblong to broadly obovate; flowers in racemes, rather loosely 10-20 flowered; calyx with subulate teeth one-half to as long as the tube; corolla purple, about 1.5 cm. long or less; pods rigid, ovate-inflated, often mottled, grooved dorsally, 2-celled except at the tip.

Description modified from Jones; no material available.

Astragalus lentiginosus var. yuccanus Jones Cont.
8:3, 1898.

Plants with hoary, ascending to erect stems, two feet high, biennials blooming as winter annuals; puberulent throughout; leaves almost sessile; leaflets about oval, 1.5 cm. long, 20-24 in number; flowers in spikes, erect, whitish; calyx cylindrical, with very short teeth; pods glabrous, membranous, ovate, short-pointed, thin and translucent,

about 2 cm. long, much inflated, in long, erect peduncles, completely two-celled, didymous.

Description from material gathered by:

J. J. Thornber, Rillito, 4/30/05; M. E. Jones, Yucca, 5/13/84; J. J. Thornber, Oracle, 5/3/05.

Astragalus lentiginosus var. fremontii T. & G.
Wats. Bot. King; 66, 1871.

Plants with stems very many from crown of a woody taproot, long-villous throughout; leaflets ovate-lanceolate to narrowly ovate, villous below, obtuse, 12-22 mm. long, short-petiolulate, 13-23 in number; flowers in rather short racemes; calyx cylindrical, narrow, 9 mm. long, the narrow, subulate teeth about 1.5 mm. long, the tube violet-red suffused, and with minute bract about 1 mm. long, tube and bract black-hairy; corolla lavender, the wings and keel violet; pods 15-20 mm. long, curved, tapering to a point, translucent, oval-ovate, tip falcate, sessile, papery-chartaceous, glabrate, sometimes very finely purple-flecked; plant examined was diseased; peduncles shorter than the leaves.

Description written from fresh material from the U. S. Forest Service at Winslow.

20. Astragalus palans Jones Zoe 4:37, 1893.

Plants differing from A. lentiginosus in that the pods are coriaceous and not translucent, and occur in spikes rather than in heads; pods linear rather than ovate, 3-4 cm. long; leaflets glabrous, about 32, oval, retuse.

Description modified from Jones, who lists this as a variety, although I would be inclined to include it as a species, since it has such marked differences.

21. Astragalus palmeri Gray Proc. Am. Acad. 7:398,
1868.

Plants with stems 2-4 dm. high, rigid, and somewhat grooved in the dried material; specimens examined grayish-strigose; leaves subsessile to petioled; leaflets 10-28, linear-oblong to elliptical, 2 cm. long or less, obtuse and markedly petiolulate; calyx tube short-campanulate, less than 2 mm. long, the deltoid teeth about as long; peduncles longer than the leaves; flowers racemose, purplish; pods triangular-acuminate, glabrate, some also ovate or nearly so. Blooming in April.

Studied from poor material gathered near Ft. Grant and from descriptions of Jones and Gray.

22. Astragalus allochrous Gray Proc. Am. Acad. 13:
366, 1878.

Plants generally annuals, with rather coarse, rigid stems which are about 2 feet high, caespitose, often angular, violet-red suffused, strigose; leaves generally greenish, about sessile, 3-9 cm. long; leaflets 8-20, generally villous beneath and glabrous above, 1-1.5 cm. long; flowers in racemes; calyx nigrescent, often ashy, about 3 mm. long, the teeth lanceolate-subulate and as long or slightly shorter than the tube; corolla purplish generally; peduncles stout, angular, longer than the leaves, bearing the few flowers above; pods sessile, papery, not sulcate, minutely reticulate, 2-3 cm. long, 1 cm. wide and high, generally minutely strigose, half-oval, apiculate, acute, with a tiny stipe, both sutures about alike. Blooming in March.

Description drawn from fresh material collected at Ft. Grant.

Astragalus allochrous var. wootoni (Sheld.) Skora

Included as a variety since the plant resembles very closely A. allochrous in herbage and growth characteristics, the only marked differences being that the pods are more membranaceous, translucent, up to about 4.5 cm. long, lunate in

outline, and the flowers are yellow-white rather than purple. Plants blooming March to May.

Studied from fresh material gathered at Ft. Grant. Herbarium material was collected by: D. Griffiths; M. French Gilman; J. J. Thornber, Tucson, 3/7/02 and 4/17/03, Safford, 4/5/15, Bowie 4/15/05, Rillito, 4/30/13, Santa Ritas, 4/17/03, Ft. Lowell, 5/2/03, Bowie, 4/4/15, Tucson, 4/22/06, Nogales, 4/1/30; J. R. Sandige, Bowie, 4/5/15; J. H. Barber, Paso Robles, 4/21/01.

Preussii

23. Astragalus preussii (Benth.) Gray Proc. Am. Acad. 6:222, 1864.

Plants perennial from semi-woody root, with ascending stems rather few, 1-3 feet high, puberulent to strigose throughout; leaves 2 dm. long or less, leaflets 10-20, obcordate, oblong, sometimes ovate, 1-3 cm. long; flowers few in racemes, about 2 cm. long; calyx strigose, black-hairy, 7-9 mm. long, the teeth about deltoid and less than half as long as the tube; corolla reddish-purple, often delicately nerved; pods oblong, about 1.5-2.5 cm. long, thick, puberulent to somewhat strigose, net-

ted-nerved, 1-celled, with stipe about as long as the calyx.

Description written from fresh material.

24. Astragalus pattersoni Gray in Brandeg. Rep. S. W. Colo. 285, 1876.

Plants perennial, with stout, erect, glabrous stems from a rather woody base, often 3 feet long, decumbent in some plants; leaves as much as 2 dm. long, about sessile, leaflets 11-24, oblong, sometimes linear-lanceolate, 2 cm. long, rather thick, glabrous above, strigose beneath; flowers sessile, in many-flowered racemes; calyx campanulate, about 5 mm. long, thin, the upper side arched and the lower straight, teeth subulate-filiform, about half as long as the tube; pods oblong-ovate, somewhat coriaceous, inflated, with partial partition formed by intrusion of the ventral sutures, and with rather short stipe.

Description is drawn from fresh material gathered near Tucson, from Jones, and from dried material in herbarium collected by: J. W. Toumey, Camp Verde, 8/3/91.

Astragalus pattersoni var. praelongus Jones Cont.
10:65, 1902.

Plants with no great number of distinct herbage characteristics since they intergrade quite freely; peduncles much shorter than the leaves; leaflets powdery-glaucous, 1-2 cm. long, oval to ovate in shape; flowers stubby; calyx teeth deltoid, about one-half the length of the tube; pods oval, somewhat plum-like, 2 cm. or less long.

Description drawn partially from Jones and from dried material in herbarium collected by : J. J. Thornber, Holbrook-Snowflake Road, 6/5/17.

Reventi-Arrecti

25. Astragalus arrectus Gray Proc. Am. Acad. 8:289,
1870

Plants quite variable, with stems usually about a foot high, slender, from rather woody roots; leaves 2 dm. long or less, the upper about sessile; leaflets 12-30, linear to ovate, the upper generally greener and more ovate; flowers white to ochroleucous, about 1.5 cm. long; calyx campanulate, black-hairy especially on the teeth, teeth about deltoid and about half as long as the tube; pods about linear, flattish,

2 cm. long and very narrow, glabrous, the ventral suture thick and raised, the dorsal sulcate; stipe about as long as the calyx, not curved; plants with minute bracts; peduncles very long and about as thick as the stems.

Description modified from Jones since no material was available.

26. Astragalus eremiticus Sheld. Minn. Bot. Stud. 9:20, 1894.

Plants growing from a rather woody caudex, branching into rather flexuose, slender, foot-long stems; leaves about 1.5 dm. long; leaflets about 20, narrowly elliptical, markedly glaucous, petiolulate, about 1.5-2 cm. long, obtuse, lax; calyx cylindrical-campanulate, black-hairy, the teeth triangular, half as long as the tube; flowers racemose, white to purple; pods 1.5 cm. long or longer, narrowly oval to oblong, cardboard-like in consistency, almost globose, on a gradually narrowing stipe about 1.2 cm. long; dorsal suture sulcate as in A. arrectus.

Description written from material sent in by the U. S. Forest Service at Holbrook.

Lotiflori

27. Astragalus accumbens Sheld. Minn. Bot. Stud. 9:20,
1894.

Plants with many short, stiff stems from an erect taproot, perennials, a number of the plants growing together in a sort of mat; leaves 5-7 cm. long, petioles over half the whole, slender; leaflets about 8-16, rather leathery, sessile, 7 mm. long, about half as wide, and hence obovate, obtuse; plants generally ashy with appressed hairs; flowers short, white, and purple-tipped, in capitate racemes, the individual flowers sessile; calyx long-cylindrical, about 3 mm. long, nigrescent, teeth deltoid, less than half as long as the tube generally; peduncles much longer than the leaves; pods 1-2 cm. long, oblong-elliptical to oval, wrinkled, minutely pubescent, the dorsal suture sulcate, rounded at both ends; blooming in April.

Description drawn from herbarium material collected by: Goodding, Alpine, 7/31/12; Wootton, Showlow, 9/13/13.

Strigulosi

28. Astragalus rusbyi Greene Bull. Cal. Acad. 1:8, 1884.

Stems branched, plants perennial, 3-6 dm. high, almost glabrous, the stipules free and distinct; leaflets 17-27, oblong to oval, about 1 cm. long, obtuse to truncate, strigillose below, glabrous above; flowers in elongate racemes, with long peduncles; calyx teeth triangular, less than one-half the nigrescent tube, which is 2 mm. long; corolla yellowing or with purple banner, 7-8 mm. long; pods straight, narrow, linear, 2 cm. long, glabrous, with a wide partial partition from the ventral suture.

Description written from herbarium material collected by: J. W. Toumey, San Francisco Mts., 9/10/94; D. T. MacDougal, Flagstaff, 7/5/98.

29. Astragalus brandegei Porter Fl. Co. 24, 1874.

Plants with stems divaricate-ascending, many, matted, flexuose, very slender; leaves 6 cm. long, often pendulous; leaflets 7-12, linear, folded, obtuse, about 10 mm. long or longer, glabrate above and strigillose below; flowers in short racemes, with about 3-7 flowers to a raceme; calyx villous-hairy, tube about 2 mm. long, the subulate

teeth almost as long, turbinate; corollas white to ochroleucous, often purple-tipped; legumes papery-membranaceous, often appressed-villous, about 1 cm. long, incurved; plants with rootstocks; pods generally linear-oblong in shape, but are often broader; dorsal suture often intruded, although not always.

Description written from fresh material gathered near Safford.

30. Astragalus cobrensis Gray Pl. Wr. 2:43, 1853.

Plants with the stems up to a foot long, suberect, zig-zag, with the internodes shorter than the combined rachis and petiole of the leaves; leaves about 9 cm. long, often less; leaflets 12-22, about 9 mm. long, obovate, to oval or narrower, retuse, glabrate; flowers in short, dense spikes, fruits in a more open raceme; calyx bell-shaped, black-hairy, 2 mm. or less long, teeth arched, subulate, as long as the tube; peduncles almost as long as the leaves; pods about linear to oblong, about 1.5 cm. long, stiff-papery, about sessile, obcompressed, dorsally sulcate, the ventral suture thickened, raised, and intruded slightly into the interior of the pod. Entire plant puberu-

lent. Blooms in summer.

Rather poor fresh material examined, collected at the Mt. Lemmon control at an altitude of about 7000 feet. Description written partly from Jones.

Flexuosi

31. Astragalus famelicus Sheld. Minn. Bot. Stud. 9:
158, 1895.

Plants erect perennials, about 2 feet high, rather flexuose, slender stems growing from root-stocks; stems generally somewhat appressed-pubescent throughout; leaves shorter than the stout peduncles; leaflets linear to oblong, 15 mm. long, about 12-17 in number; flowers inclined to be purple, on long-peduncles racemes; calyx tube inserted obliquely or at right angles to the pedicel, about 6 mm. long, obliquely or at right angles also with respect to the minute, deltoid teeth; pods oblong to oval, inflated, inclined to be coriaceous, about 2 cm. long, short-villous throughout, straight, acute, with a short stipe or none. Blooms in late spring.

Description written from dried material collected near Flagstaff; herbarium material includes the

following: J. W. Toumey, Flagstaff, 9/5/94;
D. T. MacDougal, Mormon Lake, 6/9/98; L. N. Good-
ding, White Mountains, 7/23/12.

32. Astragalus sileranus Jones Cont. 2:242, 1891.

Plants with flexuose stems, internodes 6 cm. long, several from a stout and woody root, usually prostrate; entire herbage silky-pubescent with villous hairs; leaves about 1 dm. long, about sessile; leaflets 14-20, 1-2 cm. long, oval to oblong, obtuse to retuse, truncate at the base, long petiolulate, rather thick; flowers generally ochroleucous or cream-colored, with the tips purple; calyx campanulate, tube about 2 mm. long, the teeth about as long as the tube, the whole calyx inclined to be rather membranaceous; peduncles longer than the leaves; pods papery to coriaceous, globose to oblong, straight, 2 cm. or less long, with flat, upturned apex, inflated, mottled.

Description mostly written from Jones, since only his publication on the species and very fragmentary material from the Graham Mountains were available.

Argophylli

33. Astragalus shortianus Nutt. in T. & G. Fl. N. A.
1:331, 1838.

Plants practically acaulescent, the very short stems forming a dense, crown-like mat; generally silky-villous throughout; leaves sometimes 2 dm. long, usually less; leaflets 10-30, 2.5 cm. long or less, oval, with long petiolule; peduncles shorter than the leaves, the flowers bright violet, conspicuous, in capitate racemes; calyx commonly about 1 cm. long, black and white hairy, narrowly campanulate to cylindrical, the teeth always shorter than the tube; petioles half the rachis in length; pods ovate to lanceolate, laterally flattened, leathery, with the dorsal suture somewhat intruded, ribbed, almost falcate, somewhat villous-pubescent.

Description written from herbarium material collected near Safford.

34. Astragalus argophyllus Nutt. in T. & G. Fl. N. A.
1:331, 1838.

Plants with slender, prostrate, woody stems, short internodes, occurring in tufts; leaves about 1 dm. long, slender, narrow, the petiole about half the leaf rachis; leaflets 16-18, lanceolate, acute or sometimes obovate, 12 mm. long or less, silvery-canescenscent; peduncles never longer than

the leaves; flowers pink-purple, capitate at the ends of the slender peduncles; calyx membranaceous, 1 cm. long, narrow, teeth less than one-half length of the tube; calyx teeth generally unequal; pods always villous, varying widely but generally round to ovoid-ovate, 1.5 cm. long, arcuate toward the apex, jointed to the calyx with a minute stipe, cavity coarse hairy. Blooming from May to September.

Description written from several sources since no material was available.

Astragalus argophyllus var. castanaeformis Jones
Cont. 10:62, 1902.

Stems short, in dense mats, the stipules imbricated; leaves with petioles as long as the rachis; leaflets 8-16, ovate to elliptical, acute to rounded, 1 cm. long or less, grayish short-villous; peduncles shorter than the leaves; flowers lavender, the tips purple; pods leathery, inflated, ovate-triangular, half-oval, 1.5 cm. long, grayish-villous, ventral suture thickened, ending in the short, triangular beak; dorsal suture convex and raised, but not intruded.

Description from herbarium material collected by: D. T. MacDougal, Mormon Lake, 5/7/98.

Astragalus argophyllus var. pephragmenus Jones Cont.
5:267, 1893 (as sp.)

Stems much branched, in tufts, ascending, peduncles longer than the leaves, internodes longer than the stipules, but usually not more than 6 inches long; leaflets 10-30, oval, acute, thick, about 6 mm. long, silky-canescens, appressed-hairy; leaves about 7 cm. long; pods inflated, less than 3 cm. long, chartaceous-coriaceous, lanceolate to oblong-ovate, sometimes arcuate, grayish-pubescent, with a thick, short stipe.

Description modified from Jones; no material available.

35. Astragalus desperatus Jones Cont. 2:243, 1891.

Plants almost acaulescent, such stems as exist having congested internodes, stems rigid, woody, usually prostrate, numerous in tufts from the root; leaves 3 cm. long or less, petioles slender and about twice the rachis; leaflets 8-14, oval to obovate, obtuse, not over 1 cm. long, a bit thick, folded, canescens on both sides; stipules large, hyaline, acute, conspicuous; flowers white to cream-colored, pink-purple ribbed; calyx tubular, 7 mm. long or less, sides straight, red-

dish, teeth as long as the tube or shorter, never longer, the tube crinkly white-hairy; pods quite variable, ovate to linear-oblong, smooth when old, shaggy when young, 1-3 cm. long, the cross section varying greatly in outline, sessile, leathery to papery, ventral suture raised and thick but the dorsal thickened only within and raised as a mere line without.

Description modified from Jones since no herbarium material was available.

36. Astragalus remuleus Jones Cont. 7:658, 1895.

Plants rather stout perennials with prostrate stems about 6 inches long or longer, glabrate to puberulent throughout; leaves less than 1 dm. long, flexuose, the petioles shorter than the rachis; leaflets inclined to be leathery, 9-36 in number, petiolulate, 5-30 mm. long, glabrous above, short-villous below and on the margins; peduncles 10-20 flowered, the flowers spreading, purple; calyx tube obliquely cylindrical, 6-7 mm. long, teeth triangular, usually about half as long as the tube or less; pods oval-ovate, about 3 cm. long, sessile, usually glabrous and fleshy, obcompressed but not sulcate, 1-celled, apex upcurved, deltoid-acute

in cross section; fruiting peduncles somewhat decumbent. Leaflets generally oval in outline. Jones describes a variety as occurring in Arizona, but it is apparently a hybrid with A. layneae.

Described from herbarium material collected by D. T. MacDougall, Flagstaff, 6/2/98.

37. Astragalus newberryi Gray Proc. Am. Acad. 12:55,
1876.

Plants perennial herbs with very short stems forming small, dense tufts, growing from the crowns of the straight roots; leaves with stipules about free, short, many, petioles sometimes longer than the rachis of the leaf, but sometimes sessile; leaflets 3-4, obovate, 1 cm. or less, or sometimes slightly more in length, densely fine-villous, apiculate; flowers in 2-6 flowered racemes; calyx tube about 1 cm. long, with the subulate teeth about half as long as the tube; corolla about 3 cm. long, livid, purple-tinged; pods sessile, inflated, ovate-oblong, villous, the tip laterally compressed.

Description from Coulter and Nelson and from herbarium material collected by: M. E. Jones, Peach Springs, 5/84.

Astragalus newberryi var. watsonianus (Kuntze)
Jones Cont. 10:68, 1902.

Plants with crowns oblong, 3-7 cm. long, varying widely depending on whether or not the plant grows in the shade or sun; leaves about 1-1.5 dm. long, about the same length as the peduncles; petioles twice as long as the rachis of the leaves, leaflets about 10; flowers deep blue, conspicuous, about 3 cm. long; calyx soft, black and white hairy, the teeth subulate and generally more than 5 and less than 8 mm. long, longer than the tube; pods 1 cm. long, more or less ovate, ventrally shallow-sulcate, a bit inflated, with long, villous hairs, crisped. Grows on the Mogollon Plateau at an elevation of about 6000 feet, and blooms in May or earlier at lower altitudes.

Description modified from Jones.

Malaci

38. Astragalus ensiformis Jones Cont.7:658, 1895.

Plants with few prostrate, slender, sometimes ascending stems about 1 dm. long; leaves about 1.5 dm. long, few in number; leaflets 12-16, oval to

narrowly oblong, about 1.5 cm. long; obtuse, glabrous on the upper surface, villous on the lower, as are the stems; stipules large and wide; flowers on short pedicels; flowers purple, sessile; calyx nigrescent, 4-5 mm. long, the triangular teeth about half as long as the tube; pods about 8 mm. long, obcompressed when dry, sulcate ventrally but not dorsally, reflexed, appearing vetch-like when dry, somewhat falcate, obtuse at both ends, dorsal suture intruded almost to the ventral.

Description modified from Jones, who is the only person I have found who describes this species.

39. Astragalus layneae Greene Bull. Cal. Acad. 3:
156, 1885.

Plants with very short to foot-long, flexuose stems, internodes usually less than 2 cm. long, several from the slender rootstocks; leaves prostrate, short-petiolate; leaflets 12-18, oval, 1 cm. long, long-petiolulate, often long, tangled, silvery-hairy; flowers white, tips purple, in racemes which are many-flowered, stubby; calyx about campanulate, black and white hairy, with very short, deltoid, black teeth; pods often arched

to a complete circle, short-stipitate, 3-5 cm. long, long-acuminate, somewhat fleshy, walls thick, dorsal suture intruded about half-way from the base to the middle, then 1-celled to the tip.

Description from Jones; no herbarium material available.

Mollissimi

40. Astragalus bigelovii Gray Pl. Wr. 2:42, 1853.

Plants with rather rigid stems, ascending from prostrate base, plant throughout silky-tangled-pubescent; leaves up to 2 dm. long, petioles as long as the leafy rachis; leaflets rounded to oval, 15-30, yellow-hairy; corolla violet, the flowers occurring in dense spikes, on long peduncles; calyx a bit inflated and pink, shaggy-villous, slightly curved, tube 7 mm. long, teeth filiform to subulate and about half as long as the tube; pods smooth, leathery, dehiscent, oblong to ovate, slightly arched, 1 cm. long or longer; Pods vary greatly in the species; both sutures sulcate, the legume obcompressed. Blooming February to April; in complete fruit often by the end of March.

Description written from fresh material gathered in the Santa Ritas at about 4000 feet. Herbarium material collected by: J. J. Thornber, Mescal, 5/26/06 and Empire Ranch, 9/1/05; L. N. Goodding, Bisbee, 4/09; L. C. Whitehead, northern Arizona; J. C. Reed, Cochise, 4/6/16; L. T. MacDougal, Flagstaff, 6/18/98.

Astragalus bigelovii var. matthewsii Wats. Proc. Am. Acad. 18:192, 1885. (as sp.)

Plants in general like the type species except that flowers are in loose spikes; pods about 1.5 cm. long, markedly inflated, chestnut-shaped, about as wide as long.

Description from Jones, since no material was available.

Astragalus bigelovii var. thompsonae (Wats.) Jones Cont. 8:23, 1898.

Acaulescent, few thick crowns from a semi-woody root, a beautiful plant with very showy purple flowers; leaves long, attenuate-tipped, the leaflets very many on the rachis, often as many as fifty, the pubescence white-woolly, and the leaves moss-green; flowers in loose spikes, about 2.5 cm.

long or less; calyx tube 1 cm. long or slightly less, the teeth usually less than one-third as long, nigrescent; flower stalks usually longer than the leaves; pods about oblong to almost ovate, 1-3.5 cm. long, markedly falcate, appressed silky-hairy throughout, two-celled to within about 5 mm. of the tip, both sutures sulcate. This is one of the most beautiful plants of the entire genus and at the same time probably one of the most poisonous of all loco plants, according to cattlemen.

Description written from pressed material from the Kaibab region of northern Arizona.

41. Astragalus intermedius (Jones) Palmer in Jones, Cont. 3:6, 1894.

Plants very similar to A. amphioxys, but differ in that the pubescence is fixed by the base, (villous), rather than attached at or near the middle; typical perennials with very short stems, usually less than one foot long, growing in tufts, and covered with imbricated stipules which may be 4 cm. long; leaves 5-8 cm. long, silvery-canescant, petioles about half as long as the rachis; leaflets 20-35, usually oval, 3-8 mm. long, generally obtuse or rounded; calyx tube cylindrical, short-villous, the teeth about half as long as the tube;

flowers loosely spicate, confined to the upper third of the peduncle; pods generally oblong, about 2 cm. long, about straight, the tip deltoid-flattened; pubescence on the pods generally short-villous.

Description modified from Jones; no material available.

42. Astragalus humboldtii Gray Proc. Am. Acad. 6:195,
1864.

Plants acaulescent or with short, prostrate stems; leaves usually longer than the peduncle, the petioles shorter than the leaf rachis; leaves with leaflets 40 or more, ovate, acute, 8 mm. long or less, with rather dense yellow pubescence; flowers violet to white, usually in dense spikes, rather conspicuous; calyx tube 5 mm. long or slightly less, with short, appressed pubescence, the teeth more than the tube rarely, usually more than half the tube, subulate; pods narrowly oblong to oblong, 1.5 cm. long or less, falcate, with markedly ribbed valves; when mature, pods are puberulent, two-celled from about half way down to the base. From appearances this might easily be a variety of *bigelovii*.

Description modified from Jones.

43. Astragalus mollissimus Torr. Ann. Lyc. N. Y. 2:
178, 1828.

Plants with rigid stems, which ascend from a prostrate base, internodes short and the crowns tending to be fleshy or woody; leaves with petioles about half as long as the entire leaf, or about as long as the rachis; leaflets 15-30, oblong-ovate, velvety-villous with somewhat yellowish hairs; flowers generally in rather dense spikes, bright purple, conspicuous, about 2 cm. long, the peduncles generally as long as the leaves; calyx tube about 6 mm. long, tubular, rather long silky-villous, the teeth subulate and usually less than half as long as the tube or just about half as long; pods smooth, coriaceous, narrowly oblong to oblong, laterally flattened, both sutures sulcate, when mature somewhat arcuate. This is one of the most poisonous of all the locos.

Description from fresh material collected near Ft. Grant. Herbarium material collected by:
J. R. Sandige, Bowie, 4/4/15.

Sarcocarpi

44. Astragalus plattensis Nutt. in T. & G. Fl. N. A.
1:132, 1838.

Plants perennial, caespitose, with rather

slender, mostly prostrate stems about a foot long; leaves with short petiole; leaflets 16-28, cuneate to oblong or elliptical, about 5-15 mm. long, acute, rounded, or toothed at the apex; flowers racemose, dense; calyx tube narrowly cylindrical, about 5 mm. long, black-hairy, the teeth deltoid and about half as long as the tube; pods rather fleshy or spongy, 2-celled, by intrusion of the dorsal suture, straight, usually 1.5 cm. long, usually ovate, the surface minutely rugulose, obcompressed.

Description from Rydberg and herbarium material collected by: J. J. Thornber, Willcox.

Cereati

45. Astragalus sophoroides Jones Zoe 2:12, 1891.

Plants with rather slender stems, 1-3 dm. long, internodes several and 3-6 cm. long, densely pubescent; leaves about 8 cm. long, petioles generally shorter than the rachis; leaflets 8-16, linear to oblong, rounded at apex, cuneate at base, 1-3 cm. long; flowers less than 1 cm. long, white to purple-tinged; calyx shaggy-hairy; pods arched, 5-9 mm. long, obcompressed, chartaceous, not sulcate on dorsal suture, seeds large.

Description from Jones; no material available.

46. Astragalus confertiflorus Gray Proc. Am. Acad.
13:368, 1891.

Plants diffusely branched, prostrate to decumbent; leaflets 4-12, oblong or lanceolate or linear, acutish, puberulent above, villous below; flowers white to yellowish, the peduncles longer than the leaves; flowers in elongate spikes; calyx about cylindrical, 5 mm. long, the subulate teeth about as long as the tube; pods short, about 7 mm. long, occasionally 12 mm. long, obcompressed, ovate to about oblong, always pubescent, but this varying, almost straight, with a very short stipe, deeply intruded dorsally, the sutures almost meeting within. This is exactly A. flaviflorus (O. K.) Sheld.

Description drawn mostly from Coulter and Nelson.

47. Astragalus moencoppensis Jones Zoe 2:12, 1891.

Plants densely caespitose, from the straight taproot; leaves long, often 3 dm., with green petioles about as long as the rachis or less; leaflets puberulent, about filiform or linear, long and narrow, 2.5 cm. or longer, acute, about 10 in number, the upper ones on the rachis obsolete; flowers purple-tipped, 7-9 mm. long;

calyx about 4 mm. long, tomentose, the teeth barely as long as the tube, subulate; peduncles Juncus-like, tapering, with the flowers loosely racemose on the upper half; pods about 6 mm. long, linear in cross section, neither suture prominent, long-villous, about oval to oblong, a bit sulcate dorsally and ventrally; plants blooming in spring, about March.

Description from material collected by: M. E. Jones, Moencoppa, Arizona, 6/11/90.

48. Astragalus troglodytes Wats. Proc. Am. Acad. 20:
362, 1885.

Plants with erect leaves about 1 dm. long, but practically acaulescent; petiole longer than the leaf rachis; leaflets 12-16, obovate to narrowly so, obtuse, usually about 1 cm. long, often retuse, appressed-villous; flowers in dense spikes; calyx 4 mm. long, teeth half as long as the tube, the flowers about twice as long as the calyx and tube; pods loosely villous, 6 mm. long, obcompress- ed, sutures prominent and apiculate, inflated, not sulcate.

Description modified from Jones; no material available.

Hamosi

49. Astragalus arizonicus Gray Proc. Am. Acad. 7:398,
1868.

Plants annuals, usually with the stems procumbent to prostrate, always flexuose, villous-pubescent, 25-35 cm. tall; leaves alternate, the petioles always shorter than the leafy rachis, sometimes the upper sessile, densely villous-pubescent on petiole, rachis, and both sides of the leaflets; leaflets 9-19, linear-acute to narrowly ovate-obtuse, 3-10 mm. long, 1.5-4 mm. broad; flowers numerous in short racemes, barely 1 cm. long; pods 1.8-3.5 cm. long, somewhat inflated, linear, tapering somewhat to each end, without a stipe, slightly curved, reticulate beneath the dense, appressed-villous hairs, pods sharply contracted into a beak about 4 mm. long; pods completely two-celled by membranes extending from the dorsal suture; neither suture in the least sulcate in the specimens examined; pods coriaceous; corollas purple to dirty-white; calyx tube white and black hairy, campanulate, 5-6 mm. long or less, the teeth subulate and generally much shorter than the tube; small, leafy bracts at the base of each flow-

er about 1.5 mm. long and nigrescent-hairy.

Description drawn from fresh material gathered in Tanque Verde region. Herbarium material includes that collected by: J. J. Thornber, Santa Ritas, 5/5/05; J. J. Thornber, Arivaca, 3/27/15; J. J. Thornber, Mescal, 5/5/35; J. J. Thornber, Total Wreck Smelter, 5/8/02; J. J. Thornber, Empire Ranch, 5/7/02; H. M. Spruance, Oracle, 4/5/12; H. C. Kendall, Tombstone, 4/6/35; V. M. Spalding, Sierritas, 3/20/06; W. G. Noyes, 3/26.

50. Astragalus calycosus Torr. Bot. King. 66:t.10,
1871.

Plants about acaulescent, silvery-hairy, with very short, branched caudex and divaricate leaves and peduncles; leaves with long petioles, at least twice as long as the rachis; leaflets 3-12, oblong or ovate, 3-10 mm. long, white-hairy on both sides, acutish; peduncles longer than the leaves; calyx campanulate, the tube longer than the deltoid teeth, 3-4 mm. long; corolla white or purple, cleft, the flowers in few-flowered capitulate racemes; pods mostly straight but occasionally arcuate, sessile, villous, slightly sulcate dorsally, the ventral suture a bit intruded, completely

2-celled, 1-2.5 cm. long; plants varying quite widely.

Examined from fresh material gathered in the southern foothills of the White Mountains.

Astragalus calycosus var. scaposus (Gray) Jones
Cont. 4:26, 1893.

Plants generally larger, stouter, and with longer stipes than the type species; calyx teeth almost obsolescent, the corolla wings hardly cleft, in contrast to the species, where they are markedly so.

Studied from herbarium material collected by:
M. E. Jones, 5/26/84; G. B. Grant, Grand Canyon, 5/03; J. J. Thornber, Ft. Apache, 7/24/05; J. J. Thornber, Grand Canyon, 8/11/16.

Leptocarpi

51. Astragalus nuttallianus DC. Prodr. 2:289, 1925.

Plants marked annuals, blooming generally about February to May, the stems simple or branched at the base, decumbent to ascending, slender, rather filiform, varying from a few inches to 2 feet in length; glabrate to strigose; leaves petioled, 1-6 cm. or more in length; flowers in racemes, few; peduncles about as long as the

leaves; calyx tube 1-2 mm. long, the teeth narrowly subulate and as long as the tube; corolla light lavender to purplish, 3-6 mm. long; leaflets 11-21, oblong to obovate, usually retuse, 2-10 mm. long, often smooth above and strigose below; pods rather linear, 2-3 cm. long, flattened laterally, not inflated, 2-celled, glabrous when ripe, villous when younger; pods sometimes purple-suffused.

Description from plants collected in Tucson; herbarium material collected by the following: J. J. Thornber, Tucson Mountains, 2/28/03, Wilmot, 3/24/03, Catalina Mountains, 3/21/03, University of Arizona campus, 3/30/02, Pantano, 5/7/02, Empire Ranch, 5/8/02, Casa Grande, 3/23/02, Thatcher, 3/14/05; D. Griffiths; B. F. Kilgour, Reddington, 3/4/13; L. Swingle, Tucson, 1914; Alice Samson, Tucson, 3/18/35; M. F. Gilman, Sacaton; D. Miller, Phoenix, 3/11/21; D. B. Carter, Picture Rocks, 3/26/27; J. W. Toumey, Tucson, 5/10/94.

Astragalus nuttallianus var. trichocarpus T. & G.
Fl. N. A. 1:334, 1838.

Plants annuals, villous throughout in contrast to the type species, rather low; leaflets

obtuse, 10-14 in number; stems seldom erect, usually prostrate to ascending.

Description from fresh material examined near Safford; herbarium material collected by: J. J. Thornber, Oracle, 3/12/05.

52. Astragalus nothoxys Gray Proc. Am. Acad. 6:232,
1864.

Densely leafy plants growing typically in the Santa Catalina mountains, the specimens examined being herbarium material since fresh material was not available; stems a foot long or longer, very numerous, entire plant about glabrate; leaves with petioles varying widely in length, the upper ones occasionally sessile; leaflets 10-16, about 6 mm. long generally, ovate or obovate to elliptical, retuse, a bit leathery, the pubescence sparse and villous; calyx almost cylindrical, about 4 mm. long, straight below, arched above, the almost filiform teeth less than the tube; corollas dirty-white, purple-tinged; pods acute, about 2-celled, dorsally sulcate, erect, linear, or slightly broader, often arcuate, flattened laterally. Blooming in spring.

Micranthi

53. Astragalus hypoxylus Wats. Proc. Am. Acad. 18;192,
1883.

Plants with the short stems matted, the internodes very short; leaves spreading, 2-3 cm. long, short-petioled; leaflets 8-14, obovate, long-petiolulate, obtuse, grayish-villous; calyx tube turbinate, 2 mm. long, black-hairy, with lax, subulate teeth as long as the tube; peduncles twice as long as the leaves; pods 1 cm. long, linear-oblong, narrow, ventral suture almost straight, acuminate into a deltoid beak, cordate in cross-section, sulcate dorsally, grayish-villous.

Description modified from Jones, since no fresh nor herbarium material was available.

54. Astragalus vaccarum Gray Pl. Wr. 2:43, 1853.

Plants with almost filiform, nearly erect stems 2 feet or less high, branching below; leaves 8 cm. or less long, sometimes pendent, sessile above, petioled below; peduncles filiform and generally longer than the leaves; flowers green-white to purple; calyx tube almost cylindrical, very short, teeth deltoid, about as long as the long-villous tube; calyx bracts as long as the

calyx; pods soft-villous, reniform in section, broadly sulcate along both sutures.

Description modified from Jones since no material was available.

Didymocarpi

55. Astragalus dispermus Gray Proc. Am. Acad. 13:365,
1878.

Plants with prostrate stems, the inner ones sometimes ascending, 2 feet or less long, internodes long, branched below; leaves 4 cm. long or less, petiolate, spreading; leaflets leathery, 6-10, oblong to cuneate, retuse, 3-7 mm. long, long-petiolulate; calyx white-villous, teeth subulate, longer than the tube and green; flowers capitate, purple, about 4 mm. long, the wings white; entire plant white-villous; pods oval to deltoid-ovate, 4 mm. or less long, almost as wide, more or less corrugated, sulcate dorsally, ventral suture convex but not thickened.

Description from herbarium material collected by: J. J. Thornber, 12 miles south of Oracle, 5/13/06; J. J. Thornber and Hastings, Sacaton, 4/7/76; M. French Gilman.

THE SPECIES OF ASTRAGALUS OCCURRING IN
ARIZONA (WITH SYNONYMS)

1. Astragalus accumbens Sheld. Minn. Bot. Stud. 9:157,
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A. procumbens Wats. Proc. Am. Acad. 20:361, 1885.
2. Astragalus allochrous Gray Proc. Am. Acad. 13:366,
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var. wootoni (Sheld.) Minn. Bot. Stud. 9:138,
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A. triflorus Gray Pl. Wr. 2:45, 1883. (In part).
A. subcinereus Gray Proc. Am. Acad. 13:366, 1878.
A. playanus Jones, Cont. 8:6, 1898.
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Phaca candolleana H. B. K. Gen. & Sp. vi:495, T,
586.
A. cerussatus Sheld. in Minn. Bot. Stud. 1:139,
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3. Astragalus artipes Gray Proc. Am. Acad. 13:370,
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4. Astragalus arizonicus Gray Proc. Am. Acad. vii:398,
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5. Astragalus argophyllus Nutt. in T. & G. Fl. N. A.
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- var. pephragmenus Jones Cont. 5:267, 1893 (as sp.)
var. castanaeformis (Wats.) Jones Cont. 10:62,
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uintensis Jones Cont. 7:670, 1895.
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Xylophacos uintensis (Jones) Rydb. Torr. Bull. 32:
662, 1905.
A. glareosus Dougl. Hook. Fl. Bor. Am. 1:52, 1834.
A. booneanus Nels. Bot. Gaz. 53:223, 1912. (In part).
6. Astragalus arrectus Gray Proc. Am. Acad. 8:289, 1870.
A. leucophyllus Hook. Lond. Jr. Bot. 6:211, 1847.
A. palousensis Piper Bot. Gaz. 22:489, 1896.
A. atropubescens C. & F. Bot. Gaz. 18:300, 1893.
A. cusickii Rydb. Torr. Bull. 26:542, 1899.
A. malheurensis Heller, Cat. Ed. 2:7, 1900.
Phaca arrecta (Gray) Piper Fl. Wash. 371, 1906.
Tium arrectum (Gray) Rydb. Torr. Bull. 40:49, 1913.
Tium atropubescens (C. & F.) Rydb. Torr. Bull. 40:
49, 1913.
7. Astragalus beckwithii T. & G. Pac. Rail. Rep. 111:
120, 1854.
Tragacantha beckwithii Kuntze Rev. Gen. 2:943,
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Phaca beckwithii Piper Fl. Wash. 371, 1906.
8. Astragalus bigelovii Gray Pl. Wright. 2:42, 1853.
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