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I. STUDIES IN THE GENUS *HEDYSARUM* IN NORTH AMERICA

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(PLATE 597)

SETACEOUS processes upon the reticulate lines or rib-like markings of the loment of *Hedysarum* are found in species which occur in northern Africa, certain parts of Europe and in Asia, but no species with this unusual characteristic has been recorded from America. It was, therefore, quite surprising when in 1937 plants of this genus with fruits bearing numerous setae were discovered growing in a decidedly undisturbed native habitat in the Uinta Basin of northeastern Utah. This discovery immediately raises the question as to whether these outgrowths upon the fruits are merely parallel developments in unrelated sections of *Hedysarum* or whether they indicate a close fundamental relationship between all species that possess them, despite wide geographic separation. If the latter is true, it will be agreed that a new interpretation of the geographical distribution of *Hedysarum* must be made, properly relating our new plant to those of the Old World. Since its discovery, the new plant has received intermittent attention with the view to determining its relationships and probable position in *Hedysarum* as a whole. To elucidate facts of relationship, distribution and speciation, and

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in order to present a coördinated picture of the genus as it occurs in North America south of the Yukon Territory and Alaska, a rather detailed consideration of *Hedysarum* has been necessary. The Yukon Territory and Alaska have been excluded from the present treatment because much of the material which ought to be studied is in the hands of Dr. Eric Hultén in Sweden and its return to America must await the termination of the present war. There are no questions involving name-priority which would be affected by specific names based on plants from this area.

De Candolle¹ in his monumental work upon the Leguminosae used, in part, muricate or glochidiate processes on the fruits to characterize section *Echinolobium* of *Hedysarum* and to separate it from the only other section recognized, *Leiolobium*. The two sections were clarified in his Prodrum² by the actual listing of the species belonging to each. That this classification was drawn along artificial lines apparently was first recognized by Basiner,³ who reclassified the genus by using an entirely new set of characters. The essential features of Basiner's treatment have been accepted and used by Boissier⁴ and more recently by Fedtschenko⁵ in his world-wide monograph of the genus. The latter work⁶ has been the most valuable single reference during the course of the present study, but the treatment of American plants is not satisfactory and reflects, perhaps, an inadequacy of material upon which the monographer based his decisions regarding our species. All the American plants were placed by Fedtschenko in "subtribe" *Gamotion*, which supposedly contained only those species with at least the lower stipules united. Actually, of the two separable groups of species found in America, one has the lower stipules frequently partially free and those above often entirely free, the other has the lower stipules always united and the upper somewhat united or in rare instances nearly free. On the basis of united or free stipules alone, some of our plants would fall into "subtribe" *Eleutherotion* where they obviously do not

¹ Mem. Legumin. 345 (1825).

² Prod. Syst. Nat. 2: 340-44 (1825).

³ Mem. Acad. Petrop. 6: 45-97 (1846).

⁴ Fl. Orientalis 2: 511-25 (1872).

⁵ Acta Hort. Petrop. 19: 185-325 (1902).

⁶ I am indebted to Mr. F. J. Whitefield, one of my colleagues in the Society of Fellows, for translating several passages from the Russian.

belong. In view of this fact, it appears that the use of this stipule-character, without others to support it, leads to a somewhat artificial division of *Hedysarum*, at least in so far as the American species are concerned.

Plants of *Hedysarum* in North America are divisible into two natural groups. One, which fits into section *Obscura* of Fedtschenko, has prominently veined leaflets; articles of the loment wing-margined, surface reticulations or areolae of the articles nearly as broad as long; unequal calyx-teeth which are much shorter than the tube, and linear wing-auricles which are united under the standard and equal or exceed the claw of the wings in length. In this group belong *H. alpinum*, *H. occidentale* and *H. sulphurescens*. In the other group, which does not fit clearly into any of the published subdivisions of the genus, the leaflet-veins are hidden; the articles of the loment are wingless, surface reticulations or areolae are transversely oblong to rectangular, hence much longer than broad; the nearly equal calyx-teeth are linear-subulate and longer than the tube; and the wing-auricles are free, short, broad and less than a third the length of the wing-claw. Here I place *H. boreale*, *H. Mackenzii* and *H. gremiale*. The characters which have been used to separate these two groups are surprisingly definite and have stood the test of dozens of flower-dissections in American material. It doubtless is true that this subdivision can be employed in classifying certain Asiatic species of *Hedysarum*, as a cursory examination of some of them has indicated, but it is not my purpose to so extend the present investigation.

As indicated above, *H. boreale*, *H. Mackenzii* and *H. gremiale* are not well-placed in any of the established subdivisions of *Hedysarum*, but according to the treatment of Fedtschenko they must be referred to section *Multicaulia*. Into this section both spiny-fruited and spineless-fruited species are admitted. That species with both types of fruit are sufficiently related to be placed in the same section of *Hedysarum* appears to be in accord with the facts, for my own studies indicate that *H. gremiale* is more nearly related to *H. boreale* var. *cinerascens* than to any spiny- or setose-fruited species from Africa, Europe or Asia. It must be concluded, therefore, that the discovery of a setose-fruited species of *Hedysarum* in America does not mean that

there has been a recent genetical connection between this species and those of the Old World, but that this striking feature of the loment has probably arisen independently in America from forms without spiny fruits. Such a supposition is supported to some extent by the fact that occasional plants of *H. boreale* var. *cinerascens* tend to have muricate reticulations on the loment-segment over the seed, and, in at least one case (*Tweedy* no. 132 from the Tongue River in Wyoming), short but definite nubbin-like spines have been developed.

I am indebted to the curators of herbaria in the following institutions who have loaned material or made facilities available for my use: Gray Herbarium of Harvard University (G); Forest Service, U. S. Department of Agriculture (FS); North Dakota Agricultural College (NDA); New York Botanical Garden (NY); U. S. National Museum (US). Dr. Theodor Just of the University of Notre Dame has supplied pertinent information concerning some of Greene's types. Cited collections followed by the symbol (R) are in my own herbarium.

SYNOPSIS OF THE GENUS *HEDYSARUM* L. IN NORTH AMERICA,
EXCEPTING ALASKA AND THE YUKON TERRITORY

Herbaceous perennials; stems several to numerous from a ligneous root, decumbent to erect, terete, more or less longitudinally grooved, usually appressed-pubescent at least above, often densely so; leaves odd-pinnate, petiolate, leaflets nearly sessile, often apiculate, mostly puncticulate above; stipules united or sometimes free, chartaceous; inflorescence racemose, axillary, peduncled; flowers erect to reflexed, pink to purple, yellowish or white; calyx bracteolate, campanulate, five-toothed, pubescent; corolla glabrous, wings and standard shorter than the keel; stamens diadelphous (9 & 1), included; fruit a loment with elliptical to suborbicular articles; single-seeded articles pubescent or glabrous, areolate, wing-margined or the wings absent; loment usually stipitate.

KEY TO THE SPECIES

- a. Auricles of the wings united, linear, equaling or nearly equaling the claw; calyx-teeth markedly unequal, upper nearly triangular; articles of loment wing-margined, areolae about as broad as long; leaflets conspicuously veined.

- b. Articles of the loment 3.5–5 mm. broad, narrowly wing-margined, nearly orbicular to slightly oblong; flowers less than 18 mm. long; leaflets mostly oblong to narrowly oblong, 4–7 (–10) mm. wide
 - 1. American varieties of *H. alpinum*.
- b. Articles of the loment 6–13 mm. broad, conspicuously wing-margined, elliptical to broadly oblong; flowers at least 16 mm. long or if shorter then sulphur-yellow; leaflets mostly ovate to ovate-lanceolate, 6–14 (–20) mm. wide.
 - c. Flowers sulphur-yellow, 15–18 mm. long; leaflets glabrous above; loment glabrous; keel truncate 2. *H. sulphurescens*.
 - c. Flowers reddish-purple, 16–20 mm. long; leaflets usually pubescent above; loment pubescent or very rarely glabrous; keel rounded 3. *H. occidentale*.
- a. Auricles of the wings not united, blunt, much shorter than the claw; calyx-teeth nearly equal, linear-subulate; articles of the loment wingless, areolae transversely elongated; leaflet-veins hidden.
 - d. Articles of the loment covered with setae; loment divaricate; leaflets pubescent on both sides 4. *H. gremiale*.
 - d. Articles of the loment free of setae; loment divaricate to pendent; leaflets glabrous above or pubescent on both surfaces.
 - e. Inflorescence elongated; stems branched above, 2–6 dm. high; stipules dark brown; leaflets pubescent on both surfaces or glabrous above, usually dull slate-colored above; flowers 12–19 mm. long; nodes of the loment narrow, less than half as broad as the articles; articles 2–5 5. *H. boreale*.
 - e. Inflorescence congested; stems usually unbranched above, 1–3.5 dm. high; stipules whitish-translucent, brown-streaked; leaflets green and glabrous above, rarely slightly pubescent; flowers 18–21 mm. long; nodes of the loment more than half as broad as the articles; articles 4–8 6. *H. Mackenzii*.

1. AMERICAN VARIETIES OF *H. ALPINUM*. Herbaceous perennial, stems numerous, terete, longitudinally grooved, branched above, sparsely appressed-pubescent, 2–7 dm. high; stipules connate, brown, 5–15 mm. long, lower large and obtuse, upper acute; leaves petiolate, 6–15 cm. long; leaflets 15–21, glabrous and obscurely punctulate above, sparsely pubescent (particularly along mid-vein and margins) below, prominently veined, broadly lanceolate to oblong, usually obtuse, rarely nearly acute, apiculate, 10–25 mm. long, 5–10 mm. wide; inflorescence racemose, elongated, often somewhat secund; flowers deflexed, 12–18 mm. long, reddish-purple; calyx pubescent, teeth unequal, 1–2 mm. long, shorter than the tube, upper short and triangular, lower narrower and longer; standard broadly spatulate to obovate, emarginate, 11–14 mm. long; wings narrowly oblong to linear, blunt, 10–13 mm. long, about 2 mm. wide, claw 2–3 mm. long, wing-auricles linear, united beneath standard, equaling the claw;

laments mostly stipitate, glabrous to appressed-pubescent, pendent; articles 2–5, rarely one, 5–7 mm. long, 3.5–5 mm. wide, suborbicular to slightly longer than broad, wing-margined; areolae mostly polygonal, nearly as broad as long.

KEY TO THE AMERICAN VARIETIES OF *H. ALPINUM* L.

Laments glabrous to very sparingly pubescent along the margins.

Flowers 12–15 mm. long; inflorescence elongated; stems nearly erect, 3–5 dm. high 1a. var. *americanum*.

Flowers 15–18 mm. long; inflorescence subcapitate to somewhat elongated; stems decumbent, 2–4 (–5) dm. high 1b. var. *grandiflorum*.

Laments pubescent on both surfaces, rarely glabrate 1c. var. *philoscia*.

1a. Var. *AMERICANUM* Michx. ex Pursh, Fl. Am. Sept. **2**: (1816); Fernald in RHODORA **28**: 216 (1926); Raup in Contrib. Arn. Arb. **6**: 181 (1934); Bull. Nat. Mus. Can. **74**: 148 (1935). *H. alpinum americanum* Michx., Fl. Bor.-Am. **2**: 74 (1803). *H. alpinum* sensu Marie-Victorin, Fl. Laurent. 352 (1935), non L. *H. alpinum* subsp. *americanum* Fedtsch. in Acta Hort. Petrop. **19**: 255 (1902) in part. *H. alpinum* var. *americanum* f. *albiflorum* Fernald in RHODORA **35**: 275 (1933). *H. americanum* Britt. in Mem. Torr. Bot. Club **5**: 201 (1894); Britt. and Brown, Ill. Fl. **2**: 311 (1897); Rydberg, Fl. Rky. Mts. adj. Plains 524 (1917); Fl. Pr. Pl. Cent. N. Am. 487 (1932). *H. boreale* sensu De Candolle, Prod. Syst. Nat. Veg. **2**: 343 (1825) in part; Hooker, Fl. Bor.-Am. **1**: 155 (1834); Torrey and Gray, Fl. N. Am. **1**: 356 (1838); Wood, Classbook Bot. ed. 2, 230 (1847); Gray, Man. ed. 2, 98 (1856); Provancher, Fl. Canad. **1**: 151 (1862); Stevens, Fl. Plants, 348 (1910); Henry, Fl. So. Brit. Columb. 192 (1915); non Nuttall. —Newfoundland to northern Maine and Vermont; Manitoba to British Columbia and probably Alaska. NEWFOUNDLAND: Bard Harbor Hill, Highlands of St. John, Aug., 1925, Fernald & Long 28627 (G); Bishop Falls, valley of Exploits River, July, 1911, Fernald, Wiegand & Darlington 5800 (G); Grand Falls, valley of Exploits River, July, 1911, Fernald, Wiegand & Darlington 5798 (G). QUEBEC: between Mont Louis and Rivière à Pierre, Aug., 1923, Fernald & Smith 25875 (G); Gulf of St. Lawrence, east of Marten River, Gaspé Co., July, 1922, Fernald & Pease 25171 (G); St. John River, Gaspé Co., Aug., 1904, Collins, Fernald & Pease s. n. (G); Tourelle, Gaspé Co., July, 1924, Pierce & Hodge 7a (G); Bic, Rimouski Co., July, 1904, Collins & Fernald s. n. (G); Aug., 1927, Rousseau 26823 (G); Renard River, Anticosti Island, Aug., 1927, Marie-Victorin & Rolland-Germain 27354 (G); Natiskotek River, Anticosti Island, Aug., 1927, Marie-Victorin & Rolland-Germain 27356 (G); between Baldé and Baie des Chaleurs, Bonaventure Co., Aug., 1904, Collins, Fernald

& Pease s. n. (G) ; Lake St. Jean, July, 1921, *Marie-Victorin* s. n. (G). NEW BRUNSWICK: Gorge of the Aroostook River, Victoria Co., Aug., 1909, *Fernald* 1962 (G) ; July, 1902, *Williams, Collins & Fernald* s. n. (G) ; Connors, St. John River, July, 1903, *Pease* 2262 (G). MAINE: St. John River, St. Francis, July, 1932, *Pease & Goodale* 67773 (G) ; Aug., 1893, *Fernald* 26 (G) ; Fort Fairfield, July, 1902, *Williams, Collins & Fernald* s. n. (G) ; Fort Kent, July, 1908, *Mackenzie* 3536 (NY). VERMONT: Willoughby, July, 1887, *E. & C. E. Faxon* s. n. (G) ; Aug., 1874, *Congdon* s. n. (G) ; Smuggler's Notch, Mt. Mansfield, July, 1894, *Eggleston* s. n. (G, NY) ; Aug., 1877, *E. & C. E. Faxon* s. n. (G) ; July & Aug., 1877, *Pringle* s. n. (G). MANITOBA: 6 miles east of Forest, June, 1906, *Macoun & Heriot* 70783 (G). SASKATCHEWAN: 30 miles east of Touchwood, July, 1906, *Macoun & Heriot* 70784 (G) ; Duck Lake, July, 1913, *Johnson* 1375 (NY). ALBERTA: Kootenai Plains, North Branch Saskatchewan River, June, 1908, *Brown* 946 (G, NY) ; Peace Point, Wood Buffalo Park, Aug., 1928, *Raup* 2803 (G) ; Government Hay Camp district, Wood Buffalo Park, Aug., 1928, *Raup* 2807 (G) ; Water Coulee, near Rosedale, June, 1915, *Moodie* 948 (G.) ; Calgary, June, 1903, *Barber* 240 & 262 (G.) ; near Banff, Aug., 1900, *Prince* s. n. (G.) ; July, 1897, *Van Brunt* 20 (NY) ; Cypress Hills, June, 1894, *Macoun* 4534 (G). BRITISH COLUMBIA: vicinity of Hudson Hope, June, 1932, *Raup & Abbe* 3626 (G).

1b. Var **grandiflorum**, var. nov. Herba perennis; caulibus decumbentibus, 2–4 (–5) dm. longis; floribus purpurascens, 15–18 (–19) mm. longis.—*H. alpinum* sensu Fernald in RHODORA **13**: 119 & 129 (1911); *ibid.* **28**: 216 (1926); *ibid.* **35**: 275 (1933); Raup in Contrib. Arn. Arb. **6**: 181 (1934); non L. *H. alpinum* var. *americanum* sensu Ostenfeld in Vidensk. Selsk. Skrift. I Klasse, no. 8, 55 (1909), non Michx. ex Pursh.—Labrador, Newfoundland, northern Alberta and British Columbia. LABRADOR: Forteau, 1870, *S. R. Butter* s. n. (G). NEWFOUNDLAND: Port à Port, July, 1921, *Mackenzie & Griscom* 10332 (G, US) ; Table Mountain, region of Port à Port Bay, July, 1914, *Fernald & St. John* 10849 (G) ; Cook Point, Pistolet Bay, July, 1925, *Fernald & Gilbert* 28622 (G) ; Anse aux Sauvages, Pistolet Bay, Aug. 11, 1925, *M. L. Fernald, K. M. Wiegand & Bayard Long* 28625 (G, TYPE) ; west of Big Brook, Straits of Belle Isle, *Long & Gilbert* 28620 (G) ; Sandy Cove, Straits of Belle Isle, Aug., 1924, *Fernald, Long & Dunbar* 26810 (G) ; Killdevil, Bonne Bay, Aug., 1929, *Fernald, Long & Fogg* 1835 (G) ; Eastern Point, region of St. John Bay, July, 1929, *Fernald, Long & Fogg* 1833 (G). ALBERTA: head of Malique Lake, July, 1908, *Brown* 1218 (G, NY) ; Cataract Cr., headwaters of the Saskatchewan and Athabasca Rivers, Aug., 1908, *Brown* 1452 (G) ; head of Smoky

River, Aug., 1911, *Riley* 36 (G). BRITISH COLUMBIA: Mt. Selwyn, July, 1932, *Raup & Abbe* 3967 & 4091 (G).

1c. Var. **philoscia** (A. Nels.) comb. nov. *H. philoscia* A. Nelson in Proc. Biol. Soc. Wash. **15**: 185 (1902); Coulter and Nelson, Man. Bot. Cent. Rky. Mts. 300 (1909). *H. boreale* sensu Rydb., Fl. Rky. Mts. adj. Plains 524 (1917); Fl. Pr. Plains Cent. N. Am. **487** (1932); non Nuttall.—Saskatchewan and Alberta to South Dakota and Wyoming. SASKATCHEWAN: without locality, 1858, *E. Bourgeau* s. n. (G, NY). ALBERTA: Fort Saskatchewan, July, 1938, *Turner* 58 & 59 (G). SOUTH DAKOTA: Rochford, Black Hills, July, 1892, *Rydberg* 640 (G); Black Hills, July, 1872, *Greene* 13 (NY); near Custer Peak, Lawrence Co., June, 1929, *Palmer* 37554 (G); Deerfield, Pennington Co., June, 1929, *Palmer* 37509 (G). WYOMING: Boyd, Weston Co., July, 1910, *A. Nelson* 9436 (G); Willow Creek, Albany Co., July, 1897, *A. Nelson* 3367 (G); Crow Creek, Albany Co., Aug., 1903, *A. Nelson* 8955 (G); Laramie Hills, Albany Co., July, 1901, *E. Nelson* 622 (G, NY).

In eastern Asia, as in America, there are several phases and varieties of *H. alpinum*. The exact application of Linnaeus' name to Siberian material, except in the broad sense, has not been attempted in the present study. It is evident from a careful examination of Siberian specimens of *H. alpinum* in the Gray Herbarium and in the United States National Herbarium, that the plants heretofore passing as *H. boreale* in such works as Torrey and Gray's *Flora*¹ and Gray's *Manual*,² and as *H. americanum* in Britton and Brown's *Flora*³ and Rydberg's *Flora*⁴ are not specifically distinct from those of eastern Asia. However, the North American plants do differ in certain minor ways and should be considered as separate varieties of a wide-ranging species, *H. alpinum*, which extends from Asia across the north to Newfoundland, Gaspé and Maine and southward along the mountains of western America. Such a treatment indicates clearly the relationships of our plants with those of Asia, and at the same time shows that the American plants have certain special characteristics which are not possessed by those of the Old World. The differences separating the Old World plants from those of the New, particularly those emphasized by Hooker,⁵ are at best

¹ Fl. N. Am. **1**: 356 (1838).

² Robinson and Fernald in Gray's *Manual* 7th. ed. 518 (1908).

³ Ill. Fl. **2**: 311 (1897).

⁴ Fl. Rky. Mts. adj. Plains 524 (1917).

⁵ Fl. Bor.-Am. **1**: 155 (1834).

only trivial. Certainly the actual differences are not of sufficient importance to justify specific segregation and, in my opinion, it is a mistake to obscure the natural relationships of our plants by giving them a separate specific epithet. The misapplication of the name *H. boreale* is dealt with under that species.

H. alpinum in America has three geographic varieties which are very closely related, but which have certain characteristics peculiar to themselves. Variety *philoscia* is very similar to var. *americanum* except for its densely pubescent instead of glabrous fruits. This difference is not absolute, for there are specimens with fruits pubescent along the margins or even with a very few trichomes along the edges of the flat surfaces of the loments which I have referred to var. *americanum*. Plants of the latter type are apparently of rare occurrence, but they indicate that intermediates between the two varieties actually exist and that attempts to establish either as a distinct species should be regarded with suspicion. Variety *grandiflorum* is a more dwarfed, larger-flowered plant than its nearly related var. *americanum*, and the two are usually quite easily distinguished, but here again, as far as herbarium material shows, there is a gradual transition from one to the other. Variety *grandiflorum* inhabits the headlands of Newfoundland and barrens of northern Canada, while var. *americanum* ranges southward in more favorable habitats. Their most distinctive characters have been set forth in the key above.

2. *H. SULPHURESCENS* Rydberg. Herbaceous perennial, stems several to numerous from a ligneous root, shallowly furrowed longitudinally, branched above, appressed-pubescent, 2–6 dm. high; stipules united, brown, chartaceous, lower obtuse, 1–1.5 cm. long, upper acute to acuminate, reduced; leaves petiolate, 8–12 cm. long; leaflets 9–17, elliptical to ovate-oblong, usually apiculate, conspicuously veined, sparsely pubescent below, glabrous and punctulate above, 15–30 (–40) mm. long, 5–10 (–15) mm. wide; inflorescence axillary, racemose, elongated; flowers pendent, ochroleucous to yellow, 15–18 mm. long; calyx pubescent, teeth unequal, shorter than tube, 1–3 mm. long, upper shorter and broader than the lower; standard obovate-cuneate, emarginate, 12–14 mm. long, 6.5–8 mm. wide; wings obtuse, 12–14 mm. long, 2.5–3 mm. wide, wing-auricles linear, united under standard, equaling the claw, 3–3.5 mm. long; keel sharply truncate; loments pendent, stipitate, articles 1–4, conspicuously wing-margined,

glabrous, asymmetrically elliptical, 8–12 (15) mm. long, 6–8 (9) mm. wide; reticulations not raised, polygonal.—Bull. Torr. Bot. Club **24**: 251 (1897); Mem. New York Bot. Gard. **1**: 257 (1900); Piper in Contrib. U. S. Nat. Herb. **11**: 367 (1906); Coulter and Nelson, Man. Bot. Cent. Rky. Mts. 300 (1909); Rydberg, Fl. Rky. Mts. adj. Plains 523 (1917). *H. flavescens* Coult. and Fisch., Bot. Gaz. **18**: 300 (1893), non *H. flavescens* Regel and Schmalh. ex Regel in Bull. Soc. Sci. Moscow **34**: 21 (1882). *H. boreale* Nutt. var. *flavescens* (Coult. and Fisch.) Fedtsch. in Bull. Herb. Boiss. **7**: 256 (1899). *H. boreale* Nutt. var. *albiflorum* Macoun, Cat. Canad. Pl. **1**: 510 (1884). *H. albiflorum* (Macoun) Fedtsch. in Acta Hort. Petrop. **19**: 252 (1902). *H. boreale* Nutt. var. *leucanthum* sensu M. E. Jones in Proc. Calif. Acad. Sci. **5**: 677 (1895), non *H. Mackenzii* Richards. var. *leucanthum* Greene, Pitt. **2**: 294 (1892).—Alberta and British Columbia to Washington, Idaho and Wyoming. ALBERTA: Pipestone Valley, July, 1906, *Brown* 425 (G); Bow River Valley, June, 1906, *Brown* 127 (G); Lake Louise, Aug., 1904, *Edith Farr* s. n. (G); between Lake Louise and Lake Louise Station, Sept., 1927, *Eggleston* 21810 (US); Laggan, July, 1904, *J. Macoun* s. n. (G); vicinity of Banff, June–July, 1899, *McCalla* 2140 (US). BRITISH COLUMBIA: Burgess Trail near Field, July, 1906, *Brown* 537 (G); Sept., 1904, *Shaw* 591 (G); Crows' Nest Pass, July, 1883, *Dawsan* 63 (G); Kananaskis, June, 1885, *J. Macoun* (G, ISOTYPE of *H. boreale* var. *albiflorum*). MONTANA: upper Marias Pass, Aug., 1883, *Canby* 93 (G); McDonald's Peak, Mission Range, July, 1883, *Canby* 90 (G); Cutbank Creek, Glacier Nat. Park, July, 1934, *G. N. Jones* 5425, 5438 and 5513 (G); Mt. Haggin, near Anaconda, July, 1915, *M. E. Jones* s. n. (G); Bozeman, July, 1895, *Shear* 5269 (US); Bridger Mts., Gallatin Co., Aug., 1902, *W. W. Jones* (G); Baldy Mountain, Park Co., June, 1912, *Eggleston* 8079 (G); Pioneer, July, 1898, *J. K. Uhl* s. n. (G, NDA); Bear-tooth Mts., 17 miles southwest of Red Lodge, Carbon Co., July, 1939, *Rollins & Muñoz* 2828 (G); West Fork of Sun River, Lewis and Clark Nat. For., Aug., 1912, *Saunders* 174 (FS); north slope of Pryor Mt., Beartooth Nat. For., June, 1926, *Williamson* 2 (FS). WYOMING: Little Tongue River Canyon, Big Horn Mts., Sheridan Co., June, 1936, *L. & R. Williams* 3112 (G); 20 mi. west of Dayton, Sheridan Co., July, 1935, *L. Williams* 2364 (G); Beartooth Butte, Park Co., Aug., 1937, *L. & R. Williams* 3767 (G); near Cody, Yellowstone Nat. Park, July, 1930, *Churchill* s. n. (G); Wraith Falls, Yellowstone Nat. Park, July, 1899, *A. & E. Nelson* 5706 (G). IDAHO: south end of Lake Pend d'Oreille, July, 1892, *Sandberg, MacDougal & Heller* 748 (G); Targhee Nat. For., Aug., 1911, *Willey* 161 (FS). WASHINGTON: near Winthrop, Okanogan Co., July, 1934, *Thompson* 10913 (G);

road to Salmon Meadows, Okanogan Co., June, 1931, *Thompson* 7024 (G).

Fedtschenko¹ expressed doubt concerning the ultimate validity of *H. sulphurescens* (*H. albiflorum*) as a specific entity, stating that it was very close to *H. alpinum* var. *japonicum* and an undesignated variety of *H. obscurum*. Recently, Hara² named var. *japonicum*, in the sense of Fedtschenko, as a species, which seems to indicate that the relationship is not as close as originally supposed. A careful study of the Asiatic plants referred to, shows that they are in the same species-group, but that they are not conspecific with the American plants. Our plants belong to the "*alpinum*" group, but are actually most closely related to *H. occidentale* on account of the large, widely wing-margined laments. Besides having yellowish instead of reddish-purple flowers, *H. sulphurescens* differs from *H. occidentale* in having glabrous instead of pubescent fruits, smaller flowers and a more sharply angled truncate keel. These two species probably had a common origin, but in my opinion, they have now developed differentiating characters which are constant enough to merit for each the rank of a species. *H. sulphurescens* occupies a unified phytogeographical area in the northern Rocky Mountains and adjacent ranges.

3. *H. OCCIDENTALE* Greene. Herbaceous perennial, stems several to numerous from a ligneous root, longitudinally furrowed, pubescent, branched above, 3–7 dm. high; stipules brown, chartaceous, united, fragile, lower obtuse, upper acuminate; leaves petiolate to nearly sessile, 8–12 cm. long; leaflets 11–19, ovate, elliptical or broadly oblong, apiculate, sparsely pubescent on both surfaces or rarely glabrous above, punctulate above, conspicuously veined, 12–25 (–30) mm. long, 7–14 mm. wide; inflorescence racemose, axillary, elongated, 6–13 cm. long; flowers pendent, reddish-purple, 16–20 mm. long; calyx pubescent, teeth unequal, 1–3.5 mm. long, upper short, triangular, lower nearly subulate, shorter than the tube; standard obovate-spatulate, emarginate, 13–15 mm. long, 6.5–7.5 mm. wide at widest point; wings 13–15 mm. long, 2–3 mm. wide, linear-oblong, wing-auricles united under the standard, linear, equalling the claw, 3–4 mm. long; laments pendent, stipitate; articles 1–4, elliptical, conspicuously wing-margined, pubescent or rarely glabrous, 9–14 mm. long, 7–13 mm. wide, reticulations polygonal.—Pitt. 3: 19

¹ Fedtschenko, op. cit. p. 253.

² Journ. Jap. Bot. 15: 52 (1939).

(1896); Piper in Contrib. U. S. Nat. Herb. **11**: 366 (1906); Piper and Beattie, Fl. Northw. Coast **225** (1915); G. N. Jones in Univ. Wash. Pub. Biol. **5**: 188 (1936). *H. marginatum* Greene, Pitt. **4**: 138 (1900); Rydberg, Fl. Colo. **215** (1906); Fl. Rky. Mts. adj. Plains **524** (1917); Coulter and Nelson, Man. Bot. Cent. Rky. Mts. **300** (1909). *H. uintahense* A. Nelson in Proc. Biol. Soc. Wash. **15**: 186 (1902); Coulter and Nelson, op. cit. p. 300. *H. lancifolium* Rydb. in Mem. New York Bot. Gard. **1**: 256 (1900); Fl. Rky. Mts. adj. Plains **524** (1917).—Washington to Montana, Colorado and Utah. MONTANA: Moser Mt., Flathead Nat. For., Aug., 1925, *Kirkwood 2187* (G, NY); Thompson Falls, Aug., 1909, *Butler 5058* (NY); Jocko Range, Aug., 1880, *S. Watson 95* (G); near Gunsight Lookout Station, Flathead Nat. For. July, 1928, *Liebig 303* (FS); West Fork Teton River, Lewis and Clark Nat. For., Aug., 1921, *Lane D2-3* (FS). WYOMING: headwaters of Clear Creek and Crazy Woman Creek, Big Horn Mts., July–Aug., 1900, *Tweedy 3193* (NY); Soldier's Park, Big Horn Mts., Aug., 1898, *T. A. Williams s. n.* (US); on the Red Grade near the top, eastern slope of the Big Horn Mts., June, 1934, *Rollins 503* (G, NY); Teton Pass, July, 1920, *E. B. & L. B. Payson 2096* (G, NY); July, 1901, *Merrill & Wilcox 977* (G, NY); Two-gwo-tee Pass, July, 1932, *L. Williams 955* (G); Mt. Wagner, southeast of Smoot, Aug., 1923, *Payson & Armstrong 3749* (G); Evanston, Uinta Co., June, 1900, *A. Nelson 7198* (G, NY, ISOTYPES of *H. uintahense*); near Big Muddy Creek, between Fort Bridger and Evanston, June, 1938, *Rollins 2323* (G); Ashley Nat. For., Uinta Co., June, 1924, *Kane 6* (FS). UTAH: near Mill Creek, Summit Co., July, 1926, *E. B. & L. B. Payson 4881* (G, NY). COLORADO: White River Nat. For., June–July, 1910, *Reynoldson 81* (FS); 6 miles northwest of the Rio Grande Reservoir, Hinsdale Co., Aug., 1936, *Rollins 1503* (G, NY); Pagosa Springs, July, 1899, *Baker 429* (G, NY); near La Plata, July, 1898, *Baker, Earle & Tracy 464* (G, NY); Silverton, Aug., 1897, *Shear 5227* (NY); foot of Mt. Hesperus, La Plata Mts., Aug., 1892, *Eastwood s. n.* (NY); Rio Grande Nat. For., July, 1924, *Lister 75* (FS). IDAHO: hills southeast of Victor, Teton Co., July, 1920, *E. B. & L. B. Payson 2167* (G, NY); Caribou Mt., Bonneville Co., July, 1923, *Payson & Armstrong 3538* (G); ridges south of Wiesner's Peak, July, 1895, *Leiberg 1366* (NY); divide between St. Joe and Clearwater River's, July, 1895, *Leiberg 1213* (G, NY); Waterfall Canyon, Targhee Nat. For., July, 1929, *Richwine 4* (FS); head of Georgetown Canyon, Caribou Nat. For., June, 1926, *Phinney 89* (FS). WASHINGTON: *Olympic Mts.*: without definite locality, July, 1890, *Henderson 1850* (G); 1889, *Grant 156* (G); Aug., 1895, *Piper 2227* (US); June, 1900, *Elmer 2529* (US); Mount Angeles,

Aug., 1931, *Thompson* 7831 (G) ; July, 1933, *Thompson* 9471 (G, US) ; Hurricane Ridge, Sept., 1937, *Thompson* 14176 (G, US) ; Blue Mountain, Deer Park Recreational Area, Aug., 1938, *Rollins & Chambers* 2693 (G) ; Bogachiel Ridge, headwaters of the Hoh River, Aug., 1938, *Rollins & Chambers* 2704 (G) ; Mt. Colonial Bob, July, 1931, *Thompson* 9968 (G, US) ; Aug., 1933, *Thompson* 9968 (G) ; Mt. Baldy, July, 1897, *Lamb* 1318 (US).

H. occidentale is most nearly related to *H. sulphurescens*, from which it differs in having reddish-purple instead of light yellow flowers, usually pubescent instead of glabrous fruits and more leaflets on each compound leaf. There are 13 to 19 leaflets with pubescent upper surfaces in *H. occidentale*, whereas in *H. sulphurescens* the 9–15 leaflets are glabrous above. Also, the flowers and fruits of the former are uniformly larger than those of the latter. Both these species are related in a general way to the American varieties of *H. alpinum*, but the very much larger and more broadly winged loment-articles of *H. occidentale* and *H. sulphurescens* are not matched by any other American species of the genus.

The known geographical distribution of *H. occidentale* is of interest because of the total absence of this plant from the intervening area between the Olympic Mountains of western Washington and the mountains of northern Idaho. Many other plants of boreal dispersion have a similar distribution. Doubtless a continuous range once existed to the northward, but such a continuity could hardly have survived the glacial activity which is known to have taken place in the area. This explanation presupposes a preglacial migration of *H. occidentale* from the north to the Olympic Mountains on the one hand and to the Rocky Mountains on the other. Plants from the two areas are alike in all details, hence there is no question about their belonging to the same species. *H. marginatum*, described from Colorado, and *H. uintahense*, described from Wyoming, do not differ in any significant way from *H. occidentale*. Indeed, Nelson,¹ in his citation of specimens accompanying the original description of *H. uintahense*, mentioned a Henderson specimen from the Olympic Mountains of Washington as probably belonging to the species he was describing. *H. lancifolium* Rydberg appears to be a leaf-form of *H. occidentale*. The actual type was not found at the New York

¹ Proc. Biol. Soc. Wash. 15: 156 (1902).

Botanical Garden, but specimens annotated by Rydberg and plants coming from the type-locality have proved to be narrow-leaved forms of the latter species.

There are several minor variations in *H. occidentale*, but they are mostly quantitative and are not correlated with each other or with any phytogeographical area. For example, the length of the calyx-teeth varies a millimeter or more, the size and to some extent the shape of the leaflets vary, and the total height of the plants varies with habitat and altitude. The loments are nearly always pubescent, but an occasional collection from Montana or Washington may have glabrous fruits. There is a slight difference, in some cases, as to the way in which the trichomes are disposed upon the loment. Often they are appressed, but in a number of collections the hairs are spreading and may even be slightly crooked. These variations, in so far as I am able to discern, are not of any real significance as far as classification is concerned, but might easily have resulted from the differences in habitat and climatic conditions under which the plants grew.

4. *H. gremiale*, sp. nov. (PLATE 597). Deep-rooted, perennial herb; stems numerous from a ligneous caudex, greenish, ascending, branched, densely pubescent with small simple appressed trichomes, terete, 3–6 dm. high; leaves odd-pinnate, densely appressed-pubescent; leaflets 5–13, oblong to elliptical, 1–2 cm. long, 5–10 mm. wide, often apiculate; stipules brownish, pubescent, chartaceous, very fragile, lower united, upper nearly free; inflorescence racemose, in fruit 1–1.5 dm. long; flowers numerous, erect, 1–1.5 cm. long; pedicles pubescent, 2–4 mm. long; calyx furnished with two small bracteoles, densely pubescent, calyx-teeth about equal, narrowly subulate, tipped with red, 4–5 mm. long; corolla pink to reddish-purple, drying purplish-pink; standard obovate, emarginate, 12–14 mm. long, about 1 cm. wide; wings about 1 cm. long, 3–3.5 mm. wide, auricles blunt, broad, not united, about 1 mm. long, claw broad, about 2 mm. long; keel blunt, 13–15 mm. long; loments stipitate, articles 1–5, either closely joined or with a connective of variable length, flattened, suborbicular to slightly longer than broad, prominently and loosely reticulate-nerved, rather densely appressed-pubescent, wingless, 6–8 mm. broad; nerves or costae of the articles supporting numerous spine-like or setaceous processes, these purple-tipped, 3–5 mm. long and usually with a few scattered trichomes upon them; articles one-seeded, mature seeds not seen.

Herba perennis multicaulis; caulibus erectis vel adscendentibus pubescentibus, 3–6 dm. altis; foliis imparipinnatis petiolatis; foliolis 5–13, oblongis vel ellipticis undique pubescentibus; stipulis fuscis connatis pubescentibus; inflorescentiis axillaribus racemosis; floribus erectis; calycis subcylindricis, lobis subulatis 4–5 mm. longis; corollis siccatis roseo-purpurascens 13–15 mm. longis; leguminibus articulatis stipitatis compressis; articulis suborbicularibus pubescentibus ciliatis reticulato-rugosis 6–8 mm. latis immarginatis in costis setosis vel subspinulosis.—*H. cinerascens* sensu Graham in Ann. Carn. Mus. **26**: 251 (1937) in part, non Rydberg. *H. utahense* sensu Graham, ibid. p. 252 in part, non Rydberg.—Known only from UTAH: *Uintah County*: heavy adobe soil in a narrow ravine, 14 miles west of Vernal, Uinta Basin, June 16, 1937, *Reed C. Rollins 1733* (G, TYPE, R, ISOTYPE); 18 miles north of Vernal, Uinta Basin, June, 1937, *Rollins 1757a* (G, R); bench west of the Green River, north of the mouth of Sand Wash, Uinta Basin, May, 1933, *Graham 7912* (G, US); Vernal-Manilla road north of Vernal, June 19, 1933, *Graham 8156* (US); Uinta Basin, June, 1912, *Peterson* s. n. (US).

Flowering plants of *H. gremiale* are difficult to distinguish from varieties of *H. boreale* which have both leaflet-surfaces pubescent, but with developing or mature fruits, there is no need for question as to which species one is observing. In the very young stage, fruits of *H. gremiale* do not show any signs of the very marked setae which later appear upon the flattened surfaces. As the fruit enlarges, small tubercles appear at various points along the surface reticulations. Soon these tubercles elongate into peculiar setae or spine-like processes which are sparsely covered with simple trichomes. *H. gremiale* is actually most closely related to *H. boreale* var. *cinerascens*, which it resembles in general habit. Both are pubescent throughout, though *H. gremiale* is much less densely covered with trichomes and less silvery in appearance than *H. boreale* var. *cinerascens*. A further clue to the relationship between these species is the occasional occurrence of very abbreviated tubercles on the loment of *H. boreale* var. *cinerascens*. This suggests a comparatively recent genetical connection between the two.

H. gremiale apparently occurs only locally in the Uinta Basin of northeastern Utah; however, the plants were very abundant in the two places where I observed them. The habitat is in the geologically young foothills of the Uinta Mountains, near the

bottom of the Basin. This limited distribution in a geologically young area points to a recent origin for *H. gremiale*. I should suggest *H. boreale* var. *cinerascens* or some other phase or variety of *H. boreale* as the probable ancestor.

5. *H. BOREALE* Nuttall. Herbaceous perennial, stems several to numerous from a ligneous root, terete, longitudinally grooved, pubescent, 2.5–6 dm. high, branched above; stipules brown, chartaceous, triangular with a subulate tip, lower united, upper nearly free; leaves short-petioled, 4–8 cm. long; leaflets 9–13, linear-oblong to nearly elliptical or those of the lower leaves obovate, densely pubescent on both surfaces to glabrous above, punctulate above, 3–8 mm. wide, 1–2.5 cm. long, obtuse; inflorescence racemose, elongated; bracts brown, subulate, equaling or exceeding the pedicels; flowers erect, numerous, carmine, 12–19 mm. long; calyx pubescent, teeth nearly equal, subulate, 3–5 mm. long, longer than the tube; standard obovate to broadly cuneate, emarginate, 12–17 mm. long, 7–12 mm. wide; wings 10–14 mm. long, 2.5–4 mm. wide; claw broad, 2–3 mm. long, wing-auricle blunt, free, about 1 mm. long; loment pendent to somewhat divaricate, usually stipitate; articles 2–5, orbicular to suborbicular, 5–7 mm. wide, 6–8 mm. long, appressed-pubescent, not wing-margined, flattened, rugose when mature, reticulations transversely elongated.

KEY TO THE VARIETIES OF *H. BOREALE*

- Flowers 12–16 mm. long, erect or the lower tardily reflexed; inflorescence not interrupted; leaflets 10–15 (–20) mm. long.
 Leaflets glabrous to sparsely pubescent above, articles of the loment rugose, but not deeply wrinkled, short spines never present 5a. var. *typicum*.
 Leaflets and stems silvery-canescant throughout, articles of the loment deeply wrinkled over the seed, short tubercles often present.
 Leaflets oblong to broadly linear; pubescence smooth, silvery hairs appressed, less than 1 mm. long .. 5b var. *cinerascens*.
 Leaflets obovate; pubescence shaggy, silvery hairs spreading, about 1.5 mm. long 5c. var. *obovatum*.
 Flowers 16–19 mm. long, lower reflexed; inflorescence interrupted, leaflets 15–25 (–30) mm. long 5d. var. *utahense*.

5a. *H. BOREALE* Nuttall, var. **typicum**. *H. boreale* Nutt., Gen. N. Am. Pl. **2**: 110 (1818); Journ. Acad. Sci. Philad. **7**: 19 (1834). *H. Roezlianum* Prantl, Ind. Sem. Hort. Wirceb. **8** (1873) ? *H. carnosulum* Greene, Pitt. **3**: 212 (1897); Rydb., Fl. Colo. **216** (1906); Fl. Rky. Mts. adj Plains **524** (1917). *H. Mackenzii* sensu Rydb. in Mem. N. Y. Bot. Gard. **1**: 257 (1900); Fedtsch. in Acta Hort. Petrop. **19**: 273 (1902) in part, non Richardson. *H.*

pabulare A. Nels. in Proc. Biol. Soc. Wash. **15**: 185 (1902); Rydb., Fl. Colo. **215** (1906); Fl. Rky. Mts. adj. Plains **524** (1917); Coulter and Nelson, Man. Bot. Cent. Rky. Mts. **300** (1909); Wootton and Standley in Contrib. U. S. Nat. Herb. **19**: **373** (1915); Tidestrom in Contrib. U. S. Nat. Herb. **25**: **333** (1925). *H. pabulare*, var. *rivulare* L. O. Williams in Ann. Mo. Bot. Gard. **21**: **344** (1934). *H. Mackenzii* Richards., var. *pabulare* Kearney and Peebles in Journ. Wash. Acad. Sci. **29**: **485** (1939). *H. cinerascens* sensu Tidestrom in Contrib. U. S. Nat. Herb. **25**: **333** (1925), non Rydberg. *H. utahense* sensu Graham in Ann. Carneg. Mus. **26**: **252** (1937) in part, non Rydberg.—ALBERTA to Oklahoma, Arizona and Idaho. ALBERTA: Rosedale Coulee, near Rosedale, July, 1915, *Moodie 1078* (G, NY); Rosedale Trail, near Rosedale, June, 1915, *Moodie 1020* (G); Red Deer Lakes, July, 1879, *Macoun 105* (G). NORTH DAKOTA: Donnybrook, July, 1935, *Stevens & Kluender 132* (G, US); Range 92, Township 149, Dunn Co., June, 1936, *Heidenreich* s. n. (NDA); Sanish, July, 1923, *Stevens* s. n. (NDA); Fort Buford, 1890, *Havard 2 & 3* (NY); Medora, Aug., 1923, *Stevens* s. n. (NDA); June, 1938, *Stevens & Brenkle 38-011* (G). OKLAHOMA: near Shattuck, Ellis Co., June, 1914, *Clifton 3200* (G). MONTANA: North Fork of Bear Cr., Gallatin Nat. For., Gallatin Co., *Whitham 1811* (FS); 1 mile west of Teal Lake, July, 1901, *Spragg 326* (G); Ear Mountain, Lewis and Clark Nat. For., July, 1921, *Butter D3-12* (FS); Jefferson Nat. For., Aug., 1927, *Park 65* (FS). WYOMING: Gilbert Creek, Park Co., July, 1937, *L. & R. Williams 3539* (G, NY, R); Undine Falls, Yellowstone Nat. Park, July, 1899, *A. & E. Nelson 5679* (G); along Snake River, Teton Co., July, 1932, *L. Williams 975* (G, ISOTYPE of *H. pabulare* var. *rivulare*); bars of Gros Ventre River, Teton Co., Aug., 1894, *Nelson 1087* (G); July, 1901, *Merrill & Wilcox 993* (G, NY, US); Bates Creek, Natrona Co., July, 1901, *Goodding 201* (G, US); 20 miles west of Big Piney, Sublette Co., July, 1922, *E. B. & L. B. Payson 2617* (G); 14 miles east of Evanston, Uinta Co., July, 1939, *Rollins & Muñoz 2875* (G, R). COLORADO: Canon City, Aug., 1896, *Shear 3768* (NY); June, 1917, *E. L. Johnston & Hedgecock 638* (G, NY); Trinidad, Aug., 1912, *Beckwith 91* (NY); June, 1917, *E. L. Johnston 617* (G); Trinchera Creek, about 20 miles northwest of Branson, July, 1937, *Rollins 1864* (G, R); Cimarron, Gunnison Co., June, 1901, *Baker 274* (G); mouth of Wolf Creek, White River, Rio Blanco Co., May, 1935, *Graham 9044* (G, US); Paradox, Montrose Co., June, 1912, *Walker 151* (G); Naturita, Montrose Co., May, 1914, *Payson 322* (G); Mancos, June, 1898, *Baker, Earle & Tracy 83* (G); Durango, May, 1916, *Eastwood 5311* (G). NEW MEXICO: near Cimarron, June, 1929, *Mathias 556* (G); Algodones, June, 1887,

Tracy & Evans 139 (NY); Canonicito, Santa Fe Co., June, 1897, *A. & E. Heller 3732* (G); between Gallup and Albuquerque, May, 1931, *McKelvey 2338* (G). IDAHO: Clyde, Blaine Co., July, 1916, *Macbride & Payson 3124* (G, NY, US); Warm Springs Ranger Station, Lemhi Nat. For., June, 1928, *Schulze 71* (FS). UTAH: Book Cliffs, Uinta Basin, July, 1935, *Graham 9842* (US); Soldier's Summit, 1894, *M. E. Jones 5592* (NY); Bryce Canyon, Garfield Co., July, 1938, *Rollins & Chambers 2453* (G, R); Pleasant Cr., Powell Nat. For., Garfield Co., July, 1915, *Hanks 6* (FS); Millard Co., June, 1938, *Jensen s. n.* (G); Juab, June, 1902, *Goodding 1076* (G); mesa east of Monticello, July, 1911, *Rydberg & Garrett 9203* (NY, US); Convulsion Canyon, Sevier Co., July, 1930, *Albertson 41* (FS); south of Mexican Hat, June, 1930, *Goodman & Hitchcock 1345* (G). ARIZONA: vicinity of Flagstaff, July, 1898, *MacDougal 214* (G, NDA, NY). OREGON: Hurricane Creek, Wallowa Co., July, 1897, *Sheldon 8628* (G, NY); Aug., 1898, *Cusick 2104* (G); head of North Fork of Innaha River, Wallowa Co., July, 1928, *Reid 738* (FS).

5b. Var. **cinerascens** (Rydb.),¹ comb. nov. *H. cinerascens* Rydb. in Mem. N. Y. Bot. Gard. **1**: 257 (1900); Coulter and Nelson, Man. Bot. Cent. Rky. Mts. **299** (1909); Rydb., Fl. Rky. Mts. adj. Plains **524** (1917); Fl. Pr. and Plains Cent. N. Am. **487** (1932). *H. canescens* Nuttall in T. & G., Fl. N. Am. **1**: 357 (1838), non *H. canescens* L., Sp. Pl. **2**: 748 (1873). *H. Macquenzii* f. *canescens* Fedtsch. in Acta Hort. Petrop. **19**: 274 (1902). *H. Macquenzii* v. *canescens* Fedtsch., ibid. in index p. 362.—Saskatchewan and Alberta to Wyoming. SASKATCHEWAN: Quappelle, June, 1879, *Macoun s. n.* (NY); Whiteshore Lake, Aug., 1906, *Macoun & Heriot 70786* (NY); Bare Hills, Aug., 1906, *Macoun & Heriot 70785* (G, NY); Moose Jaw, July, 1880, *Macoun s. n.* (G); without locality, 1858, *E. Bourgeau s. n.* (G, NY). ALBERTA: Cypress Hills, June, 1894, *Macoun 4532* (G); Medicine Hat, May, 1894, *Macoun 4531* (NY); Milk River Ridge, June, 1883, *Dawson s. n.* (G). WITHOUT DEFINITE LOCALITY: Lewis River, Rocky Mts., *Nuttall* (NY, ISOTYPE ?); Rocky Mts., *Nuttall* (G, ISOTYPE? possibly same as previous collection). MONTANA: Sec. 28, T. 10 N., R. 10 E., Jefferson Nat. For., June, 1925, *Bouham 25* (FS); Yellowstone River, 1878, *Havard s. n.* (G); Midvale, July, 1903, *Umbach 372* (NY, US); Lima, June, 1895, *Shear 3363* (NY, US); June 29, 1895, *Rydberg 2721* (NY);

¹ There is some question as to whether var. *canescens* Fedtschenko, though based on the illegitimate *H. canescens* Nuttall, should not take precedence over the combination I have made here, because of its possible priority in the varietal category. The fact that the combination *H. Macquenzii* v. *canescens* was dubiously made only in the index of Fedtschenko's monograph, l. c., makes it almost imperative that the legitimate valid *H. cinerascens* be taken up in order to make the nomenclature of this variety definite and clear.

Livingston, 1901, *Scheuber* 222 (NY, US); Sixteen Mile Creek, July, 1883, *Scribner* 32 (G); Spanish Creek, Gallatin Co., June, 1901, *Vogel* s. n. (G); Park County, June, 1889, *Tweedy* s. n. (NY). WYOMING: Shirley Basin, Aug., 1908, *A. Nelson* 9179 (G, NY); Red Bank, Big Horn Co., July, 1901, *Goodding* 332 (G, NY, US); Headwaters of Tongue River, Big Horn Mts., July, 1898, *Tweedy* 132 (NY); Dayton-Kane Road, Sheridan Co., June, 1932, *Dickson* 250 (FS); Lower Blackrock, Teton Nat. For., *Rosencrans* 39 (FS).

5c. Var. **obovatum**, var. nov. Herba perennis argentea pubescentia; foliolis obovatis; pilis ca. 1.5 mm. longis.—Northern NEVADA: Thorpe Creek, east of Lamoille, Elko Co., Humboldt National Forest, July 25, 1928, *Harold H. Price* 168 (FS, TYPE).

5d. Var. **utahense** (Rydberg), comb. nov. *H. utahense* Rydberg in Bull. Torr. Bot. Club **34**: 424 (1907); Fl. Rky. Mts. adj. Plains 524 (1917); Tidestrom in Contrib. U. S. Nat. Herb. **25**: 333 (1925). *H. boreale*? sensu Durand. in Journ. Acad. Nat. Sci. Philad. **11**: 162 (1859), non Nuttall. *H. Mackenzii* sensu Watson, Bot. Fortieth Parallel 78 (1871), non Richardson.—Northern UTAH: Wasatch Mts., July, 1869, *Watson* 294 (G, NY); Fort Douglas, June, 1906, *Garrett* 1798 (G); May, 1908, *Clemens* s. n. (G); vicinity of Salt Lake City, May, 1883, *Leonard* 55 (NY, TYPE); Mt. Nebo, Aug., 1922, *Harris* c22402 (G); Ogden Canyon, July, 1902, *Pammel & Blackwood* 3705 (G); Rock Canyon, near Provo, June, 1925, *Garrett* 3324 (G); Lehi, May, 1916, *W. W. Jones* 170 (G); Salina Canyon, June, 1894, *M. E. Jones* 5319g (NY); Brigham, May, 1910, *Zundel* 193 (NY); between Linder and Pleasant Grove, Utah Co., June, 1917, *Eggleston* 13870 (US); South Sink, Garden City, Cache Nat. For., July, 1927, *Craddock* 20 (FS).

H. boreale has been widely misunderstood, possibly because of Nuttall's¹ own suggestion that his plant was "*H. alpinum* ? Mich. Fl. Am. 2. p. 74." Apparently realizing his error, perhaps because he became familiar with the species of Michaux, Nuttall clarified his position by listing² one of Wyeth's specimens from the "sources of the Missouri" as "*Hedysarum boreale*, *H. Mackenzii* of Richardson, not *H. alpinum* of Michaux." Whatever led many authors, including Torrey and Gray,³ Gray,⁴ Britton and Brown⁵ and Rydberg,⁶ to apply the name *H. boreale* to one or

¹ Gen. N. Am. Pl. **2**: 110 (1818).

² Journ. Acad. Sci. Philad. **7**: 19 (1834).

³ Fl. N. Am. **1**: 356 (1838).

⁴ Man. Bot., ed. 2, 98 (1856).

⁵ Ill. Fl. **2**: 392 (1913).

⁶ Fl. Rky. Mts. adj. Plains 524 (1923).

another of the varieties of *H. alpinum* is not at present entirely clear. Several points brought out by Nuttall in his original description of *H. boreale* such as "stipules . . . subulate," "articulations of the loment . . . rugose," and "calix subulate" could hardly be applied to any of the American varieties of *H. alpinum*. Most suspicious of all, when one attempts to utilize the usual interpretation given in most floras and manuals, is Nuttall's statement of habitat "in arid and denudated soils around Fort Mandan, on the banks of the Missouri." Those familiar with the Fort Mandan region of North Dakota and the usual habitat for any of the varieties of *H. alpinum* are aware that no single species of *Hedysarum* is apt to be found in both habitats. Five collections of *Hedysarum* from North Dakota have been supplied by Dr. O. A. Stevens of the North Dakota Agricultural College for my study. All of these collections, one of which is from Dunn County in the Fort Mandan area, are the same species, *H. boreale*. In recent manuals plants comparable to these have been passing as *H. pabulare* and *H. cinerascens*, or in some instances as *H. Mackenzii*. Durand¹ long ago seems to have been on the right track as to the true identity of *H. boreale* when he noted that, "I cannot but consider *H. boreale* & *H. canescens* of Nuttall, and *H. Mackenzii* of Richardson, as forms of the same species, which it is impossible to separate."

H. boreale is one of those species with several recognizable varieties and numerous variants of less stable character. In several areas in its wide geographic range from Saskatchewan to Oklahoma and Arizona, trends of development are observable. Most prominent, perhaps, are those which have given rise to the large-flowered type found chiefly in northern Utah which Rydberg named *H. utahense* and the silvery-canescens type from northern Wyoming, Montana and adjacent southern Canada named *H. canescens* by Nuttall. Unfortunately, var. *obovatum* is not well enough known for its relationships with other varieties of *H. boreale* to be at all clear. Greene named another variant *H. carnosulum*, but the only points which are at all even measurably different from *H. boreale* var. *typicum* are the shorter stem-internodes and smaller leaves. These, it seems to me, are hardly sufficient to warrant keeping it up even in varietal rank.

¹ Journ. Acad. Sci. Philad. 11: 162 (1859).

Neither the original publication nor the type, if there be one, of *H. Roezlianum* have been available to me, but Fedtschenko¹ has reproduced Prantl's original diagnosis and notes in their entirety. The description is certainly that of a *Hedysarum* and, in my opinion, *H. boreale* or possibly one of its varieties. *H. Roezlianum* is based upon plants grown in the botanical garden of the University of Würzburg from seeds supplied by Rözl, who supposedly collected them in California. Since the genus *Hedysarum* is not known to occur in California and since Rözl is known to have traveled rather widely² in the Great Basin and Rocky Mountain regions, I think it is safe to assume that the seeds came from some locality in these areas.

6. *H. MACKENZII* Richardson. Perennial; stems several to numerous from a ligneous caudex, mostly simple above, terete, shallowly furrowed above, sparsely appressed-pubescent, 1–4 dm. high; stipules white-translucent with brown streaks, united, tips of the upper free; leaves petiolate, 4–8 cm. long; leaflets 4–6, oblong to broadly lanceolate or nearly elliptical, thick, glabrous to very sparsely pubescent and punctulate above, appressed-pubescent below, 15–25 mm. long, 4–10 mm. wide, obtuse to acute, not apiculate; inflorescence racemose, subcapitate; flowers 5–12, purple, erect but soon pendent, 18–21 mm. long; bracts subulate, pubescent, broadly scarious-margined; bracteoles linear, 2–3 mm. long; calyx villose, teeth linear-subulate, nearly equal, longer than tube, 3.5–6 mm. long; standard cuneate to broadly spatulate or nearly obovate, emarginate, 15–17 mm. long, 9–11 mm. wide; wings oblong, 14–16 mm. long, 3–4 mm. wide, claw broad, about 3 mm. long, wing-auricles blunt, rounded, free, about 1 mm. long; loment pendent to divaricately ascending, stipitate, 3–8-articled; articles nearly orbicular, not wing-margined, appressed-pubescent, 4–6 mm. wide, 5–8 mm. long, reticulations prominent, transversely elongated.—App. Franklin's Journ. 745 (1823); Hooker, Fl. Bor.-Am. 1: 155 (1834); Torrey and Gray, Fl. N. Am. 1: 357 (1838); Basiner in Mem. Acad. Sci. Petrop. 6: 58 (1846) in part; A. Nelson in Proc. Biol. Soc. Wash. 15: 184 (1902); Fedtschenko in Acta Hort. Petrop. 19: 273 (1902) in part; Henry, Fl. So. Brit. Columb. 192 (1915); Rydberg, Fl. Rky. Mts. adj. Plains 524 (1917); Fl. Pr. and Plains Cent. N. Am. 487 (1932) in part; Raup in Contrib. Arn. Arb. 6: 181 (1934); Bull. Nat. Mus. Can. 74: 148 (1935). *H. americanum Mackenzii* Britt. in Mem. Torr. Bot. Club. 5: 202 (1894). Newfoundland and Quebec; Manitoba and northwestward; also

¹ Acta Hort. Petrop. 19: 324 (1902).

² Garten- und Blumenzeit. Hamb. 422 (1874).

eastern Siberia. Without definite locality, presumably the Canadian Arctic, *Richardson* s. n. (G, ISOTYPE?). NEWFOUNDLAND: Green Gardens, Cape St. George, July, 1922, *Mackenzie & Griscom 11005 and 11053* (G). QUEBEC: Vaureal River, Anticosti Island, July, 1925, *Marie-Victorin et al. 20871* (G). MANITOBA: Churchill, Hudson Bay, July-Aug., 1910, *J. M. Macoun* (G). NORTHWEST TERRITORY: Chesterfield, Aug., 1933, *Gardner 434* (G); Bernard Harbour, Aug., 1915, *Johansen 331* (G). ALBERTA: Calgary, July, 1903, *Barber 211* (G); near Fortress Pass, July, 1927, *Ostheimer 82* (G); Ptarmigan Lakes and vicinity, July, 1906, *Brown 401* (G); Bow River Valley near Banff, June, 1906, *Brown 75* (G); head of Malique Lake, July, 1908, *Brown 1219* (G); 40-60 miles southwest of Banff, July-Aug., 1905, *Clark* s. n. (G); Mt. Temple, Laggan, July, 1907, *Butters & Holway 121* (G); between Salt Mt. and Junction Lake, June, 1928, *Raup 2802* (G). BRITISH COLUMBIA: Mt. Selwyn, July, 1932, *Raup & Abbe 3757* (G); vicinity of Hudson Hope, June, 1932, *Raup & Abbe 3603* (G); vicinity of the mouth of Wicked River, July, 1932, *Raup & Abbe 3854* (G); Burgess Trail near Field, July, 1906, *Brown 538* (G); Telegraph Creek, June, 1918, *Walker 1203* (G). YUKON TERRITORY: Herschel Island, Aug., 1934, *Dutilly 235* (G).

H. Mackenzii is a close relative of *H. boreale* Nutt. and might with some propriety be considered a variety of it, but there are some good reasons for keeping the two as separate species. *H. Mackenzii* is an arctic-alpine species which extends, interruptedly, from eastern Siberia to Newfoundland, and southward along the Rocky Mountains in western Canada. On the other hand, *H. boreale* is not a high-mountain species at all, but rather inhabits the low hills of the plains region of southern Canada and the western plains states together with the intermontane basins and lower mountain slopes of the Rocky Mountain Region. *H. Mackenzii* has fewer, larger, more brilliantly colored flowers and a more globular inflorescence than *H. boreale*, in which the flowers are a dull reddish-purple and disposed in an elongated raceme. On the whole, the two species differ considerably in habit and general aspect as well as in a number of technical characters which have been emphasized in the key. Considering the fact that *H. Mackenzii* and *H. alpinum* var. *americanum* (*H. americanum* Britt.) belong to two entirely different sections of the genus, it is almost incredible that Britton should have considered the two to belong to the same species. His combination

H. americanum Mackenzii must have been the result of a very hasty judgment.

PLATE 597. *HEDYSARUM GREMIALE* Rollins, sp. nov.: FIG. 1, ISOTYPE, $\times 1/3$, from 14 miles west of Vernal, Utah, *Rollins 1733*; FIG. 2, loment, $\times 3$; FIG. 3, upper portion of inflorescence, $\times 3$.

II. SOME SPERMATOPHYTES OF EASTERN NORTH AMERICA

M. L. FERNALD

(PLATES 598–625)

In an attempt to place the flora of the area covered by Gray's *Manual* upon a basis of greater precision it is found necessary to check the treatment of every genus and species. In the present paper notes which have accumulated during the past year are presented. In several cases nomenclatural transfers are necessitated by study of the actual types or of photographs of them purchased with aid of appropriations for research from the Department of Biology of Harvard University. The photographs of types of Linnean species have been received through the coöperation of Mr. Spencer Savage, Assistant Secretary of the Linnean Society of London, and of Dr. John Ramsbottom, Keeper of Botany at the British Museum of Natural History. For those of Lamarek, Desrousseaux and Michaux I am indebted to the always helpful Professor H. Humbert and M. R. Metman of the Muséum National d'Histoire Naturelle of Paris. To all these gentlemen I extend my grateful appreciation.

Some transfers are made from indefinite trinomials (published without clear statement of rank) or of plants originally described as subspecies. Most unfortunately, the term *subspecies*, clearly understood and correctly used by some of the most accurate of Old World systematists, has become debased and confused by a group of relatively inexperienced taxonomists (chiefly in this country) and its incorrect use is being urged by them, in the sense of the long-established term *varietas*. As correctly used the two are by no means of the same rank. The *subspecies* of the best taxonomists is a subdivision of an aggregate-species, *Gesamtart* or *species collectivus*, the subspecies often consisting of



Rollins, Reed C. 1940. "Studies in the genus *Hedysarum* in North America." *Rhodora* 42, 217–239.

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