Poa secunda Presl; cordilleran; submontane-alpine; Hot Springs Creek, B&S 121-66; Vulcan, B 37-64 AGUW; Slumgullion Gulch, B 95-59 CS, RMBL; East Brush Creek Valley (south), B&S 639-62 CS, RMBL, AGUW; Baldy Chato, B&S 462-62 RMBL, AGUW; Cumberland Pass, Wi 12150 (1954). P. secunda comes close to matching P. Fendleriana in the wideness of its distribution in the Gunnison Basin. About the only difference between them in this respect is that P. Fendleriana, being more tolerant of shade and of moisture, is somewhat more frequent than P. secunda in the northern half of the Basin, that P. secunda, being more tolerant of openness and drought, is somewhat more frequent in the southern half of the Basin. Both species are about equally tolerant of alkaline soil. But morphologically, the round-backed lemmas of P. secunda will be noted the moment magnification is applied to a spikelet, and there is a gross character that allows the grass to be recognized before collection. The tips of the lemmas are not purple and dark (as is the case with many sun-exposed grasses), but light-colored, ranging from hyaline to yellow to golden brown. This gives to the panicle of the species a variegation all of its own, whether encountered in the alpine zone or on the floor of the Basin. On the floor of the Basin, as observed earlier,* P. secunda is apt to be the gramineous associate of the sagebrush, occasionally being replaced by Festuca arizonica, which is elsewhere the more common associate.

Poa Canbyi (Scribner) Piper; boreal; submontane-montane; Gold Basin Creek drainage, B&S 46-66, B&S 53-66 (two stations); Cathedral, B&S 219-62 CS, RMBL, AGUW. This is a larger, more vigorous grass than P. secunda, with the same peculiar light-and-dark variegation of the panicle; in fact this grass stands to P. secunda very much as P. macroclada stands to P. leptocoma, the lemmas of P. Canbyi running to about six millimeters; those of P. secunda to about five millimeters. What is intriguing about this presumably boreal species, which grows on the Gaspé Peninsula

* See above, p. 46.

and in Rimouski County, Quebec, is that in the Gunnison Basin it is clearly centered in the submontane zone, and furthermore is found in the Colorado Plateau country immediately west of the Basin. Can it be that this is a species which, originally cordilleran, migrated east during a recent interglacial and thus only appears to be boreal?

Nevadenses, The Prairie Bluegrasses

Sometimes this group is united with the preceding, perhaps because of the reputed roundness of its lemmas. But Poa juncifolia, a member of the group well established in the Gunnison Basin, has lemmas that are distinctly keeled; and in habit of growth and other features it is quite unlike P. secunda and P. Canbyi. Actually, it is habit of growth more than anything else that seems to link the two Gunnison Basin members of the Nevadenses. Thus both P. juncifolia and P. nevadensis have slender panicles and stiff leaves, and the added characteristic of sending forth innovations from the base of the parent culm.

Poa juncifolia Scribner; cordilleran; submontane; Cebolla Hot Springs, B&S 669-62 CS, RMBL, AGUW. At this station, the culms of this plant of alkaline soil grow to about a foot in height; but the stemleaves are hardly more than an inch long, and even the leaves of the innovations attain to little more than three inches. The spikelets seem to be consistently three-flowered.

Poa nevadensis Vasey; cordilleran; montane; East Beaver Creek, G 2812 (1964) WS. The habit of this plant of montane meadows has already been discussed. The long ligules, decurrent down the scaberulous sheaths, are striking and will remove any residual doubt as to the plant's identity.

Annuae, The Annual Bluegrasses

The annual poas are relatively low plants with open panicles and slight root systems. They are quite differ-

ent from the coarse, barnyard type of annual grass.

Poa annua L.; adventive; subalpine-montane; Gothic, W 9102 (1955) COLO; Crested Butte, H&M 7177 (1952) CS. These collections are from moist open places, not more than six inches high, and with inflorescences rising above the leaves. The three- to four-flowered spikelets are short and broad. I report the species as adventive in accordance with the Hitchcock-Chase manual, but must observe that in the Gunnison Basin it acts like a native plant.

Puccinellia Parlatore, Alkali-grass

It is the alphabet that has placed Puccinellia after the poas in this flora. But it so happens that in Puccinellia the backs of the lemmas are rounded as they are in the subgenus of the poas called the Scabrellae. On the other hand, Puccinellia is also like Glyceria, for the nerves of its lemmas (although not prominent) similarly stay apart until near the top. The genus is adapted to saline soil.

Puccinellia distans (L.) Parlatore; adventive; submontane; Cebolla Hot Springs, B&S 447-62 CS, RMBL, AGUW. This annual grows a foot and a half tall; and where collected, was growing in large patches along with similar large patches of Carex praegracilis. If one waits long enough, the panicle branches will droop, although at the moment of collection they may well be extended at right angles from the central stem. The collector will note the erose edges of the glumes and lemmas.

Hordeae, The Wheats, Ryes, and Barleys

A few days before turning to the Hordeae, while on a hike in southern Wisconsin, I took a rest on a grassy roadside in the April sunshine. There beside me were the culms of some hordeaceous grass. The spikelets were all gone, as they were supposed to be, and the

leaves were flattened to the ground; but the culms were intact and erect, and gave a wonderful exhibit of the peculiarity of the Hordeae. For toward the top, at a node, each culm suddenly changed into a series of square waves. The node was flattened so as to form a pedestal for a spikelet or spikelets, and then the culm bent back and forth between successive pedestals until it ended in a last one.

This device, simple yet strong, would seem to be the most economical way of holding aloft a number of vertical objects, and I am surprised that engineering has not made use of it in architecture. Or maybe it has, and I don't know about it. In any case, the device is the chief thing about the Hordeae, and many of the distinctions between both the species and the genera of the tribe will have to do with this device, as well as with the arrangement of the spikelets upon the pedestals.

Agropyron Gaertner, The Wheatgrasses

In the Gunnison Basin, the spikelets of this wheatlike genus are all placed singly, each upon a separate node or pedestal. The species are also all perennial.

Agropyron desertorum (Fischer) Schultes; adventive; montane-submontane; Cement Creek Valley, B 81-57 RMBL; Cathedral, B&S 353-62 CS, AGUW; Cochetopa Park, H 9088 (1959) CS. A. desertorum will catch the collector's eye because of the symmetrical, herringbone arrangement of the spikelets in the spike. One has to go to the chlorid grasses for anything else so combed and neat.

Agropyron repens (L.) Beauvois; adventive; submontane; Cebolla Hot Springs, B 69-64 RMBL. This adventive wheatgrass is a dweller in moist to median habitats, and has rhizomes so stout that at times they seem almost in scale with some of the more slender spikes. The spikelets are short-awned to awnless, and the glumes are strongly ribbed. The plant is tolerant of alkaline soil.

Agropyron riparium Scribner & Smith; cordilleran; submontane; Gunnison, Ko 9/7/61 (two stations) WS. This plant is very close to A. repens, and may be regarded as its native counterpart, showing a cordilleran adaptation to drier sites, and with involute rather than flat leaves. It is also rhizomatous. But apparently it is not tolerant of alkaline soil.

Agropyron Saundersii (Vasey) Hitchcock; cordilleran; montane; Gothic, L 3877 (1954) COLO. On account of its straight awns and the slenderness and shortness of the spike, this is a wheatgrass that could pass for a fescue. As a matter of fact, the above collection was made in Festuca Thurberi grassland and illustrates the principle, mentioned by Gleason,* that plants which live together often tend to look alike. The Hitchcock-Chase manual reports that sometimes, in the middle of a spike, the spikelets occur in pairs.

Agropyron Scribneri Vasey; cordilleran; alpine; Virginia Basin, L 278 (1949) CS; Cumberland Pass, B 101-57 CS, RMBL, AGUW; Long Branch Baldy, B&S 114-66; Rough Creek Pass, B&S 627-62 CS, RMBL, AGUW. No grass in the Gunnison Basin is more distinctive than this. A plant of the alpine zone, where most of the vegetation is low, it rises a foot or more high, holding its nodding, stout spikes to the alpine winds as though it were more than able to withstand them. The awns run to an inch and a half in length, the spikes to three and a half inches.

Agropyron Smithii Rydberg; cordilleran; submontane; The Palisades, B 63-57 CS, AGUW; Almont, B 121-59 RMBL; Quartz Creek Valley, S 65-104 RMBL; Powderhorn, B 152-64; Cebolla Hot Springs, B 244-65; Cathedral, B&S 218-62 CS, RMBL, AGUW. Despite the caution with which the character of rhizomes must be used in the Gunnison Basin,** the presence of rhizomes is usually employed to separate this species from A. trachycaulum, which is seldom rhizomatous. But there

* Gleason & Cronquist, The Natural Geography of Plants, N.Y., 1964, p. 131.

** See above, p. 17.

are other characters. A. Smithii is a plant of the submontane zone, reaching up into the lower montane zone only in open places (B&S 218-62). Furthermore the plant is tolerant of alkaline soil as A. trachycaulum is not; and it is not tolerant of shade, as A. trachycaulum is. Again, A. trachycaulum, especially in the alpine zone, darkens and reddens in response to the sun. Yet in the above collections of A. Smithii (all from open places), the only one that shows the least suffusion of pink is the one from the alkaline habitat of Cebolla Hot Springs. Finally, there is the excellent character of anther length. The anthers of A. trachycaulum range from one to two millimeters in length, those of A. Smithii from three and a half to four and a half millimeters in length.

Agropyron trachycaulum (Link) Malte; boreal; alpine-submontane; Cumberland Pass, B 104b-57 CS, RMBL, AGUW; Gothic Natural Area, B 176-59; Capitol City, S 62-41; Cathedral, B 696-62 CS, RMBL; Gunnison, B&S 307-62. At least by implication, A. trachycaulum has already been adequately differentiated from the other wheatgrasses in the Gunnison Basin. It is by far the most widespread and the most frequent of them all. In the case of A. Smithii and A. trachycaulum, it is interesting that of these two closely related species the most frequent and widespread should be the boreal, not the cordilleran, plant. It is also interesting that on purely ecologic and taxonomic grounds, A. Smithii can be regarded as a cordilleran modification of A. trachycaulum--indeed as a modification that has probably moved east since the retreat of the glaciers, thus obscuring to some extent the distinction between the cordilleran and the boreal species. I remember that when I first thought of writing this flora I supposed that a manual of plant geography had long since been written in which the various species were ascribed to the phytogeographical elements to which they belonged. It did not take long to disabuse me of my supposition. In the interim when, as far as I can see, the business is largely a matter of educated guesses, I hope it will be remembered that the phytogeographical opinions advanced

in this flora are tentative only, and that a number of the species set down here as of boreal origin may quite possibly turn out to be cordilleran plants that moved east in the wake of the retreating ice.

Elymus L., The Wild Ryes

In Elymus, the spikelets are two or more to a node, with the glumes gathered together to form a fence around the rim. In E. cinereus, the larger of the two Gunnison Basin species, the glumes are narrow and the fence is only a series of palings. In E. glaucus, the glumes are wide and are placed edge-to-edge.

Elymus cinereus Scribner & Merrill; cordilleran; submontane-montane; Gunnison, B 67-55 RMBL; Cebolla Hot Springs, S 66-177; Cathedral, B&S 385-62 CS, RMBL. This is the largest grass in the Gunnison Basin, growing in enormous tussocks along roadsides on the floor of the Basin and attracting the attention of every one interested in plants. It is tolerant of alkaline soil, and in dry places reaches up into the lower montane zone.

Elymus glaucus Buckley; cordilleran; subalpine; Gothic Natural Area, B 175-59 CS, RMBL, AGUW; Peeler Basin, I 18874 (1961). Except morphologically, this plant is about as far removed from E. cinereus as well could be. As retiring as E. cinereus is conspicuous, it is a broad-leaved grass seeking the drier spots in the spruce-fir forest. At present, it is known only from the Elk Mountains section of the Gunnison Basin.

Hordeum L., The Barleys

In Hordeum, the spikelets occur as triplets on the pedestals; but the lateral spikelets, evolutionarily speaking, are on their way out, being reduced in some cases to mere awns. As with Elymus, there are, apparently, two native species in the Gunnison Basin: H. brachyantherum and H. jubatum. I have seen a collection of H. vulgare; but the data contained a contradiction, and

in any event the population could have represented only a few plants sprung from some dropped feed.

Hordeum brachyantherum Nevski; boreal; montane-submontane; Gothic, B 184-59; Crested Butte, B 65-57; Cathedral, B&S 421-62 CS, RMBL, AGUW; Willow Creek Valley, B 157-65. In this species, the glumes are practically awns, and the lateral spikelets of the triplet (each composed of a reduced floret between a pair of such awns) are elevated on short pedicels. After the spike has attained maturity, there is a good test for the species. The rachis of the slender spike soon starts disarticulating, the terminal segment falling, and thus causing the spike to end in a V. The V then recedes until finally it reaches the culm itself.

Hordeum jubatum L.; boreal; submontane; Almont, B 40-59 CS; Gunnison, B&S 308-62 RMBL; Powderhorn, B&S 492-62 CS, RMBL, AGUW. The structure of the spike here is pretty much as in the preceding species. There are, however, a number of gross differences. The awns are many times longer, which not only brings out their purple tinge but makes the spike seem much thicker than that of H. brachyantherum. Again, the plant is tolerant of alkaline soil as H. brachyantherum is not. Finally, the species is a plant of waste places, principally in the submontane zone, while H. brachyantherum is generally a grass of montane meadows. Both species are found in moist to median, not dry, habitats.

Sitanion Rafinesque, The Squirreltails

This genus is close to Hordeum and confusable with it. For although the spikelets come in pairs instead of triplets, each spikelet (instead of being one-flowered) is often two-flowered, the second floret being borne on a considerable rachilla, which seems like a pedicel. Thus sometimes (unless one looks very close), he may think he has the pediceled spikelets of Hordeum instead of the elevated florets of Sitanion.

Sitanion Hystrix (Nuttall) J.G.Smith; cordilleran; submontane-montane; Gold Basin Creek drainage, B 27-59 CS; Cebolla Hot Springs, B 245-65; Gothic, B 125-59 CS; Fish Creek Valley, B&S 345-62 CS, RMBL, AGUW. In spite of the possibility of morphological confusion between Sitanion and Hordeum, there is almost no possibility of confusing the species if one sticks to gross characters. For S. Hystrix is a plant of dry places, and the only location in which I have found S. Hystrix and H. jubatum in proximity was in the alkaline region of Cebolla Hot Springs, where there was a division of dry and moist sites between them. Again, the spike of S. Hystrix is not only larger but much less dense. You can see air holes in it. And this you cannot do with H. jubatum.

Lolium L., The Darnels

The genus Lolium is notable among the Hordeae for having its spikelets (solitary on their pedestals) turned edgewise to the rachis of the spike. In the process, the inner glume has become lost except for the terminal spikelet. Thus the protruding, edgewise spikelets give a regular, zig-zag effect to the spike, and one cannot help wondering what the adaptive significance of this device (if any) may be.

Lolium multiflorum L.; adventive; submontane; Gunnison, Ste 11/11/61 WS. This is a larger, stouter plant than L. perenne, but is best separated from it by the presence of awns on some of the florets.

Lolium perenne L.; adventive; submontane; Gunnison, Ko 9/27/61 WS. This species is less tall, and less robust, than the preceding, and can be distinguished from it by the awnless spikelets.

Phalarideae, The Phalarid Grasses

The phalarids are a curious tribe of grasses if only for the fact that with the whole ring of boreal continents at their command in the past they muster today only a

half-dozen genera. Two of these genera are represented in the Gunnison Basin, each by a single species. Technically, the hallmark of the tribe is the presence of two vestigial florets below the single, perfect floret.

Hierochloë R.Brown, The Sweetgrasses

In Hierochloë, as distinguished from Phalaris, the two vestigial florets are staminate and larger than the perfect floret.

Hierochloë odorata (L.) Beauvois; boreal; montane; Gothic, Wi 10351 (1954); Fish Creek, B&S 32-62 CS, RMBL, AGUW. This grass of moist places is slenderly but profusely rhizomatous. The inflorescence is pyramidal, and the relatively large, light golden-brown spikelets frequently hang from the branches. In northeastern North America, generations of Indians have used this sweet-smelling species as a material for baskets; and years after collection (and fumigation with PDB), herbarium sheets still give forth the delightful odor.

Phalaris L., The Canarygrasses

In Phalaris, the two vestigial florets beneath the perfect floret have been reduced to mere scales, or empty lemmas, as they are perhaps more frequently called.

Phalaris arundinacea L.; boreal; montane-submontane; Gothic, Hu 59-112 RMBL; Powderhorn, B 106-64; Parlin, B&S 122-66. A few pages back (and in reference to its enormous tussocks), Elymus cinereus was called the largest grass in the Gunnison Basin. P. arundinacea and Glyceria grandis (which frequently grow cheek by jowl) are easily the tallest grasses, commonly reaching heights of between four and five feet. The panicle of P. arundinacea is compact and often spikelike (much resembling that of Calamagrostis inexpansa), and its rhizomes are both less profuse and stouter than those of Hierochloë odorata. It also is a grass of moist and even wet places.

Zoisieae, The Zois Grasses

The zois grasses (pronounced like the woman's name, Lois) constitute a curious tribe with only a few genera in the world and but one species in the Gunnison Basin. The inflorescence, which is spikelike, is composed of short spikes (sometimes reduced to a single spikelet) that are virtually sessile on the central axis and fall as units.

Hilaria HBK., The Galletas

In this genus the small spikes are composed of three spikelets, the central one being pistillate, the lateral ones staminate. The six glumes then combine to form a false involucre.

Hilaria Jamesii HBK.; cordilleran; submontane; Dry Gulch, Ba 8/2/53 CS; Sapinero, Wd 6/29/55 CS. One could hardly miss this rhizomatous grass with the three spikelets of each spike clustered at the nodes, a crown of whiskers underneath each cluster, and the lemmas sawed off. As a consequence of the latter, the spikelike inflorescence has a steplike, geometrical appearance. Apparently the grass is found only in the lowest and driest part of the Basin, between Elkhorn and Sapinero.

Paniceae, The Panic Grasses

There is a jump in logic here, for the Paniceae do not follow, as one more tribe, the seven that have preceded it in this flora. It is customary, and with reason, to include the seven preceding tribes in the subfamily Festucoideae, and then to jump to the subfamily Panicoideae before taking up the tribe Paniceae. There are a number of reasons for the custom, the most relevant here being the geographical. For there seems to be little doubt that the Panicoideae came from the south, perhaps even from the subtropics, and that the Festucoideae, are of boreal, or at least temperate, origin.

That is why the following (and final) three collections are unusually interesting. For early in my collecting I saw that I must not scrub for particular plants, but must maintain a general collecting focus that would yield a dependable statistical picture of all the vascular plants of the Gunnison Basin. And as late as 1960, when I had been through all the herbaria in Colorado in my search for Gunnison Basin plants, it is a fact that neither I nor any one else represented in these herbaria had collected a member of the Paniceae in the Gunnison Basin. Nor have I seen any growing since.

But about that time an enthusiastic young professor of botany, who had specialized in Setaria, arrived in Gunnison to teach for a year or two at Western State College. In a matter of weeks his students were digging grasses out of tennis courts and cement walls. And in a couple of months, as the following citations will show, single collections of three genera of the Paniceae came to light, the whole business reminding me of the famous crime wave created in New York City by reportorial enthusiasm at the time of Theodore Roosevelt's police commissionership. I am sure it can all happen again. But I am also sure that the general statistical picture of the plants of the Gunnison Basin as presented in this flora is accurate. As for the Paniceae (let alone the subfamily to which they belong), the Gunnison Basin is not their country, and they know it.

Thus I shall merely list the following three species of the Paniceae with sufficient remarks to make their identity clear. All of them are annuals, and all of them, naturally, show the earmarks of the tribe, namely, an upper glume that looks like a lemma, a first floret that is either rudimentary or staminate, and a final perfect floret. The lemma and palea of the perfect floret are tough and often shiny, and seal up both flower and fruit except at the moment of anthesis.

Echinochloa crusgalli (L.) Beauvois; adventive; submontane; Gunnison, Ko 10/25/61 WS. In this coarse species, for many years called barnyard grass in the

East, the two glumes and the sterile lemma are setose. In addition, the upper glume and the sterile lemma bear awns, whether short or long. The panicle is composed of a number of spikes set along a main axis.

Panicum capillare L.; widespread North American; submontane; Gunnison, Ko 9/7/61 WS. Commonly known as witchgrass, this species is as fine as the above species is coarse, its panicle resembling nothing so much as a spray of water droplets. The spikelets are without awns.

Setaria viridis (L.) Beauvois; adventive; submontane; Gunnison, Ko 9/31/61 WS. In Echinochloa crusgalli, the setae were on the backs of the glumes and sterile lemma. Here they are at the base of the spikelet, giving the genus its name, and since the panicle is spikelike, making many of the species resemble a timothy.

HALORAGIDACEAE, The Water Milfoil Family

Hippuris L., The Marestails

Hippuris vulgaris L.; boreal; montane-submontane; Gothic, W 9372 (1955) COLO; Crested Butte, B 226-60; Parlin, W&J 8565 (1953) COLO; Doyleville, H&M 7143 (1952) CS. The common marestail looks like an aquatic lycopodium, like something out of the Pennsylvanian. Hence it is always something of a shock to learn for the first time that it is one of the higher, flowering plants. The inconspicuous axillary flowers are notable for possessing but a single style and a single anther. The short linear leaves are in whorls at the nodes (these latter not much more than a quarter of an inch apart), and the tops of the stems usually rise above the water.

Myriophyllum L., The Water Milfoils

Myriophyllum exalbescens Fernald; boreal; subalpine-submontane; Horse Park, B 119-64; Peanuts Lake, H&M

7173 (1952) CS; Cochetopa Park, B&S 66-135. The segments of the leaves of this water milfoil are as fine as thread; and since the leaves are much divided, the plant might be taken for a potamogeton. But the main stem is much too stout for that, and besides, the flowering spikes that rise above the water are unmistakable. The apical flowers are staminate, and just before anthesis are enclosed in a bright-red, fugacious perianth. Very likely the bright-red tops of the flowering spikes were what attracted the collector's eye in the first place.

HYDROPHYLLACEAE, The Waterleaf Family

Hydrophyllum L., The Waterleafs

Persons who know the common waterleaf of eastern North America (which after all is the type species of the genus) will carry with them the look of the plant, which will include the compound leaf, the prominent, bristly stamens, and the white to lavender corollas. This will be helpful in recognizing the members of the genus in the Gunnison Basin.

Hydrophyllum capitatum Douglas; cordilleran; montane-alpine; Crested Butte, P&Ha 2605 (1951) COCO; Gothic, S 62-35 RMBL; Lake Irwin Basin, K 605 (1947) DBG; Mt. Belleview, Shp 7/3/58 RMBL. No waterleaf is more distinctive than this low herb with its ballhead clusters of lavender flowers. In the Gunnison Basin, it presents an interesting ecologic and geographic problem. For it is known only from a single section of the Basin, not exceeding ten miles in any one extent. Yet within that short range it shows a greater variability of habitat than in all the states covered by Hitchcock & Cronquist's Vascular Plants of the Pacific Northwest, ranging as it does from open, dryish sagebrush slopes to moist, densely shaded aspen groves; and from 9,000 to 12,000 feet! With such evident adaptability, what can restrict it to so small a section of the Gunnison Basin? Or is this a case of where the collectors (including the author) simply haven't noticed it anywhere else?

Hydrophyllum Fendleri (Gray) Heller; cordilleran; montane-subalpine; Gothic, Ke 7/9/49 WS; Avery Flats, B 10e-54; Emerald Lake, R 10063 (1959) CS. This species is closely related to the preceding, but the plant is two or three times as large, with a cymose, lighter-colored inflorescence. It seems to pass freely from meadows to the shade both of aspens and of spruce, but is even more restricted in its Gunnison Basin geography than H. capitatum. For it has been collected only in the upper seven or eight miles of a single river valley!

Phacelia Jussieu, The Scorpion Weeds

The popular name for this genus is not a very good one since it comes from the unrolling, scorpioid racemes of some of the species, a manner of growth shared by many of the borages and even by such a remote genus as Penthorum.

Phacelia heterophylla Pursh; cordilleran; montane-submontane; Gothic, B 146-52; McIntyre Gulch, B 199-65; Red Creek, S 64-108. The species is well named, for the plant shows both simple and compound leaves, the simple occurring toward the top of the stem. The flowers are white, although half hidden by the pubescent sepals.

Phacelia leucophylla Torrey; cordilleran; alpine; Alpine Pass, Hs (1905) COLO; East Maroon Pass, B 228-52; Mt. Belleview, B 172-60. This low, long-lived alpine plant is quite different from P. heterophylla. The leaves are all simple, not heterophyllous, and the flowers are lavender. The plant is particularly at home in alpine scree, where its roots indicate that it lives to a great age. P. heterophylla seems partial to montane loams and the light shade of Douglas fir or aspen, and is a short-lived perennial.

Phacelia neomexicana Thurber; cordilleran; submontane-montane; Almont, Wi 10416 (1954); Cochetopa Pass, B 74-55; Cathedral, B&S 314-62, B 131-64 (two stations). The bipinnatifid leaves of this vigorous annual are remarkable for their greenness, remaining green for years after mounted on herbarium sheets. The white flowers are displayed in scorpioid racemes.

Phacelia glandulosa Nuttall; cordilleran; submontane-alpine; Big Mesa, B 186-65; Henson Creek Canyon, B&S 248-62; Cathedral, B&S 549-62; Baldy Chato, B&S 483-62. P. glandulosa is an even more vigorous annual than the preceding species. Its purple-blue flowers are of an especially vivid hue, and the glandulosity of the calyces and stems of P. neomexicana extends here to the surfaces of the leaves. The vigor of P. glandulosa is particularly evident in its altitudinal adaptivity, as mentioned in the Introduction.*

Phacelia sericea (Graham) Gray; cordilleran; submontane-alpine; Signal Peak Ridge, B 23-61; Schofield Pass, B 50-52; Slumgullion Mesa, B 254-65. The most widely distributed of the phacelias in the Gunnison Basin, this species is also the most showy. Its flowers occur in dense cylindrical spikes, from which protrude on all sides the yellow stamens and the forked purple styles. The narrow silky leaves are pinnatifid or bipinnatifid, and the stems have a strong tendency to redden in the sun. This occurs frequently since the plant has a predilection for open places, including roadsides in the subalpine zone.

HYPERICACEAE, The St. Johnswort Family

Hypericum L., The St. Johnsworts

Hypericum formosum HBK.; cordilleran; montane-submontane; Crested Butte, B 87-59; Powderhorn, B&S 572-62. With its bright-yellow petals, small paired leaves like those of Symphoricarpos, and bright-red roots, the only St. Johnswort in the Gunnison Basin is easily recognized. Its straight stems grow about a foot high, and it inhabits nonsaline bogs.

* See above, p. 15.

IRIDACEAE, The Iris Family

Iris L., The Irises or Blue Flags

Iris missouriensis Nuttall; cordilleran; montane-submontane; Henson Creek Valley, B 34-61; Lujan Creek Valley, H 9012 (1959) CS; Doyleville, D 14228 (1963) RMBL; Gunnison, B&S 14-62; Gothic, R 10032 (1959) RMBL. The only blue flag in Colorado, this species is widely distributed in the Gunnison Basin. It frequents open bogs, but like so many cordilleran plants, shows an enormous capacity for withstanding drought.

Sisyrinchium L., The Blue-eyed Grasses

Sisyrinchium demissum Greene; southwestern; submontane-montane; Gunnison, B 75-61; B&S 77-62; Quartz Creek Valley, S 65-105 RMBL; Cement Creek Valley, S 65-47 RMBL. The flowers of this species are lavender rather than blue, and the two spathes enclosing the flower cluster are about equal. Harrington reports only two records for Colorado; but in the Gunnison Basin the plant is not rare. It is an inhabitant of moist open places, and is tolerant of alkaline soil.

Sisyrinchium montanum Greene; boreal; submontane-montane; Sapinero, Wh 571 (1898) COLO; Gunnison, B 54-64; Cochetopa Creek, Ke 7/10/49 WS; Gothic, R 10536 (1959) CS. This blue-eyed grass is really blue, and the two unequal spathes are frequently crossed like the half-bills of a crossbill. The species is slightly more frequent in the Gunnison Basin, but (as far as I know) it is not tolerant of alkaline soil.

ISOËTACEAE, The Quillwort Family

Isoëtes L., The Quillworts

Isoëtes Bolanderi Engelmann; cordilleran; subalpine; Peeler Lake, B 326-61. When one first sees this plant in the shallow water of a subalpine pond, it seems like a

miniature pineapple plant; that is, one sees tufts of small, straight quills radiating from a common point, with the individual plants well spaced. The species also grows in the Mexican Cut ponds, a mile or so northwest of the topographic Gunnison Basin, but well within the floristic Basin. It is unconfusable with any other plant in the Gunnison Basin.

JUNCACEAE, The Rush Family

To turn to the rush family is to be reminded of the sedge and the grass families. For the rushes also show a history of wind pollination, in the course of which the calyx and corolla became brown and papery and protective in function only. But here the history stopped, the rushes still showing all the floral parts of the lilies from which they are undoubtedly derived. Needless to say, this makes the business of the taxonomist considerably easier.

Juncus L., The Rushes

Juncus albescens (Lange) Fernald; boreal; subalpine; Elko Park, Ma 7/16/58 RMBL. Elko Park is a quarter of a mile northwest of Schofield Pass and the topographic edge of the Gunnison Basin. But the above collection is included in this list since the flora of the Gunnison Basin in this direction extends without change not only to Elko Park but several miles beyond. J. albescens is a tufted rush two or three inches high. At the summit of a culm is a cuplike inflorescence composed of one or a few flowers. The bracts are brown; but the calyx and corolla by exception are a greenish white, which provides both the specific name of the plant and its most striking character. The plant inhabits moist open places.

Juncus alpinus Villars; boreal; montane; Cement Creek, W&L 9523 (1955) COLO. There is no question of this plant's boreality; but with respect to the Gunnison Basin its alpinity is a misconception. It is not a dwarf rush like the preceding, but a montane plant about a foot high

with a cymose inflorescence composed of a number of small brownish heads. The plant is both rhizomatous and septate-leaved, and dwells in moist open places.

Juncus balticus Willdenow; boreal; submontane-subalpine; Gold Basin Creek drainage, B 92c-57; Gunnison, B&S 190-62 CS; Razor Creek Valley, B&S 66-49; Cathedral, B&S 173-62 CS; Crested Butte, B 88-59 RMBL; North Pole Basin, B 114-57 RMBL. Discussed in the Introduction as the admired wiregrass of the ranchers,* this is the most adaptive and the widest-ranging of the Gunnison Basin rushes. It grows in bogs, yet also on sagebrush slopes; in the meadows around Gunnison, yet at the bottom of North Pole Basin in that extension of the Gunnison Basin flora already mentioned under J. albescens and Isoëtes Bolanderi. There are no leaves in this species, only sheaths around the bases of the culms, which rise close together from the stout horizontal rhizomes. The single cluster of flowers emerges from the side of the culm about two-thirds of the way up. Of course, the upper third of the culm is not really culm but prolongation of the spathe of the flower cluster. However, the simulation is perfect, and it seems to be as much culm as the stem below.

Juncus confusus Coville; cordilleran; submontane-subalpine; Hartman Rocks, B 146-65; Crested Butte, B 85-57 RMBL; Schofield Pass, B 194-60 CS, RMBL. In many ways this rush resembles the preceding. It is almost, if not quite, as adaptive and wide-ranging. Again, its spathe simulates the culm, although not nearly so convincingly. In fact occasionally the prolongation is omitted. The species is also equipped with a scattering of filiform leaves at the base as J. balticus is not. However, the real difference emerges in the fact that J. confusus is not rhizomatous; J. balticus strikingly so. Both rushes occasionally grow to the height of a foot and a half.

Juncus longistylis Torrey; cordilleran; submontane-montane; Gunnison, B&S 191-62 CS; Willow Creek Valley,

* See above, pp. 25-26.

B 158-65; Los Pinos Creek Valley, B 53-60 CS, RMBL; Fish Creek, B&S 404-62 CS, RMBL. It is always a pleasure to look under magnification at a plant that one knows; but no competent botanist would ever need a lens to identify this rush in the field. The hemispherical heads occur in two or three planes at the summit of the culm, and each head has a conspicuous shallow involucre of whitish, papery bracts at the base. The plant dwells in moist open places, and is thinly rhizomatous.

Juncus saximontanus Nelson; cordilleran; subalpine-submontane; North Pole Basin, B 115-57; Copper Creek Valley, B 98a-57 CS; Crested Butte, B 85b-57; Fish Creek, B&S 194-62 CS, RMBL; East Elk Creek, S 64-97. Probably J. saximontanus is not so frequent as J. balticus. But it certainly is the equal of the latter with respect to wide-rangingness and variability. Its inflorescence can be singly capitate, capitate in different planes (like J. longistylis), or even cymose. Again, it varies greatly in vigor, the rhizomes of one collection frequently being twice the thickness of those of another. The bases of the culms are what is most distinctive. The leaves are equitant (as in Iris) and white-edged, and the bases themselves are frequently reddened. At the edge of a brook, J. saximontanus often forms a sort of symbiosis with J. longistylis, sending out floating rhizomes a foot into the water, while J. longistylis, behind it, maintains connection with the land, both plants being in flower at the same time.

Juncus Parryi Engelmann; cordilleran; subalpine; Ohio Peak, B 72-57 RMBL; Schofield Pass, B&S 75-66. It is the turn now of a group of rushes found in the subalpine and alpine zones. J. Parryi is the rarest of these, and besides being rare it seems to be restricted to openings in the subalpine forest. It is a largish, straight-stemmed, broomlike rush indistinguishable from J. Drummondii except in the hand. Both plants have a single flower cluster with a short, simulated prolongation of the culm, and the only dependable differentiae between them consist of such fine characters as the acute capsule of J. Parryi, the retuse capsule of J.

Drummondii, or the round-shouldered termination of the leaf-sheath beneath the mucro of J. Parryi, the square-shouldered termination of J. Drummondii. Both species even frequent the same dryish sort of habitat. Since J. Parryi is one of the rarest of alpine and subalpine plants, J. Drummondii one of the commonest, one would give a month of field work if he could ascertain the respective causes of their rarity and commonness.

Juncus Drummondii E. Meyer; cordilleran; alpine-subalpine; Mesa Seco, B 81-64 RMBL; East Maroon Pass, B 193-59 RMBL; Ohio Peak, B 71-57; Avery Peak, L 1081 (1950) COLO; Henson Creek, B&S 36-66. For the differentiation of this rush, the reader is referred to the preceding species; for the interesting historical problem involved, to the succeeding.

Juncus Mertensianus Bongard; cordilleran; alpine-subalpine; East Maroon Pass, B 187-59 RMBL; American Flats, B&S 65-192 RMBL; Emerald Lake, B 80-59; Taylor Pass, B 47-59 CS, B 48-59; Henson Creek, B&S 35-66. Whereas J. Parryi and J. Drummondii are caespitose rushes of dryish places, J. Mertensianus is a rhizomatous rush of wet places. Its dark-brown hemispheric heads are solitary at the summits of their culms, and usually surpassed by one or more of the leaves. The short spathe of the head is clearly a spathe, and indeed frequently absent.

The reader will note that for both this and the preceding species a collection cited from the lower montane zone was not used in the calculation of the altitudinal range. I hope it will also be noticed that both collections were made at the same time, and that previously both species had been collected growing together in an alpine basin above East Maroon Pass at an elevation of 12,500 feet.

How, then, is one to account for the gap in altitude, especially since the two collections of each species are remarkably similar? The most frequently offered hypothesis is that the seeds were washed down from above. And it is true (as the cited collections bring out) that

twenty miles away, at the head of Henson Creek, J. Mertensianus grows at an elevation of 12,200 feet. But J. Drummondii was not growing there, and would seldom be in a position anywhere to send its seeds downstream. Furthermore a full half of the alpine relicts in the montane zone of the Gunnison Basin are found where no spring freshet or even spring flood could possibly have stranded them. Thalictrum alpinum, for instance, turns up in montane bogs at the heads of creeks. But to return to the Henson Creek populations of J. Drummondii and J. Mertensianus, is it not more economical to suppose that they stayed behind in the coolness of Henson Canyon when the rest of the species moved uphill? In time, presumably, J. Drummondii made an adjustment to a moister habitat than is its wont. But is not this easier to suppose than that the alpine plant, suddenly transported from the heights to the lower regions, did as well in the moist habitat as in the dry one? And if it is said that the wash-down happened long ago, it seems to me that we are back where we started from without the advantage of the known fact that after the retreat of the last glaciation there was a general movement of the vegetation upward. As a matter of fact the lower valley of Henson Creek is a perfect asylum of alpine plants. Arenaria rubella, Carex ebenea, and Carex nova are also found in the canyon, and at Capitol City, farther up Henson Creek, is found Penstemon Harbourii, which is a plant of alpine screes!

Juncus bufonius L.; widespread North American; submontane; Quartz Creek Valley, S 65-113; Gold Basin Creek drainage, B 92-57 RMBL; Cebolla Hot Springs, B&S 495-62 CS, RMBL. This annual rush is notably different from all the preceding species. In the first collection cited, the little threadlike plants are only an inch and a half to two inches high. In the last collection cited, the plants are small bushes six inches high and eight inches across. The flowers of the species occur singly, at the joints of the many branches, or up and down the unbranched portions. The species is also tolerant of alkaline soil.

Luzula DC., The Woodrushes

The woodrushes are farther from the lilies than the rushes. In most of the rushes, there remains a distinction (if only in height) between sepals and petals. But in Luzula, the distinction is largely lost, and calyx and corolla are usually regarded simply as the perianth of the pistil and stamens. Again, the leaves of Luzula are flat and more grasslike than those of Juncus, although suggestive of Carex in their closed sheaths. Finally, the woodrushes are often sparsely hairy in their own individual way.

Luzula multiflora (Retzius) Lejeune; boreal; montane; Slate River Valley, B 104-60 CS, RMBL. The unit of inflorescence in this species is a cylindrical spike about a centimeter long. Furthermore the inflorescence can be called umbellate if it is remembered that the rays are by no means equal and occasionally bear a rudimentary umbel of their own. It is interesting that our Gunnison Basin plant is the variety elsewhere known as congesta (Thuiller) Koch and ascribed by Fernald to Newfoundland, St. Pierre, and Miquelon.

Luzula parviflora (Ehrhart) Desvaux; boreal; montane-alpine; Cathedral, B&S 175-62; Ohio Peak, B 69-57; Virginia Basin, B 36b-57. In this species, the cymose panicle is open and grasslike; that is, if one remembers that the units of the panicle are small juncaceous flowers instead of spikelets. The leaf blades are very broad, and the plant shrinks in height from a montane two feet to a mere five inches in the alpine zone, yet with no perceptible change except the loss in gross size.

Luzula spicata (L.) DC.; boreal; alpine; Cumberland Pass, B 50-59; Mt. Baldy, B 233-61; Rough Creek Pass, B&S 657-62 CS, RMBL; Carson Pass, B&S 65-186; Sawtooth Mtn., B&S 90-66. Although confined to the alpine zone, L. spicata is by far the most frequent and wide-ranging woodrush in the Basin. It also shows the greatest amount of variation. Sometimes, the spikes are long and slender; again, short and stubby. Sometimes they nod at the ends of long peduncles; occasionally they are

sessile at the summit of the culm amid an involucre of stemleaves. What remain constant are the ciliate and lacerate floral bracts, which the collector will not want to miss observing under a lens. There is usually a reddish hue to the spike.

Luzula subcapitata (Rydberg) Harrington; Coloradan; alpine; Twin Lakes, B 119-60 CS, RMBL; Mineral Mtn., B&S 378-62 CS. This species is very close to L. parviflora, the open, cymose panicle of the latter here becoming contracted, while the brown of the florets deepens appreciably. Sometimes there is a single head at the summit of the culm; sometimes two auxiliary heads curve away from the one in the center; sometimes an auxiliary head rises to the plane above. But the plant has its own look, and would never be confused with any of the other three species in the Basin. Once again, the second collection cited is very slightly beyond the topographic edge of the Gunnison Basin, but palpably within the floristic Basin.

JUNCAGINACEAE, The Arrowgrass Family

Triglochin L., The Arrowgrasses

Triglochin maritima L.; boreal; submontane; Gunnison, B 66-60; Cochetopa Creek, Ke 7/17/49 WS; Iola, Kl (1947) CS; Cebolla Hot Springs, B&S 445-62 CS, RMBL. This is a large plant, with wiry basal leaves (its only kind) as much as a foot tall, and spikelike racemes (one to a plant) as much as two feet tall. Since the species grows in the salt marshes along the oceans of the northern hemisphere, it is not surprising that in the Gunnison Basin it should be found in saline as well as in nonsaline bogs. Although the white petals are small, the spikes when flowering are rather showy.

Triglochin palustris L.; boreal; montane-submontane; Gothic, B 92-59; Cement Creek, B 200-61; Gunnison, B 66a-60; Cebolla Hot Springs, B&S 493-62 CS. This species is in every way a lesser T. maritima, with three carpels instead of six in the flower, and growing (in the

Gunnison Basin) no more than a foot in height. Yet in the submontane zone it is an ecological equivalent of T. maritima, and this both in saline and in nonsaline habitats.

LABIATAE, The Mint Family

The various genera of the mint family in the Gunnison Basin seem to be represented, each, by a single species, making differentiation of the species unusually easy.

Agastache Clayton, The Giant Hyssops

Agastache urticifolia (Bentham) Kuntze; cordilleran; montane-submontane; Gothic, R 10545 (1959) CS; Crested Butte, Wa 8/4/03 COCO; McIntyre Gulch, B 198-65; Sapinero, Wh 543 (1898) COLO. A. urticifolia grows at least a yard high, and from the thickety roadsides, with its simple or compound spikes of white flowers, beckons the motorist interested in plants to stop and investigate. The square stem, of course, is a give-away, and the leaves really are nettle-like. If the collector needs a further identifying character, he will note that the teeth of the calyx are pink.

Mentha L., The Mints

Mentha arvensis L.; boreal; submontane-montane; Powderhorn, B&S 570-62; Sheep Gulch, B 125-60; Crested Butte, B 154-60 CS, RMBL. This rhizomatous plant is notable for having axillary flowers with regular corollas. With respect to wet and dry, the plant ranges from the very edges of streams to gulch bottoms in the submontane zone that for most of the year are mesophytic only.

Moldavica (Tournefort) Adanson, The Dragonheads

Moldavica parviflora (Nuttall) Britton; boreal; montane-submontane; Gothic, Wi 10332 (1954); Meridian Lake, B 86-55; Fish Creek Valley, B&S 332-62; Al-

mont, B 205-60. In this species the flowers occur both in axillary clusters and in short terminal spikes. The teeth of the bracts and of the upper leaves are spinulose, and the plant inhabits dryish waste places.

Monardella Bentham, The Monardellas

Monardella odoratissima Bentham; cordilleran; alpine-subalpine; Gothic Mtn., B 72-55; Granite Basin, L 55 (1949) COLO. In M. odoratissima the inflorescence is terminally capitate, the bracts forming an involucre strongly suggestive of the Compositae. The stems also are roundish rather than square; but the plant is delightfully menthaceous in odor.

Prunella L., The Selfheals

Prunella vulgaris L.; boreal; montane-submontane; Gothic, Wi 10262 (1954); Slate River Valley, B 105-60; Cement Creek Hot Springs, L 105 (1949) COLO; Waunita Hot Springs, E (1888) COLO. The inflorescence of this low plant of moist places is a short terminal spike. The paired leaves of the stem are petioled and sinuately dentate, and it does seem as if every one interested in plants must know the common heal-all (or selfheal) of all the northern continents. In the Gunnison Basin, it grows equally well in saline and in nonsaline soil.

Scutellaria L., The Skullcaps

Scutellaria galericulata L.; boreal; submontane; Sapinero, Wh 541 (1898) COLO. In all the other Gunnison Basin species of the Labiatae, the flowers when axillary are clustered. In S. galericulata, they occur singly in the leaf axils, that is, two to a node. Since the above is the only known collection of the plant from the Gunnison Basin (although the plant is known to occur just west of the Basin in the Black Canyon of the Gunnison River), the question remains whether the above collection is

really from the Gunnison Basin. In the early days of plant collecting in the West, the collectors were interested chiefly in the kinds of plants, and usually labeled their collections according to the hotel where they were staying. Thus all of Wheeler's collections from the summer of 1898 are labeled simply Sapinero. Since Sapinero is on the western edge of the Basin, there is thus doubt whether they were collected in the Basin or just outside of it. I have duplicated a number of Wheeler's previously unique records, and believe that the vast majority of them came from within the Basin. But some of them very probably came from beyond the Basin, and S. galericulata may be one of these.

Stachys L., The Hedge Nettles

Stachys palustris L.; cordilleran; submontane-montane; Sapinero, Wh 462 (1898) COLO; Gunnison, Ke 7/29/49 WS; Parlin, B 107-60; Crested Butte, B 153-60 RMBL. S. palustris is a stouter plant, and more strongly rhizomatous, than Mentha arvensis, while its axillary flower clusters at the summit of the stem make an interrupted spike. Its leaves are softly pubescent, and it is a frequenter of moist, open places.

LEGUMINOSAE, The Pea Family

Astragalus L., The Milkvetches

In North America, the milkvetches are predominantly a western genus. Evidently they are well suited for adaptation to continental aridity since their greatest concentration is in the mountains and steppes of central Asia. To the western botanist, then, the genus quickly becomes familiar, the only other genus resembling it being Oxytropis, the locoweeds or locos. Here a distinction that is admittedly not universally valid is nevertheless of great value to the field botanist. The milkvetches, on the whole, whether large or small, are bushy, much-branched plants; the locos on the other

hand are seldom branched, stems and leaves alike arising from the summit of the root.

Astragalus agrestis Douglas; cordilleran; submontane-montane; Gunnison, B 154-61, B 129-64 RMBL (two stations); Madeira Siding, B 45-60 RMBL; Cathedral, B 8-64. Varying in height from two inches to twelve, this is a capitate milkvetch, and is commonly found growing with grass whether in the shade of aspen or in the open. Its flowers are purplish, with calyces that show black hairs mixed with white. However, the most striking character is furnished by the pods. These are white with a dense pubescence that is noticeable to the naked eye.

Astragalus alpinus L.; boreal; montane-subalpine; Gothic, B 89-52; Spring Creek (south), B&S 66-34; Fish Creek Valley, B&S 35-62; Fish Creek Mesa, B 84-64. A. alpinus is essentially a plant of moist to mesic, montane meadows and woodlands. At least in the Gunnison Basin there is nothing alpine about it at all, so that the specific name in the Gunnison Basin is a misnomer. The relatively large leaflets are delicate and elliptical, while in habit the plant is recumbent rather than erect. Its blossoms are blue, and the black-haired pods are not only reflexed close to the stems but pendent beneath their calyces.

Astragalus anisus Jones; Gunnison Basin; submontane; Madeira Siding, B 86-65; South Beaver Creek drainage, B&S 66-21; Gold Basin Creek drainage, B 80-65; Doyleville, S 65-25 RMBL. This well-known endemic of the Gunnison Basin is a gray cushion-plant of the Basin floor parallel with the gray cushion-plants of the upper alpine zone. Its numerous ovoid pods are the most conspicuous feature of the plant, and range in length from half an inch to nearly an inch. This is the place to utter a word about the inherent weakness of highway collecting. For a number of years A. anisus was known only from along Route 50 and was thought to be rare. As a matter of fact it is rather common on the sagebrush floor of the Basin, and I remember that once when I was collecting arabises and grasses on the Basin floor, every time I stopped, A. anisus was growing at my feet.

Astragalus bisulcatus Gray; cordilleran; submontane; Sapinero, Wh 477 (1898) COLO. Under Scutellaria galericulata I mentioned the early custom of labeling all one's collections according to the place in which one was staying and the possibility in the case of H.N. Wheeler, who amassed hundreds of collection numbers at "Sąpinero" in 1898, that some of these collections came not from the Gunnison Basin but from beyond the Basin. A. bisulcatus is one of these collections to which doubt attaches. I have seen no other collection of the plant from the Basin in any Colorado herbarium, and have not myself seen it growing in the Basin, although the closely related A. Haydenianus is conspicuous in the hills above and around Sapinero. In any event, A. bisulcatus is a large bushy milkvetch with thick stems and thick, erect, spikelike racemes which in this collection have white flowers. The glabrous, pendent, bisulcate pods, as in A. alpinus, are extruded from the calyx by means of a stipe.

Astragalus Brandegei Porter; southwestern; submontane; Gunnison, Ry&By 10231 (1950) COLO, W 9341 (1955) COLO; Powderhorn, W 12149 (1964) COLO. This species, as it grows in the Gunnison Basin, is a broomy, brushy plant about six inches tall. The leaflets are exceedingly fine, and there are so many naked rachises and stems that the plant suggests A. convallarius. The small white blossoms with traces of pink or purple are inconspicuous; but the elliptical pods are more noticeable, and about half an inch long.

Astragalus ceramicus Sheldon; cordilleran; submontane; Gunnison, Ke 6/20/49 WS. Taking its specific name from its large, inflated, "ceramic" pods, this astragalus is only confusable with the other Gunnison Basin species to have such similarly large and inflated pods, namely, A. oöphorus. The pods of both species are amazing--as much as an inch and a half long by an inch wide, and mottled with red or purple, those of A. ceramicus more conspicuously so. Yet although the two species belong to the same taxonomic group, differentiation between them is easy. The flowers of A. ceramicus are cream-

colored, those of A. oöphorus a bright yellow. Again, A. ceramicus is bereft of leaflets in the ordinary sense, the naked green branches and leaf-rachises taking over the work of photosynthesis, while A. oöphorus is plentifully supplied with oval leaflets of the most conventional sort. Finally, A. oöphorus is fairly common in the southwestern quarter of the Basin, while A. ceramicus seems to be rare in any quarter.

Astragalus cerussatus Sheldon; Coloradan; montane; Iron Mtn., B 47-65. In this, the only known collection of A. cerussatus from the Basin, the small, annual-appearing plants not more than two and a half inches high were scattered over the slopes of Iron Mountain in openings of the mixed juniper and Douglas-fir forest. A few plants were in flower, bearing their purple-tinged white blossoms less than a quarter of an inch long. Most of the plants were in fruit, their plumlike pods, about half an inch long, hanging singly or in twos from the short peduncles.

Astragalus convallarius Greene [A. diversifolius Gray]; cordilleran; submontane; Gold Basin Creek Valley, B 52a-57, B 19-59 (two stations); Escalante Hill, Ke 6/26/49 WS; Soap Mesa, B 45-65. Among the Gunnison Basin astragali this is the one that most resembles A. ceramicus in the loss of leaflets and relegation of the photosynthetic function to branches and leaf-rachises. But not quite, for on a single plant one can usually find everything from a complete leaf with three pairs of leaflets and a terminal leaflet, through a leaf with only the terminal leaflet preserved, to a leaf with nothing left but the bare rachis, the latter being the most common form. The pods, like narrow scalpel blades, are about an inch and a quarter long; but the sharply curved ochroleucous flowers are only about three-eighths of an inch long. The plant has long rhizomes of the same thickness as the stem, and grows in grassy or brushy places in the open or in light shade.

Astragalus Drummondii Douglas; cordilleran; submontane; Almont, B 14-55 RMBL, B 30a-55 (flower and fruit);

Willow Creek Valley (south), B 40-66; Sapinero Guard Station, B 73-65 RMBL. This handsome species with hirsute gray-green leaves grows about a foot and a half high in the Gunnison Basin. The white flowers, which can be nearly an inch long, first appear pointing upward in dense spikes at the summits of the stems. But then as the spikes lengthen, the flowers separate and bend down, until finally the long, narrow, glabrous fruits are not only protruded from their calyces but sharply bent back against the stem. The plant is most at home on fertile sagebrush slopes.

Astragalus Hallii Gray; southwestern; submontane-montane; Gunnison W 9331 (1955) COLO; Gold Basin Creek drainage, B 25-60; Cathedral, B&S 130-62; Cochetopa Pass, B 75a-55. Many astragali have the habit of forming birds' nests upon the ground. In A. Hallii, the stems are weak and prostrate and radiate from the crown of the root, and the bird's-nest tendency achieves a certain maximum. The stems are often reddish, and the blossoms a reddish-purple, while the fruits are transversely veined and slightly hairy contrary to the veins. The plant grows on the floor of lodgepole- and of ponderosa-pine forest, and yet is at home on open sagebrush slopes.

Astragalus Haydenianus Gray; cordilleran; submontane; Big Soap Park, S 64-121; Sapinero Guard Station, B 72-65. Few botanical monographs have so much impressed me as Rupert Barneby's Atlas.* When I read it, I remember that I was quite persuaded by his acceptance of Jones's reduction of A. Haydenianus to a variety of A. bisulcatus; and for a year or two I went along with him in his opinion. But when I got down to the serious business of writing this flora, then the logic of the plants of the Gunnison Basin kept telling me that A. Haydenianus could not be any variety of A. bisulcatus. And it was not a question of minor differences. The narrow, erect spikes of white flowers (only half as wide

* R.C.Barneby, Atlas of North American Astragalus, 2 vols., N.Y., 1964.

as those of A. bisulcatus) seemed to proclaim the individuality of A. Haydenianus to the student of the Gunnison Basin flora. At least I know of no case in the Gunnison Basin where such a conspicuous and constant difference in the size of a part does not betoken a difference in species. In the neighborhood of the Sapinero Guard Station, A. Haydenianus grows with the much more thickly white-spiked A. Drummondii as an ecological equivalent.

Astragalus iodopetalus Greene; southwestern; submontane-montane; Sapinero, Wh 447 (1898) COLO; Goose Creek Valley, B 98-65 RMBL; Ninemile Hill, B 12-66; Iron Mtn., B 138-65 RMBL. A. iodopetalus is easily one of the most memorable plants in the Gunnison Basin. To see it once is never to forget it. 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 flowers. But in juniper and Douglas-fir forest (as in the last collection cited), the habit of the plant is upright, and the heads mingle with the leaves. The pale, glabrous pods, an inch long, are distinctive. At the apex they have a hook, sharply bent back.

Astragalus leptaleus Gray; cordilleran; submontane; Gunnison, B 61-64 RMBL, B 160-64 RMBL. The cited station is the only one known to me in the Gunnison Basin, although Barneby reports two collections from just north of the northwest corner of Saguache County. The plant was growing, along with A. agrestis, in a grassy old field about three miles west of Gunnison, both species attaining about the same height and occurring in large patches of about the same size. A. leptaleus is a white-flowered, rhizomatous plant, with a conspicuous purple spot at the tip of the keel. The small flowers are sparse, as are the pods, the latter being about a quarter of an inch long.

Astragalus microcymbus Barneby; Gunnison Basin; submontane; Hierro, Ry&By 7179 (1945) COLO (ISOTYPE), W 9144 (1955) COLO (TOPOTYPE); South Beaver Creek drainage, B&S 71-66. Except for the sequel, the story of A. microcymbus is intriguingly told in Barneby's

Atlas. The original collection was made by Barneby in gravelly soil along Route 50 at the western limit of the floodplain of the Gunnison River just before it enters the canyon at Hierro. The second collection was made at the same place from a thinning population ten years later by Weber, who came to my cabin in Gothic that night to give me a first duplicate. Weber's enthusiasm easily communicated itself to me, and in the subsequent years (especially after he had aroused my interest in writing this flora), we often talked about the lost plant--the Shortia of the Gunnison Basin, as it might be called. It was even a source of disagreement between us, as Weber followed his thought that the plant had been introduced with roadfill and I asseverated the principle mentioned on page 27 that if a plant in the Gunnison Basin can be native then it is native. But I did not find the plant, although I kept my eyes open for it.

Then in the last summer of my systematic collecting, as my assistant and I were sitting down to lunch one day in a delightful grove of narrowleaf cottonwoods in the drainage of South Beaver Creek, we saw an odd-looking astragalus over against a low cliff of granite. "Wouldn't it be a joke," I said, "if that was Astragalus microcymbus." And the joke is, that it was! The plant grows more than two feet tall, with several branches from the crown of the root. But the cuneate leaflets are only about a quarter of an inch long, and the pinkish flowers only about three-eighths of an inch long. The elliptical pods are also about a quarter of an inch long. The plant's associates in the sandy soil at the base of the cliff were Purshia tridentata, Ribes cereum, Rhus trilobata, Eriogonum umbellatum, Penstemon teucrioides, and Erigeron pumilus, all plants being in bloom at the same time.

Astragalus miser Douglas [A. decumbens (Nuttall) Gray]; cordilleran; submontane-subalpine; Sapinero, Wh 522 (1898) COLO; Gold Basin Creek drainage, B 8-60 CS, RMBL; Waunita Park, B 96-61, B 97-61; Cathedral, B&S 129-62; Fish Creek Mesa, B 82-64; Buck Meadow, B 146-61. Although largely limited

to the southern half of it, A miser is clearly the most frequent and widespread astragalus in the Gunnison Basin. It would be confusable with A. leptaleus if it were not as common as the latter is rare. For both species have small white blossoms with purple-tipped keels, and both are "grassy" species, in that they are commonly found growing with grass, the multitude of their leaves blending with the leaves of the grass. But there are two gross differences. A. miser has an erect habit, A. leptaleus a sprawling habit. Again, the pods of A. miser are straight and narrow and commonly held out at right angles, while those of A. leptaleus are short and elliptical and pendent, although without stipes.

Astragalus molybdenus Barneby [A. plumbeus Barneby]; Coloradan; alpine; Mt. Belleview, B 100c-55; Virginia Basin, B 25-55; Conundrum Pass, B 70g-55 RMBL. This little alpine plant only grows about three inches high. Beneath the leaves it bears one (or occasionally two) flower clusters, each containing only two or three blossoms. But these few blossoms seem to set seed with uncommon dependability, and at the end of August the small legumes will be observed held horizontally from the peduncle.

Astragalus oöphorus Watson; cordilleran; submontane; Sapinero, Wh 536 (1898) COLO; Goose Creek Valley, B 97-65; Ninemile Hill, B 13-66; Willow Creek Valley, B 97-65 RMBL. For the differentiation of this species the reader is asked to consult A. ceramicus. It is interesting that its commonest plant associate is A. iodopetalus, which blooms at the same time and which the reader may also wish to consult.

Astragalus Pattersonii Gray; southwestern; submontane; Almont, B 15-55 RMBL, B 30b-55; Doyleville, B 274-65 RMBL, B 24-66. The ability of this handsome milkvetch to blossom twice in a flowering season was mentioned in the Introduction.* It not only grows to about the same size as A. Drummondii but grows with

* See above, p. 19.

it, and in fact, the large white blossoms at the summits of the plant stems seem almost identical. But there are gross differences. In the first place, A. Pattersonii is a glabrous plant; A. Drummondii a hirsute plant. In the second place, the fruits of A. Pattersonii are upright, those of A. Drummondii sharply reflexed back toward the stem.

Astragalus Robbinsii (Oakes) Gray [A. occidentalis (Watson) Jones]; boreal; montane-alpine; Gothic, B 33-55, B 72a-55; Spring Creek Valley, B 91-65 RMBL; Mineral Creek Valley, B 151-65 RMBL; Virginia Ridge, B 24-54, B 70a-54; Mt. Belleview, B 168-60. A. Robbinsii is a wide-ranging species in the Gunnison Basin, both altitudinally and geographically. In the montane zone, the plant commonly grows a foot and a half tall with many acutely elliptical leaflets. Curiously, the mature, reflexed pods are about the same size and shape as the leaflets. In the alpine zone, at least on exposed ridges, the plant shrinks to the height of six or seven inches, and the flowers are pink rather than purple. But what remains constant in all zones and exposures is the black pubescence of calyx and legume. The contrast between black calyx and pink corolla is striking in the exposed alpine plants.

Astragalus striatus Nuttall; relict of the plains; submontane; Gunnison, B 92-60; Quartz Creek Valley, S 65-109 RMBL; Willow Creek Valley, B 159-65 RMBL; Cochetopa Park, B&S 188-66; Cochetopa Pass, B&S 66-133. Thelesperma megapotamicum was mentioned as a plant the presence of which in the Gunnison Basin seems reasonably explicable only by means of the relict-of-the-plains hypothesis.* Here is another. Both species seem clearly to be plants of the Great Plains rather than of the Rocky Mountains. In the light of the relict-of-the- plains hypothesis, the last cited collection from Cochetopa Pass may seem anomalous. The explanation, however, is not far to seek. At no other place in the Gunnison Basin does the submontane flora so closely approach a mountain pass,

* See above, pp. 139-140.

which in any event is only 10,000 feet high. Nay more. The submontane flora follows the pass almost to the summit, with Solidago missouriensis growing just a few hundred yards below the top. Here is an example, not of the popular hypothesis of seeds being washed down, but of plants advancing up by the usual paths open to them. As for the characteristics of A. striatus, the species is much like A. agrestis only larger, with the capitate heads becoming oblong and being held aloft. In case of doubt the collector need only compare calyces. They are quite different in shape and in the proportion of teeth to tube. Besides, the calyces of A. striatus have dolabriform hairs, and those of A. agrestis do not.

Astragalus tegetarius Watson; cordilleran; submontane-subalpine; Cochetopa Park, B 82-55; Mineral Creek Valley, B&S 537-62. The specific name of this species means mat-forming, and that is just what this species does whether in the ash beds of Cochetopa Park or in the moist subalpine spruce forest of Mineral Creek Valley. The gray-green, pointed, hirsute leaflets are about five millimeters long, and the lavender blossoms only a millimeter longer. The plant is like no other milkvetch in the Basin and can be recognized from horseback in the twilight, as was the case in the second of the collections cited.

Astragalus tenellus Pursh; cordilleran; montane-alpine; Razor Creek Park, B&S 65-66 RMBL; Fish Creek Mesa, B 83-64 RMBL; Tin Cup, B 159-61; Marshall Pass, B 130-60 CS, RMBL; Cement Mtn., B 85-55. Earlier it was observed that A. miser is the most frequent and widespread of the milkvetches in the Gunnison Basin. A. tenellus is its closest competitor, being fully as widespread but not quite so frequent. Both belong to the same subgenus of Astragalus, and I suppose it is not surprising that the conditions of the Gunnison Basin should suit two such closely related species so well. It is not hard to separate them. Once again, habit of growth is probably the readiest of a number of field characters. The erect habit of A. miser has already been mentioned. Curiously, the habit of A. tenellus is quite as sprawling

as that of A. leptaleus. In fact I think the habit of A. tenellus the most distinctive thing about it. The crown of its taproot is often half an inch wide; but the annual stems that it sends forth are frequently less than a millimeter thick and so weak that at least to begin with they need the support of the ground. Incidentally, it is difficult to collect both stems and taproot without severing them, and few taproots are carried over to the herbarium sheet. On the other hand, in the herbarium, the blackened stipules of A. tenellus are very nearly an infallible sign of the species.

Dalea Jussieu, The Indigo Bushes

Dalea Jamesii (Torrey) Torrey & Gray; southwestern; submontane; Gunnison, Ke 6/20/49 WS. The only member of its genus to have been collected in the Gunnison Basin, this plant is also the only trifoliate species in the genus. It forms a small bush in dry, open places, with short spikes of yellow flowers. The collector will note the purplish bracts almost as long as the plumose-appearing calyx lobes.

Glycyrrhiza (Tournefort) L., The Licorices

Glycyrrhiza lepidota Pursh; cordilleran; submontane; Sapinero, Wh 453 (1898) COLO; Steuben Creek Valley, B 71-54; Cebolla Hot Springs, B&S 497-62; Doyleville, B 276-65 RMBL. This vigorous roadside (and ditchside) perennial herb, with axillary spikes of greenish-white flowers, is frequent on the floor of the Gunnison Basin. Its cylindrical rhizomes, by actual measurement, can be as much as three-quarters of an inch thick, and its pods are covered with small hooks.

Hedysarum L., The Sweet Vetches

Hedysarum occidentale Greene; cordilleran; submontane-alpine; Cochetopa Park, B 89b-55; Wood Gulch, B&S 147-62; Gothic, B 183-52; Mt. Avery, B 195-61; North

Italian Mtn., L 406 (1949) COLO. This is the common hedysarum of the Gunnison Basin, and must come first, out of alphabetical order, since the other two species (known from single collections only) will inevitably be compared with it. Its lavender flowers, in a loose raceme at the summit of the stem, are handsome and much more conspicuous than the later, segmented pods. But I think the most striking character of the species will be found in the leafless, cinnamon-brown closed stipules at the base of the plant.

Hedysarum alpinum L.; boreal; montane; Needle Creek Valley, B&S 70-66. Growing two and a half feet high, this is the tallest of the hedysarums in the Gunnison Basin; but the blossoms, although in a more compact raceme, are not so long as those of H. occidentale. The base of the plant, at least in the above collection, is devoid of leafless, enclosing stipules. Mere scales take their place.

Hedysarum boreale Nuttall; cordilleran; alpine; Wolverine Basin, Ew 11836 (1938) COLO. This plant also is without the cinnamon-brown closed stipules of H. occidentale, while the individual blossoms in the racemes do not have the tendency to droop shown by those of both the preceding species. Actually, the most striking character of H. boreale is the cross-reticulation of the segmented pods. The pods of the other two species show no determinate pattern.

Lathyrus L., The Sweet Peas

Lathyrus eucosmos Butters & St. John; southwestern; submontane; Sapinero, Wh 568 (1898) COLO; Gunnison, B 119-65 RMBL. With large, profuse blue blossoms, this species is one of the showiest roadside plants in the Gunnison Basin. It is half bush and half vine (although thoroughly herbaceous), and seems to take the place in the Gunnison Basin occupied by L. latifolia in other parts of the country.

Lathyrus leucanthus Rydberg; cordilleran; submontane-

montane; Sapinero, Wh 529 (1898) COLO; Jack's Cabin Pass, B 20d-57; Gothic, B 30-52; Fish Creek Mesa, B&S 197-62. Equally at home in the shade of aspen forest or in open sagebrush country, this handsome, white-flowered sweet pea is both frequent and widespread in the Gunnison Basin. It is interesting to note that in a rich aspen forest on the southeast-facing slope of Fish Creek Mesa in Hinsdale County, this species and Vicia americana were growing as such ecological equivalents of each other that the tendrils of the two species were thoroughly intertwined.

Lotus L., The Bird's-foot Trefoils

Lotus Wrightii (Gray) Greene; southwestern; submontane; Red Creek Valley, S 64-104 RMBL; Steuben Creek Valley, B 172-65; Willow Creek Valley, B&S 56-66. The popular name of this genus is a good one if it is remembered (in the case of the Gunnison Basin species) that the leaflets of the trefoil are only between a centimeter and a centimeter and a half long. The banner of the small flower is red, the wings yellow, and the straight, knife-like pod, two or three centimeters long, is held out horizontally from the plant stem.

Lupinus L., The Lupines

Before consulting the annotations of this genus, the reader is asked to review the discussion of the lupines in the Introduction, pages 31 to 34. Surely, in those introductory pages, at least L. amplus and L. rubricaulis were adequately differentiated from the other lupines thus far collected in the Gunnison Basin.

The annual lupines

Lupinus brevicaulis Watson; cordilleran; submontane; Parlin, P&Ha 4217 (1951) COCO. This is a very small plant, with the capitate flower cluster borne on a short peduncle. The leaves are divided into seven or eight

leaflets, the upper surfaces of which are both a lighter green and essentially glabrous. The plant grows in the company of sagebrush, and for further differentiation the reader is referred to the next species.

Lupinus Kingii Watson; southwestern; submontane-montane; Sapinero, W 9324 (1955) COLO; Sargents, W&J 8547 (1953) COLO; Powderhorn, B 28-64. L. Kingii is similar to L. brevicaulis, but with important differences. For instance, although the plants are also very small, L. Kingii has a longer leafy stem. In L. brevicaulis, the peduncles and leaves all seem to be basal. Again, in L. brevicaulis, the upper lip of the calyx is short and undivided; in L. Kingii, it is about equal to the lower lip and divided. Finally, the leaflets of L. Kingii are not essentially glabrous on the upper side, but silky all over.

The perennial lupines (in order of ascending altitudinal range)

Lupinus floribundus Greene; cordilleran; submontane; South Beaver Creek Valley, B 193-65 RMBL; Gunnison, B 289-61, B 130-66 (two stations); Almont, B 60-54. With its narrow, wandlike panicles and the narrowest leaflets of any perennial lupine in the Basin, this roadside species can be recognized from a passing automobile. Its individual blossoms are small, scarcely more than a quarter of an inch in diameter; but before anthesis, when each flower is surrounded by its furry calyx and bract, the blossoms are a pearly white and the wandlike panicle is striking. As in L. brevicaulis, the upper side of the leaflet is essentially glabrous.

Lupinus caespitosus Nuttall; cordilleran; submontane-montane; Gold Basin Creek drainage, B 78-65 RMBL; Almont, S 64- 83 RMBL; Hot Springs Creek Valley, B 3-66; Gothic, B 21-55. Here the usual order of things is reversed. The short, spicate panicles are close to the ground, while the leaves on their long petioles rise above them. As its specific name in part implies, this is a low, caespitose lupine.

Lupinus caudatus Kellogg; cordilleran; submontane-montane; Willow Creek Valley (south), B 41-66; Vulcan, B 38-64, B 39-64; Cement Creek Valley, L 779 (1950) COLO. The narrow, spikelike panicles of L. caudatus suggest those of L. floribundus, but they are neither so narrow nor so long nor so dense; in fact there are plenty of air holes in them. The leaves, of course, are considerably wider, and silvery with hairs on both sides, whereas those of L. floribundus are green and glabrous above. L. caudatus is seldom found far from sagebrush.

Lupinus argenteus Pursh; cordilleran; submontane-subalpine; Gold Basin Creek drainage, B 79-65; Cochetopa Park, B 185-66; Powderhorn Divide, S 64-34 RMBL; Gateview Divide, B 102-65 RMBL; Cochetopa Hills, B&S 179-66. This species, although most at home in the openings and partial shade of dryish montane woodlands, reaches down into the submontane zone of the Gold Basin Creek drainage and up into the dry subalpine spruce forest of the Cochetopa Hills. Hence the populations at the two limits of its range will vary from those more typical populations in the middle. In these midrange populations one is struck by the cylindrical, even short and stubby, racemes. The leaves are always to some extent two-colored, with the upper surfaces a darker green and sometimes relatively glabrous. Finally, as a last check, the banners will be found to be reflexed below the middle.

Lupinus amplus Greene; Coloradan; montane-submontane; Gothic, B 71-52; Mill Creek Valley (north), B 18a-55; Little Percent Gulch, S 65-30; Prosser Creek Valley, B&S 57-66; Iron Mtn., B 46-65; Signal Peak Ridge, B 16-61. This species is so thoroughly a plant of the montane zone that the only place where I have found it growing in the sagebrush country of the submontane zone was just downslope from the Douglas-fir forest clothing the north side of Signal Peak Ridge. Curiously, Cerro Summit, about thirteen miles west of the topographic Gunnison Basin and the scene of C.F. Baker's type collection, is also situated at the upper edge of the submontane zone. L. amplus is apparently the only species of lupine in the Gunnison Basin which occurs in a pink form.

Lupinus rubricaulis Greene; Coloradan; alpine-montane; Scarp Ridge, B 57-54; Gothic, B 28b-55; Soap Mesa, B&S 48-66; Henson Creek Valley, S 62-51; Prosser Creek Valley, B&S 58-66. This is the highest-ranging of the Gunnison Basin lupines, and in many ways (which were only partially suggested in the Introduction), it is the most individual of them all. For instance, in June 1966, my assistant and I found L. amplus and L. rubricaulis once again growing together, this time near a small aspen grove in Prosser Creek Valley. As usual, L. rubricaulis was in the relative shade, L. amplus in the relative openness; but imagine my surprise to find L. rubricaulis covered with red-and-black ants and not a one on L. amplus! As I observed rather ruefully to my assistant, the ants are better botanists than many of us human beings. L. rubricaulis is another of C.F. Baker's type collections from the Gunnison Watershed, in this case coming from Crested Butte, which is about five miles southeast of the Scarp Ridge mentioned above.

Medicago L., The Alfalfas

Medicago lupulina L.; adventive; submontane; Gunnison, Si 7/13/44 WS. A decumbent, annual weed throughout most of the United States, this species may be known by its short, capitate racemes of yellow flowers, which are followed by black, coiled pods. The above is the only collection I know of from the Gunnison Basin.

Medicago sativa L.; adventive; submontane; Gunnison, B 86-60; Almont, R 10360 (1959) RMBL. The familiar perennial alfalfa of widespread cultivation, this species is not much planted in the Gunnison Basin, and is not common either as an escape or as a survivor in old fields.

Melilotus Jussieu, The Melilots or Sweet Clovers

Melilotus alba Desrousseaux; adventive; submontane; Gunnison, B 235-61; Almont, R 10369 (1959) RMBL. As

suggested on page 23 of the Introduction, this species is less frequent in the Gunnison Basin than the yellow melilot. Its axillary spires of small white flowers usually suffice for the recognition of the plant; but it will be noted that the leaflets are narrow and cuneate, and not nearly so cloverlike as those of the yellow melilot. Again, the sweet fragrance of the dried plant is stronger than that of the yellow melilot, and equaled only by that of the sweet grass, Hierochloë odorata.

Melilotus officinalis (L.) Lamarck; adventive; submontane-montane; Gunnison, B 234-61; Gothic, L 2162 (1952) COLO. For the differentiation of this plant from the white melilot, the reader is referred to the preceding annotation. One would like to know why the yellow melilot is more successful as an adventive in the Gunnison Basin than the white melilot.

Oxytropis DC., The Locoweeds or Locos

Oxytropis deflexa (Pallas) DC.; cordilleran; submontane-alpine; Gunnison, B 286-61; Cathedral, B 56-64; Gothic, B 134-60 CS, RMBL; Cochetopa Pass, B&S 109-66; Virginia Basin, Ed 109 (1939) COLO; Virginia Col, K 1276 (1948) DBG. Growing in all parts of the Basin, in sun and in shade, in dry and in wet habitats, and extending from the floor of the Basin well into the alpine zone, this is by all odds the commonest loco in the Gunnison Basin. Its leaflets are gray-green with a white pilosity, and its linear pods are deflexed so promptly that they serve as the chief means of identifying the plant.

Oxytropis foliolosa Hooker; boreal; alpine-montane; Virginia Ridge, B 160-52, 13b-54, 70c-54; Tin Cup, B 158-61; Capitol City, S 64-38. Descending from the alpine zone to the upper montane zone, and preferring open places, although growing both in wet and in dry habitats, O. foliolosa has a more limited range than that of O. deflexa. It has been confused with O. deflexa presumably because it has not been collected with mature fruits. The mature fruits of O. deflexa are narrow parallelograms

sharply deflexed against the rachis of the inflorescence. Those of O. foliolosa are broad ellipses projecting at right angles from the rachis.

Oxytropis Lambertii Pursh; cordilleran; submontane-montane; Gold Basin Creek drainage, B 117-65 RMBL; Glacier, B 41-52; Cathedral, B&S 132-62; Devil's Hole, B&S 153-62; Monchego Park, B 91a-55. The reddish flowers of the racemes of this species are spaced up and down the stem and held at a rigid, distinctive angle of about 60° from the continuing rachis. The plant is a handsome one, and it is sad, not only that the reddish hues change to a dark bluish purple upon drying, but that the plant is usually a sign of overgrazing or of otherwise eroded soil surfaces.

Oxytropis podocarpa Gray; boreal; alpine; Dorchester Pass, B 34-54; Mt. Belleview, S 65-69 RMBL; Handies Peak, P 1531 (1940) COCO. This is a rare species in the Gunnison Basin. Individual plants form cushions which, when in flower, frequently resemble a clump of violets. The fruits are distinctive. Ovoid, but acuminate at the small end, they suggest the onionlike steeple of a Russian church.

Oxytropis sericea Nuttall; cordilleran; submontane; Gunnison, Ke 7/49 WS; Cochetopa Park, B 49-60 CS, RMBL, B&S 66-44. In its vigorous habit of growth, O. sericea is suggestive of O. Lambertii. But its blossoms are white, making it one of the easiest plants in the Gunnison Basin to identify. In Cochetopa Park, it is known to have poisoned horses.

Oxytropis splendens Douglas; cordilleran; montane-subalpine; Cathedral, B 226-65; Devil's Hole, B&S 158-62; Cochetopa Pass, B&S 108-66; Brush Creek Valley (south), B 33-64 RMBL. O. splendens has a curious distribution in the Gunnison Basin. It seems to be confined to the southern margin of the Basin and to the upper montane zone, barely entering the subalpine zone. Yet in this narrow strip, it is not rare and is certainly one of the most striking plants in the Basin. Its pink blossoms upon drying turn dark-blue like those of O. Lam-

bertii; but in its silky luxuriant racemes it does hot resemble O. Lambertii at all. The racemes grow denser as the fruits mature, and end by being spikes rather than racemes.

Oxytropis viscida Nuttall; cordilleran; alpine; Virginia Basin, B 5-67; Virginia Ridge, B 70d-54; Red Mtn., B 171-61; Cumberland Pass, O 7/7/58 RMBL. Apparently restricted to the Elk Mountains section of the Basin, this low alpine oxytropis is the only species that is glandular-viscid. The inflorescence is essentially capitate (drying a light-blue); but in fruit, the heads lengthen into short spikes. The plant gives forth a pleasing resinous odor.

Thermopsis R.Brown, The Golden Peas

Thermopsis montana Nuttall; cordilleran; submontane-montane; Sapinero, Wh 510 (1898) COLO; Gunnison, B 17-55, B 151-61; Doyleville, D 14226 (1963) RMBL; Cathedral, B&S 214-62. In midsummer, no plant is more in evidence along the fences of the hayfields and pastures on the floor of the Basin than T. montana. Its leaves are a vivid green to begin with; but most conspicuous are the vertical pods appressed to each other and to the stem. In spring, the large yellow flowers make a bright spot of color; but they are soon succeeded by the vegetative green of the plant.

Thermopsis divaricarpa Nelson; cordilleran; subalpine-montane; Marshall Pass, B 127-60 CS, RMBL; Marshall Creek Valley, B 28-66; Cliff Creek Valley, S&Wb 64-230; Parlin, D 14266 (1963) RMBL. The divaricate, or spreading, pods of this species are the best means of separating it from T. montana, and the tendency can be detected long before the pods are mature. The distribution of this plant in the Gunnison Basin is interesting. It occurs (and flowers simultaneously) throughout the length of Marshall Creek Valley from Tank Seven (at 9,000 feet) to the pass on the Continental Divide (at 10,800 feet). It has also been collected just beyond Castle Pass at the opposite end of that diameter suggested in the Introduction as dividing the volcanic

from the non-volcanic rocks.* Finally, an isolated population of the species has been found near Parlin, at about the midpoint of this diameter.

Now this distribution pattern, and all the distribution patterns and hypotheses of this study, can be overturned tomorrow by fresh and further collections. But in the meantime, as former President Conant reiterates in his Science and Common Sense,** the very life of science is the life of the hypotheses that are formed on the available evidence and reach beyond it. In this situation, it does seem as if the hypothesis of flight from the center is the best possible (because most economical) hypothesis to account for the presently known distribution pattern of T. divaricarpa in the Gunnison Basin.

Curiously, the distribution pattern of Carex obtusata*** closely parallels that of T. divaricarpa. There are two alpine (rather than subalpine) stations at opposite edges of the Basin, there is the isolated relict station in the center, and two upper-montane stations at the foot of the encircling mountains corresponding to Tank Seven on Marshall Creek. True, the hypothesis of chance can still be invoked. But I beg the reader to recollect that the hypothesis of chance is the least economical of all hypotheses.

Trifolium L., The Clovers

The native clovers [illegible] white in book

Trifolium dasyphyllum Torrey & Gray; cordilleran; alpine; Rustler's Gulch, B 314a-61; Cumberland Pass, B 170-52; Baldy Chato, B&S 477-62; Henson Creek Basin, B&S 273-65; Castle Pass, B 111-59; Spring Creek Valley, B 277-65, B 92-65. With red wings and keel, but white banner, this clover is as easy to recognize as it is common in the alpine zone; and indeed, the first five stations listed make a circuit of the alpine regions of the

* See above, p. 8. ** New Haven, 1951.
*** See above, pages 3 and 170.

Gunnison Basin. But the plant also occurs two and three thousand feet lower down, in the cool, narrow valley of Spring Creek, as indicated by the last two collections cited. And particular interest here derives from the fact that the first collection cited comes from rather dry spruce forest just south of Bondholder Meadows, at some distance from the creek and at an elevation of more than 10,000 feet, the second collection from the grassy bank of the creek itself, five miles farther down the valley and a thousand feet lower in altitude. The very disparity of the two habitats convinces me that there are other populations of this plant up and down the valley, and that it is reasonable to suppose that the species has been living here for hundreds of years.

Trifolium Fendleri Greene; southwestern; submontane; Gunnison, Wi 10199 (1954); Willow Creek, B 166-65 RMBL; Steers Gulch, B 181-65 RMBL. To turn to this species is to descend from the highest to the lowest elevations in the Basin, for in the Gunnison Basin T. Fendleri is known only from the streamsides of the submontane zone. As the small streams cut across the sagebrush floor of the Basin, meandering half a dozen feet below the level of the land, one will come upon an entire bow between the meanders that is bright red from the heads of this plant. Yet the bracts beneath the heads are a bright green! It would be impossible to misidentify this species.

Trifolium gymnocarpon Nuttall; cordilleran; submontane; Powderhorn, B 22-65 RMBL; Tenmile Springs, B 30-65 RMBL; Hot Springs Creek Valley, B 19-66. This low, caespitose clover is apparently limited to the sagebrush zone of the Basin. Its rose-colored heads are distinctive, but the leaves, glabrous above and pubescent beneath, are more distinctive. For the veins of the leaflets end in small teeth, making the leaflet a minute replica of the leaf of the holly.

Trifolium longipes Nuttall; cordilleran; submontane-subalpine; Sapinero, Wh 410 (1898) COLO; Doyleville, E (1888) COLO; Willow Creek Mesa, B 52-65; Gothic, Wi 10060 (1954); Los Pinos Pass, B&S 159-62; Alpine Plateau, B 118-61. This native white clover is as vigorous and adaptive and widespread in the Gunnison Basin as a native plant can be. It is a rhizomatous species; but unlike the adventive white clover (T. repens), its plant-stems rise eight or nine inches high, where sometimes they support heads as large as those of the common red clover. The plant grows either in shade or in the open, and in habitats that range from moist to dryish. The veins of its lanceolate sessile leaflets, like those of T. gymnocarpon, end in small points, but the leaflets do not remotely resemble the leaves of the holly.

Trifolium nanum Torrey; cordilleran; alpine; Cumberland Pass, B 36-57; Baldy Chato, B&S 260-62; Trallala Peak, B 240-65. T. nanum is a rare plant in the Gunnison Basin, and what is even rarer, it is a clover that doesn't look like a clover! Whereas all the other clovers in the Basin are capitate, in this species there are commonly only two flowers to a peduncle. Thus it resembles that other cushion plant of the alpine zone, Oxytropis podocarpa, with the exception that its blossoms are red, those of the oxytropis violet. But there is one field character that unmistakably tells the genus. The minute trifoliate leaves could only be those of a clover.

Trifolium Parryi Gray; cordilleran; alpine-subalpine; East Maroon Pass, B 37g-54; Tin Cup Pass, B 165-61; Baldy Chato, B&S 261-62; Mesa Seco, B 79-64 RMBL, B 80-64 RMBL; East Brush Creek, L 1087 (1950) COLO. Although five inches is about the maximum height for this chiefly alpine species, it is the largest-headed clover in the Basin and instantly recognizable for this reason. Curiously, it occurs both in a white-flowered and in a purple-flowered form, populations of the two kinds growing together without intergradation, in which case the white-flowered form is the larger and more vigorous plant. The Mesa Seco collections from 12,300 feet illustrate the two forms nicely.

The adventive clovers

Trifolium pratense L.; adventive; submontane-montane; Gunnison, B 198-61; Crested Butte, St 55 (1959)

RMBL. The common red clover would seem to be too well known to need identifying remarks in this list. It occurs here and there along roads and in hayfields, but nowhere seems permanently to survive competition with the established native plants.

Trifolium repens L.; adventive; submontane-montane; Gunnison, B 236-61; Gothic, R 10482 (1959) CS. The common white clover must be as well known as the red. Perhaps it competes with the native plants more successfully than the red clover. But it is less frequent, probably because it is less often planted.

Trifolium hybridum L.; adventive; submontane-montane; Parlin, W 9456 (1955) COLO; Powderhorn, B&S 38-66; Cathedral, B&S 351-62; Gothic, D 14591 (1963) RMBL. Curiously, the alsike clover, as this species is called, seems to be the most successful of the adventive clovers in establishing itself in the Gunnison Basin. At least it is more frequent in out-of-the-way places than any of the other adventive species. The specific name "hybridum" comes from an old misconception that the plant was a cross between the red and the white clovers. Misconception or not, the notion certainly describes the plant, which seems to be about halfway between the two supposed parents.

Trifolium fragiferum L.; adventive; submontane; Gunnison, Sto 7/52 WS. The last of the adventive clovers is the least frequent of the four. Called the strawberry clover, it is more noticeable in fruit than in flower. Then the calyces become reddish and inflated, causing the head to double in size and giving the plant its popular name. Its stems have the creeping habit of the white clover.

Vicia L., The Vetches

Vicia americana Muhlenberg; boreal; submontane-subalpine; Gunnison, B&S 80-62; Fish Creek Mesa, B&S 198-62; Avery Flats, B 10g-54. The only tendril-bearing plant in the Gunnison Basin that could be confused with V. americana is Lathyrus leucanthus. L. eucosmos is

much more of a bush than a vine; and like the bush it is, it grows on open roadsides. But both V. americana and L. leucanthus are low-climbing vines, and what is more, they are frequently ecological equivalents (as noted under L. leucanthus), attaching their tendrils to each other, like the halt leading the blind. Yet the flowers of the lathyrus are an ivory-white, those of the vicia a bluish-purple, and really, no more is needed to separate the two species.

LEMNACEAE, The Duckweed Family

Lemna L., The Duckweeds

Lemna minima Philippi; widespread North American; submontane; Parlin, P 5117 (1961) COCO. It would seem that every one knows the duckweeds--those plants composed of green scales that can completely cover a small pool of quiet water, and have long trailing roots descending from each scale or cluster of scales. In L. minima, the scales, or fronds (as they are more technically called), are very small (usually only two or three millimeters long by one or two wide) and either nerveless or with just the trace of a single nerve.

Lemna trisulca L.; boreal; submontane; Sapinero, Wh 549 (1898) COLO; Parlin, W&J 8567 (1953) COLO. In this considerably larger species, daughter plants grow out on stalks from either side of the mother plant, and continue to do so for several generations. The secondary fronds thus held out more or less at right angles from the principal frond become the chief diagnostic of the species and can be detected with the naked eye.

LENTIBULARIACEAE, The Bladderwort Family

Utricularia L., The Bladderworts

Utricularia vulgaris L.; boreal; submontane-montane; Parlin, E (1888) COLO; Almont, H&M 7165 (1952) CS; Cement Creek Valley, W&L 9516 (1955) COLO, S 64-248.