

# THE NORTH AMERICAN SPECIES OF AQUILEGIA.

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## INTRODUCTION.

Doctor Gray once said: "Species are but judgments—judgments of variable value, and often very fallible judgments." No one who has ever studied plants in the field, in the garden, or in the herbarium will question the truth of this remark. Species are, indeed, judgments, and not only that, they are matters of convenience. It very often happens that species merge into one another almost imperceptibly, and for this reason it is often hard to decide how to classify an intermediate form. Yet the persistence of these intermediate forms furnishes no reason why the extremes should not be considered separate species. In order to speak accurately, and in order to make systematic botany of real value to science, distinctions must be critical and nice. The practice of grouping a mass of distinguishable and distinct things under a single name deserves no sympathy; but, on the other hand, the habit of giving a specific name to every slight variation is equally bad. The variability of the species is, of course, much more marked in some genera than in others. *Aquilegia* is a genus of the former class.

Different characters have different relative values for purposes of classification, and these characters differ in different genera; what would be considered specific in one group is no criterion in another. In *Aquilegia* characters which are of the utmost importance in many other genera are practically of no value. The leaflets, for instance, are extremely variable in size and shape and, except in a very general way, are of no diagnostic value. Whether the leaves are twice ternate or thrice ternate, on the other hand, seems to be a criterion of considerable value, although plants of species normally having triternate leaves may occasionally develop biternate leaves, and very occasionally those with biternate leaves may produce triternate ones. In a general way, certainly, this character is very useful. It will be in place, also, to notice in this connection that the species of the warmer, more arid regions are those having triternate leaves with rather small leaflets, while those of cool, moist regions are the ones with biternate leaves and large leaflets. Similarly, species of

arid regions are usually more pubescent than those of cool, moist habitats. Pubescence is extremely variable in the same species and except in a few cases of no moment whatever.

It is in the flower structures that the greatest and most constant differences are to be found. The relative length of the sepals, laminae, and spurs is very uniform for plants of the same species, as is also the position of the sepals, and it is on these characters that most of the present classification is based. Color is quite suggestive, although yellow forms of red flowers and white forms of blue flowers are not uncommon. Neither the stamens nor the pistils offer many differences, although the length of the style is at times a valuable character. The size of the follicles and their shape vary but little. That indefinable resultant of several characters—these mostly unimportant in themselves—described by the overworked word "aspect" is often a safe and sure guide to species, but it must necessarily be learned by each for himself, since it can not be stated except in suggestive terms. Finally, the range of a species must be regarded as a check of great importance. Plants differing by comparatively slight characters yet consistently separated in range must be considered distinct species, while plants exhibiting what seem to be no greater differences, yet having no distinct ranges, must be considered conspecific. Since hybridism is so easy and so prevalent, it is difficult to see how very closely related species could remain distinct when growing together. In this connection it must be remembered that in the western and particularly in the southwestern portions of this continent habitats vary immensely within a few miles, and that, although the ranges may seem to overlap on the map, the species commonly do not really intermingle, being separated by many hundred feet of altitude and living in very different surroundings.

The genus *Aquilegia* has for several years been of unusual interest to the author, and it is with great pleasure that, through the kindness of Prof. Aven Nelson, he has been able to bring to completion what he hopes will prove a conservative survey of the North American species. The work was done at the Rocky Mountain Herbarium under the direction of Professor Nelson, to whom the writer is greatly indebted for suggestions and constant encouragement and for making possible certain field work which has been of great advantage. To Mr. J. Francis Macbride, of the Gray Herbarium, the author wishes also to express his thanks for bibliographic assistance.

The success of any taxonomic work must depend largely upon the availability of adequate exsiccatae. In this matter the author feels himself particularly fortunate and wishes to acknowledge his indebtedness to the individuals and institutions who have so kindly lent material. He is under special obligation to the authorities of the

United States National Museum for the loan of the extensive collections of western United States and Mexican material in the National Herbarium, which, with the specimens in the Rocky Mountain Herbarium, the herbarium of the Missouri Botanical Garden, and the private collection of Mr. Marcus E. Jones, of Salt Lake City, have served as the main basis of the work. The material of the last mentioned collection was especially valuable on account of Mr. Jones's field knowledge of western Aquilegias and from the fact that his collections were made principally in regions where the particularly interesting forms occur. Other valuable collections studied were those of the Washington State College, Washington State Museum, Colorado State Agricultural College, and Nevada State Agricultural College, as well as that of Mr. George Osterhout, Windsor, Colo.

The accompanying illustrations were prepared by the author.

## CHARACTERS OF GENUS AND SECTIONS.

### AQUILEGIA L. COLUMBINE.

Stems usually several, terminating the branches of the thick caudex, erect, 10 to 120 cm. high (in *A. jonesii* almost entirely lacking); basal leaves tufted, biternate, triternate, or occasionally in some alpine species simply ternate; petioles generally long, dilated and sheathing at base; cauline leaves relatively few, diminishing in size and degree of complexity upward; involucre bracts often entire; leaflets obovate, cuneate, or suborbicular, 1 to 5 cm. long, irregularly 2 or 3-lobed, the lobes from entire to 5-cleft, usually rounded, glabrous or rarely pubescent, glaucous or glaucescent beneath; flowers nodding in the bud, erect or nodding in anthesis; sepals 5, attached to the torus by a short, narrow claw, the blades from narrowly lanceolate and acuminate to broadly oblong and obtuse; petals<sup>1</sup> composed of two parts, the *lamina*, an expanded petal-like structure alternating with the sepals, and the *spur*, a hollow prolongation of the base of the lamina bearing at its apex the nectar-secreting gland; laminae from spatulate and well developed to almost entirely obsolete; spurs short and hooked to long and straight; stamens numerous, 2.5 cm. long or less, in most cases exceeding the sepals; anthers yellow, about 1 mm. long, adnate; ovaries usually 5, surrounded by a sheath of membranous, flattened staminodia, erect, usually pubescent and glandular; styles filiform, 3 to 18 mm. long; fruits erect, follicular, the suture being on the inner side, 1 to 2 cm. long, the tips more or less spreading.

In a consideration of the internal relationships and the development of *Aquilegia* the question presents itself, what should be considered primitive and less specialized and what recent and more specialized characters. The characters we have to concern ourselves about here relate to:

1. *The stem.* The few-flowered stem of medium height with few branches is considered the most primitive stem of modern species, and the low, single-flowered stem of certain alpine species as well as the very tall, much-branched, many-flowered stems of some southern representatives are held to be derived forms.

<sup>1</sup> This name is retained for these structures for convenience only, since it seems probable that they are greatly modified nectar-secreting staminodia instead of true perianth segments. For a complete discussion of this point see Prantl, in Engl. & Prantl, *Pflanzenfam.* 3<sup>2</sup>: 49. 1888.

2. *The leaf.* The biternate leaf is regarded as representing the form from which the triternate leaves of southern species as well as the simply ternate ones of a few alpine species have been evolved.

3. *The presence or absence of indument.* When quite universally present, pubescence undoubtedly shows specialization.

4. *The petals.* Since we must consider these organs to be greatly modified staminiodia, developed from structures similar to the large petal-like organs of some species of *Isopyrum* and *Clematis* which bear at their bases a small depression in which nectar is secreted, it is evident that the large, well-developed laminae as well as the short spurs are more primitive than the short or obsolete laminae and long spurs.

5. *The posture of the flowers.* The nodding condition of the flower seems to be more primitive, for the modern species at least, than the erect position, since the flowers of otherwise more primitive plants are nodding while the flowers of otherwise more specialized forms are erect. It is also suggestive that the nodding condition is universal in the bud.

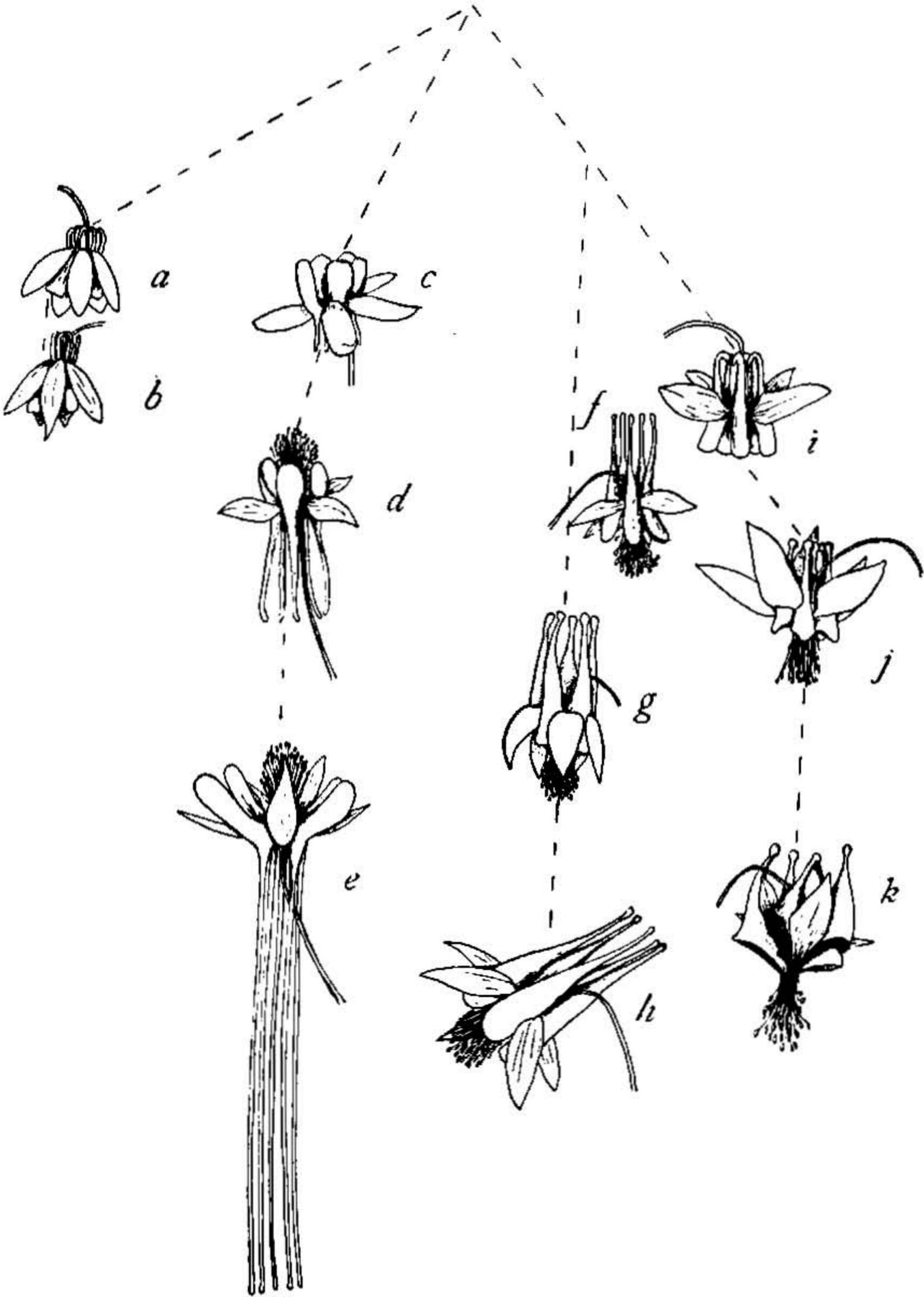
6. *The color of the flowers.* The modern species of *Aquilegia* seem to have been developed from species having blue flowers. These seem first to have given rise to white-flowered, these to yellow-flowered, and these finally to red-flowered species.

7. *The habitat.* *Aquilegia* evidently was originally a genus of cooler habitats, and an advance into warmer regions is in itself an indication of specialization, inasmuch as the less specialized forms structurally are those that live in cool regions and the more specialized structurally those that live in the more arid, hotter habitats. An advance into arctic conditions (on mountain tops) is also an evidence of specializing adaptation.

The species of *Aquilegia* group themselves into three quite distinct sections, which I have termed *Cyrtoplectrae*, *Rhodanthae*, and *Macroplectrae*. The first is characterized by biternate leaves, small, blue or white, nodding flowers, large, dilated laminae, short, usually hooked spurs, mostly included stamens, and short styles. The second by biternate or triternate leaves, larger, occasionally yellow but usually red, nodding flowers, short or nearly obsolete laminae (except in *A. flavescens*), rather long, stout, and mostly straight spurs, exserted stamens, and long styles. The third section, *Macroplectrae*, possesses biternate or triternate leaves, large, erect, blue, white, or yellow flowers, large and dilated laminae, very long, slender, straight spurs, exserted stamens, and styles of medium length.

*Cyrtoplectrae* is the section least conspicuous in America, being represented (so far as now known) by only three native species, these local at high altitudes in the Rocky Mountains from Colorado into Canada. If we are to assume that the genus had its genesis in America, as seems likely, we must consider this section to be the oldest of the three, since it alone has spread through the temperate portions of the northern hemisphere. It also contains more primitive characters than do the other sections, and so may be thought of as representing more nearly the ancestral type of *Aquilegia*.

There are in the section *Rhodanthae* two fairly distinct lines of development, one group characterized by *A. formosa* of the Pacific coast and the other by *A. canadensis* of the eastern United States and Canada. The first contains the species *formosa*, *flavescens*, *tracyi*, etc., and is characterized by the rather short spurs, the short or almost obsolete laminae, and the large, horizontally spreading or reflexed sepals which often equal or exceed the spurs in length. This group is connected somewhat with the section *Cyrtoplectrae* by the species *flavescens* which has small, yellow flowers, short and often hooked spurs, and well-developed laminae. In the second group we find the most highly developed flowers of the section in the species *A. skinneri* of Mexico. In this plant the blossoms resemble superficially those of the section *Macroplectrae* and, judging from the length of the spurs and the lighter color of the flower, are pollinated differently from those of most other species of this section, i. e., by moths instead of humming birds.



PHYLOGENETIC CHART OF NORTH AMERICAN AQUILEGIA.

The section *Macroplectrae* is confined to the Rocky Mountains of the United States and northern Mexico and contains such well-known ornamental plants as *A. caerulea* and *A. chrysantha*. In it we find an interesting mingling of what have been considered primitive as well as those thought of as modern characters. The erect flowers and the very long spurs are modern adaptations, while the large laminæ and the more primitive colors (blue, white, or yellow) are characters persisting from ancestral types. It is not difficult to see why the color has remained light, since these plants are mostly pollinated by moths. The large laminæ serve to make the flower more conspicuous, and it is for this reason undoubtedly that they have been retained. It seems that this section must be considered the most specialized and modern of the three and *A. longissima* the most highly developed of all the species of the genus.

Hybridism is of common occurrence in this genus. Wherever two species are found growing together we may expect to find hybrids, even though the species belong to different sections. Mr. M. E. Jones has noticed and collected many hybrids between *A. caerulea* and *A. flavescens* where the species were growing together at Alta, Utah. *A. caerulea alpina* may be the result of such a cross, since the locality in which it was found is in a region where the ranges of *A. caerulea* and *A. flavescens* join. Probably it is because *Aquilegiae* are so variable and hybridize so readily that no two closely related species seem ever to grow together. For this reason, also, isolation may be thought of as being the chief factor in species production in this genus.

The accompanying chart (pl. 8) represents the hypothetical course of development of the species of *Aquilegia*. The flowers are shown at about one-half natural size. It will be noticed that the succession of the figures downwards on the page represents in each group a progressive development in color and structure. At the same time the upper figures in every case are of more northern species than the lower, or else of alpine ones; that is, extension southward or to lower altitudes is coordinate with specialization in color and form.

## DESCRIPTIONS OF SPECIES WITH KEY.

### KEY TO THE SPECIES.

#### Flowers nodding.

Flowers blue or white; spurs hooked, less than 1.5 cm. long; laminæ as long as the stamens. (CYRTOPECTRAE.)

Flowers blue and white.

Stems 30 cm. tall or more.

Flowers about 2 cm. long; native species..1. *A. brevistyla*.

Flowers about 3.5 cm. long; introduced species..2. *A. vulgaris*.

Stems 8 to 15 cm. tall, glabrous.....3. *A. saximontana*.

Flowers white. Plants more or less pubescent.....4. *A. laramiensis*.

EXPLANATION OF PLATE 8.—Figs. *a* and *b*, representatives of the section *Cyrtoplectrae* in America. *a*, *Aquilegia saximontana*, flowers blue, alt. 3,000 to 3,600 meters, Colorado; *b*, *A. laramiensis*, flowers white, alt. 2,100 meters, southern Wyoming.

Figs. *c*, *d*, and *e*, representatives of the section *Macroplectrae*. *c*, *A. jonesii*, flowers blue, alpine, Montana; *d*, *A. pallens*, flowers white, alt. 1,500 meters, Colorado; *e*, *A. longissima*, flowers yellow, mountains in northern Mexico.

Figs. *f*, *g*, and *h*, representatives of the *canadensis* group of the *Rhodanthæ*; *f*, *A. lithophila*, flowers yellow, eastern Utah; *g*, *A. triternata*, flowers red, Arizona; *h*, *A. skinneri*, flowers light red and greenish, Mexico.

Figs. *i*, *j*, and *k*, representatives of the *formosa* group of the *Rhodanthæ*. *i*, *A. flavescens*, flowers yellow, higher altitudes, Montana; *j*, *A. formosa*, flowers red, low altitudes, from Oregon to Alaska; *k*, *A. tracyi*, flowers red, California.

- Flowers red or yellow; spurs nearly straight, 2 to 5 cm. long; stamens longer than laminae. (RHODANTHAE.)
- Sepals horizontally spreading or reflexed, usually equaling or exceeding the spurs.
- Flowers yellow, the sepals occasionally pink....5. *A. flavescens*.
- Flowers red or pink.
- Base of spur truncate or one side produced into a more or less distinct lamina.
- Spurs about 2 cm. long; leaves usually biternate.
- Leaves membranous; sepals light red...8. *A. wawawensis*.
- Leaves thick; sepals dark red.....6. *A. formosa*.
- Spurs about 3 cm. long, slender; leaves triternate.
7. *A. shockleyi*.
- Base of spur cut backwards, the laminae obsolete. Leaves triternate .....9. *A. tracyi*.
- Sepals slightly spreading or erect, shorter than the spurs.
- Spurs (as also the laminae) yellow; leaflets viscid...10. *A. lithophila*.
- Spurs red; leaflets various.
- Basal leaves biternate rather than triternate.
- Flowers large, the sepals about three-fourths as long as the spurs; eastern species.....11. *A. canadensis*.
- Flowers small, the sepals about one-half as long as the spurs; western species.
- Leaflets not viscid, suborbicular.
- Leaflets green above; sepals light red.
15. *A. elegantula*.
- Leaflets glaucous on both surfaces; sepals dark red.
13. *A. desertorum*.
- Leaflets viscid, narrow.....14. *A. rubicunda*.
- Basal leaves distinctly triternate. Southern species.
- Spurs about 3 cm. long; sepals red .....12. *A. triternata*.
- Spurs 4 to 5 cm. long; sepals greenish.....16. *A. skinneri*.
- Flowers erect. Spurs slender, straight, usually more than 3.5 cm. long, never red. (MACROPLECTRAE.)
- Spurs not over 8 cm. long.
- Basal leaves once or twice ternate.
- Sepals blue or white.
- Leaflets normal.
- Spurs 5 cm. long or more; leaflets not viscid...18. *A. caerulea*.
- Spurs about 3 cm. long; leaflets viscid beneath.
20. *A. pallens*.
- Leaflets thick, small, closely clustered.
- Spurs about 1 cm. long; stems scapose.....17. *A. jonesii*.
- Spurs about 4 cm. long; stems bracteate..21. *A. scopulorum*.
- Sepals yellow.
- Leaflets small, glabrous throughout. Native of southern New Mexico.....24. *A. chaplinei*.
- Leaflets medium-sized, glabrate to densely pubescent beneath. Alpine in the Sierra Nevada of California...22. *A. pubescens*.
- Basal leaves, or some of them, triternate.
- Spurs not more than 2 cm. long or wanting .....19. *A. ecalcarata*.
- Spurs 4 to 7 cm. long. Flowers yellow.
- Sepals and petals subequal.....24. *A. chaplinei*.
- Sepals exceeding the petals.....23. *A. chrysantha*.
- Spurs 10 cm. long or more.....25. *A. longissima*.

**1. *Aquilegia brevistyla* Hook. Fl. Bor. Amer. 1: 24. 1829.**

*Aquilegia vulgaris* L. err. det. Richards. Bot. App. Frankl. Journ. 740. 1823.

*Aquilegia vulgaris brevistyla* A. Gray, Amer. Journ. Sci. II. 33: 243. 1862.

Stems 40 to 80 cm. high, simple, glabrate or puberulent below, pubescent and often glandular above; basal leaves biternate, the leaflets petioluled, medium to large (17 to 40 mm. long, 27 to 52 mm. wide), pubescent and glaucous beneath, the uppermost leaves simple and entire; flower 1.5 to 2 cm. long, 2.5 to 3 cm. across, nodding; sepals blue, lanceolate, acute, slightly spreading, 13 to 16 mm. long, exceeding the laminae by 2 to 4 mm., these and the sepals exceeding the stamens; laminae yellowish white, longer than the spurs, oblong, more or less truncate at apex; spurs blue, 6 to 7 mm. long, stout and strongly hooked; styles 5 to 7 mm. long; ovaries pubescent; follicles about 2 cm. long.

TYPE LOCALITY: Western Canada.

RANGE: South Dakota and Alberta, north to the Yukon.

REFERENCES: Torr. & Gray, Fl. N. Amer. 1: 30. 1838. Robinson, Syn. Fl. 1: 43. 1895. Rydb. Contr. U. S. Nat. Herb. 3: 482. 1896. Davis, Minn. Bot. Stud. 2: 334. 1899. Britt. & Brown, Illustr. Fl. ed. 2. 2: 93. 1913.

## SPECIMENS EXAMINED.

YUKON: Five Finger Rapids, *Tarleton* 91b. Mill Flat, *Gorman* 1049.

NORTHWEST TERRITORY: Fort Good Hope, Mackenzie River, *Taylor*.

ALBERTA: Banff, *McCalla* 2107. Calgary, *Macoun* 18069.

SOUTH DAKOTA: Piedmont and Little Elk Creek, *Rydberg* 503.

*Aquilegia brevistyla* belongs to the Old World type of columbines, and has much the aspect of *A. vulgaris*. Its range, like those of *A. saximontana* and *A. laramiense*, is peculiar in that it is widely separated from those of its relatives. These species seem to have become stranded, as it were, away from their fellows. Once, perhaps, this type was common throughout North America, but, if so, it has been superseded by the two more recent groups.

**2. *Aquilegia vulgaris* L. Sp. Pl. 533. 1753.**

Stems stout, finely pubescent throughout, 30 to 70 cm. high; basal and lower cauline leaves biternate; flowers 3.5 to 5 cm. broad and about as long, nodding, blue or purple to white; sepals spreading, ovate, acute, about 2.5 cm. long; laminae as long as the spurs, equaling the head of stamens, shorter than the sepals; spurs stout, much incurved, 10 to 13 mm. long; ovaries pubescent; styles 1.3 cm. long; follicles 2.5 cm. long, densely pubescent.

It is this species that is seen most often in cultivation. The flowers in the horticultural varieties vary greatly in color and are often exceedingly double as a result of the multiplication of spurs or, in the stellate ones, of the assumption by most of the flower structures of the form of plane sepals. A native of Europe and Siberia, occasionally escaping from cultivation, especially in the Eastern States.

**3. *Aquilegia saximontana* Rydb.; Robinson, Syn. Fl. 1: 43. 1895.**

*Aquilegia vulgaris brevistyla* A. Gray, Amer. Journ. Sci. II. 33: 242. 1862, excluding synonyms.

*Aquilegia brevistyla* Hook. err. det. Coulter, Man. Rocky Mount. 10. 1885.

Smooth and glabrous throughout; stems densely tufted, scarcely exceeding the leaves, 8 to 15 cm. high; basal leaves biternate, the cauline few (mostly reduced to bracts), the similar or simply ternate leaflets small (12 to 16 mm. long), sessile, thickish, broadly cuneate or truncate at base, the lobes rounded; flowers 1.5 to 2 cm. long and about as wide, nodding; sepals blue, ovate-oblong, obtuse or acute; laminae white "or yellowish" (?), about 8 mm. long, obtuse; spurs blue, incurved or strongly hooked, about 6 mm. long; styles 3 to 4 mm. long; ovaries glabrous; follicles 5 or 6, 1 cm. long, the tips slightly spreading.

TYPE LOCALITY: Rocky Mountains of Colorado.

RANGE: Alpine or subalpine on the mountains of north central Colorado as far south as Pikes Peak.

REFERENCES: Rydb. Contr. U. S. Nat. Herb. 3: 482. 1896, a valuable article, giving figures of *A. brevistyla* and *A. saximontana*, and discussing the relationships of the species of this group. Rydb. Colo. Agr. Exp. Sta. Bull. 100: 136. 1906. A. Nels. in Coulter, New Man. Rocky Mount. 192. 1909.

SPECIMENS EXAMINED.

COLORADO: West of Cameron Pass, Larimer County, *Crandall* 1885. Flat Top, Estes Park, *Osterhout* 789. Bottomless Pit, near Pikes Peak, *Clements* 511, 528. Mountains of Estes Park, *Osterhout* 2827, 3121, *Johnston* 369. Twin Sister Mountain, Estes Park, *Cooper* 7. Argentine Pass, *Jones* 875. Foot of Grays Peak, *Shear* 4632. Near Georgetown, *Marsh*. Mount Princeton, *Sheldon* 331.

A rare species, allied to *A. laramiensis* A. Nels. and *A. brevistyla* Hook., but apparently intergrading with neither. Unique in the genus because of its total lack of pubescence.

4. *Aquilegia laramiensis* A. Nels. First Rep. Fl. Wyo. 18. 1896.

Stems many from a rather large root, 10 to 20 cm. high, more or less decumbent and diffuse, sparingly pubescent; basal and larger stem leaves biternate, the leaflets short-petioluled, broadly obovate, large (for this group), 20 to 28 mm. long, thin, glaucous and sparingly pubescent beneath, the lobes obtuse and rounded, none of the leaflets simple; flowers 1.5 to 2 cm. long and about as wide, exceeded by the leaves, nodding; sepals greenish white, lanceolate, acute, 10 to 15 mm. long, exceeding the laminae by 1 to 3 mm., slightly spreading; laminae cream-colored, oblong, obtuse, 10 to 12 mm. long; spurs white, incurved or hooked, 5 to 7 mm. long; styles about 5 mm. long; ovaries pubescent; follicles 5, 1 to 1.2 cm. long, the tips slightly spreading.

TYPE LOCALITY: Cottonwood Canyon, Albany County, Wyoming.

RANGE: Albany County, Wyoming.

REFERENCE: A. Nels. in Coulter, New Man. Rocky Mount. 191. 1909.

SPECIMENS EXAMINED.

WYOMING: Cottonwood Canyon, *Nelson* 1581 (type). Ragged Top, *Nelson* 8232. Antelope Basin, *Nelson* 7505.

An apparently distinct and most interesting species, collected by Dr. Nelson in practically but one locality in Albany County, Wyoming, where it grows in rock crevices or beneath overhanging ledges at an altitude of less than 2,100 meters. It is to be distinguished from *A. saximontana*, to which it is closely allied, by its longer, more diffuse stems, its much larger, thinner leaflets with scanty pubescence, and its white flowers and longer styles.

5. *Aquilegia flavescens* S. Wats. in King, Geol. Expl. 40th Par. 5: 10. 1871.

*Aquilegia canadensis aurea* Roehl; Regel, Gartenflora 21: 258. pl. 734. 1872.

*Aquilegia caerulea flavescens* Lawson, Proc. & Trans. Roy. Soc. Canada 2<sup>d</sup>: 76. 1885.

*Aquilegia depauperata* Jones, Contr. West. Bot. 8: 1. 1898.

*Aquilegia caerulea flavescens* Jones, Contr. West. Bot. 8: 2. 1898.

*Aquilegia canadensis flavescens* Davis, Minn. Bot. Stud. 2: 335. 1899.

*Aquilegia formosa flavescens* Frye & Rigg, Northw. Fl. 165. 1912.

Stems 30 to 60 cm. high, usually pubescent; basal leaves biternate, the leaflets rather large, glabrate or finely pubescent, glaucous beneath; flower 3 to 3.5 cm. long, 3.5 to 4 cm. across, nodding, yellow throughout; sepals occasionally tinged with red, ovate-oblong, spreading or reflexed, 20 to 25 mm. long, exceeding the laminae about 10 mm.; laminae broadly rounded, 7 to 9 mm. long; spurs stout and usually more or

less hooked at apex, 15 to 18 mm. long; styles 9 to 10 mm. long; ovaries finely pubescent; follicles 4 to 6, 1.5 to 2 cm. long, the tips usually erect.

TYPE LOCALITY: Wasatch Mountains, Utah.

RANGE: From the Canadian Rocky Mountains south through western Montana and adjacent Wyoming to northern Utah, westward to eastern Oregon and Washington.

REFERENCES: A. Gray, Amer. Journ. Sci. III. 3: 149. 1872. Baker, Gard. Chron. n. ser. 10: 20. 1878. Jones, Zool 4: 257. 1893. Robinson, Syn. Fl. 1: 43. 1895. A. Nels. in Coulter, New Man. Rocky Mount. 191. 1909. Jones, Bull. Univ. Mont. 61: 28. 1910. Tidestrom, Amer. Mid. Nat. 1: 171. 1910.

SPECIMENS EXAMINED.

CANADA: Selkirk and Rocky Mountains, British Columbia, *Shaw* 282. Selkirk and Rocky Mountains, *Peterson* 23. Selkirk Mountains, headwaters of Downie Creek, *Shaw* 1141. Vicinity of Banff, Alberta, *McCalla* 2108. Head of Smoky River, Alberta, *Hollister* 10. Lake Louise, *Macoun* 64289, *Taylor*. Sophie Mountain, British Columbia, *Macoun* 63471. Lime Dike, British Columbia, *Scheuber*. South Fork of Moose River, British Columbia, *Riley* 52.

MONTANA: Mystic Lake, *Blankinship* 5. MacDougal Peak, near Flathead Lake, *Clemens*, *Jones* 7983. Spanish Basin, Madison Range, *Flodman* 453. Lambert Valley, Mission Mountains, *Jones*. Gallatin Mountains, *Jones*. Mount Haggin, near Anaconda, *Jones*. Mineral Park, Glacier National Park, *Jones*. Avalanche Lake, Glacier National Park, *Jones*. Mount Bridger, Gallatin Valley, *Jones*. Mountains east of Tobacco Plains, *H. B. Ayres*. Near Red Lodge, *Rose* 105. Near Bozeman, *Canby* 14. Columbia Falls, *Williams* 685. Bridger Mountains, *Rydberg & Bessey* 4067. Jack Creek Canyon, *Rydberg & Bessey* 4070. Midvale, *Umbach* 189. Bracket Creek, *W. W. Jones*. Glacier Basin, *Vreeland* 1056. Lake McDonald, *Vreeland* 907.

YELLOWSTONE NATIONAL PARK: Undine Falls, *A. & E. Nelson* 5685. "North-western Wyoming," *Parry* 2. Yellowstone Falls, *Broadhead*. Near Mammoth Hot Springs, *Burglehaus* 34. Amethyst Mountain, *Knowlton*. Yellowstone Lake, *Adams*. Swan Lake Valley, *Knowlton*. Aldridge, *Scheuber*. Tower Falls, *Mearns* 3578. Electric Peak, *Mearns* 127.

WYOMING: Teton Mountains, *Merrill & Wilcox* 1064.

UTAH: City Creek Canyon, near Salt Lake City, *Clemens*; *G. Engelmann*; *Jones*. Black Mountain, Manti, *Jones*. Logan Canyon, Divide, *Mulford* 203. Alta, *Jones*. Provo Canyon, *Jones* (type of *A. depauperata* Jones). Silver Lake, American Fork Canyon, *Jones*. Marysvale, *Jones*. Deer Creek, Wasatch Mountains, *Jones* (sepals pink). Wasatch Mountains, *Watson* 36, 35. Ephraim Canyon, *Tidestrom* 321. Big Cottonwood Canyon, *Rydberg* 6739.

IDAHO: Cuddy Mountains, *Jones* 6128. Packsaddle Peak, near Lake Pend d'Oreille, *Sandberg*, *MacDougal & Heller* 840. Payette Lake, *Jones*. Seven Devil Mountains, *Jones*. Lolo Trail, *Watson* 20. Near source of Mill Creek, above Lemhi Indian Reservation, *Henderson* 4023. Slopes of Stevens Peak, *Leiberg* 1458. Bonanza, *Macbride & Payson* 3488.

WASHINGTON: Wenatchee Mountains, *Elmer* 446. Near top of Mount Baldy.

OREGON: Wallowa Mountains, *Cusick* 2450. North of Bald Knob, *Sampson & Pearson* 102.

*Aquilegia flavescens* is certainly most closely related to *A. formosa* Fisch. and may, I believe, be considered the parent of that species. The greatest development of *flavescens* occurs in the higher mountains of Montana and adjacent Wyoming and Canada. As we go westward from this region we find the species apparently merging into *formosa*; the sepals become salmon-colored or pink, the laminae shorter, and the spurs straight. This transitional area is often characterized by the lack of typical plants of either species, and in the mountains of Custer County, Idaho, the author

has seen great patches of a variety with beautiful salmon-colored flowers entirely replacing the red *formosa* and the yellow *flavescens*. Since in the centers of their ranges *formosa* and *flavescens* are amply distinct, the author is very loath to treat one plant as a subspecies of the other. It would seem best to retain each as a species, never forgetting, however, that in certain regions the two actually merge.

*AQUILEGIA FLAVESCENS* forma *MINOR* Tidestrom, Amer. Mid. Nat. 1: 171. 1910.

"Subalpine, smaller and more hairy. Wasatch Plateau." (Tidestrom.)

6. *Aquilegia formosa* Fisch.; DC. Prodr. 1: 50. 1824.

*Aquilegia canadensis* Hook. Fl. Bor. Amer. 1: 24 (in part). 1829.

*Aquilegia arctica* Loud. Hort. Brit. 610. 1830.

*Aquilegia canadensis* L. err. det. Bong. Mém. Acad. St. Pétersb. VI. Math. Phys. Nat. 2: 124. 1832.

*Aquilegia canadensis formosa* S. Wats. in King, Geol. Expl. 40th Par. 5: 10. 1871.

*Aquilegia columbiana* Rydb. Bull. Torrey Club 29: 145. 1902.

Stems 35 to 90 cm. high, usually glabrous below, more or less pubescent and viscid in the inflorescence; lower leaves biternate, the upper ones simple or 3-cleft, the petioles and lower surfaces of the typically large leaflets frequently pubescent; flowers 3.5 to 4 cm. long, 5 to 5.5 cm. across, nodding; sepals red, ovate-lanceolate, acute, widely spreading or reflexed, 21 to 26 mm. long; laminae yellow, rounded or truncate at apex, 2 to 5 mm. long; spurs red, stout, straight, slightly shorter than sepals; styles 10 to 13 mm. long; ovaries pubescent; follicles mostly 5, 2 to 2.5 cm. long.

TYPE LOCALITY: Kamchatka.

RANGE: Nevada and northern California, eastward to Utah and northward into Alaska; also in eastern Siberia.

REFERENCES: S. Wats. in King, Geol. Expl. 40th Par. 5: 10. 1871. Jones, Contr. West. Bot. 5: 259. 1893. Robinson, Syn. Fl. 1: 44. 1895. Davis, Minn. Bot. Stud. 2: 340. 1899. Tidestrom, Amer. Mid. Nat. 1: 169. 1910. Jepson, Fl. Calif. 518. 1914.

SPECIMENS EXAMINED (localities only).

ALASKA: Taku Inlet; Wrangell; Juneau; Windham Bay; Disenchantment Bay; Sitka; Short Bay; headwaters of Chilkat River; Blue Lake, Sitka; Cleveland Peninsula; Howkan; Haenke Island, Disenchantment Bay.

CANADA: Vancouver Island; Queen Charlottes Island, British Columbia; Selkirk and Rocky Mountains, Asulkan Valley, British Columbia; head of Smoky River, Alberta; Moresby Island, British Columbia.

WASHINGTON: Wilbur; Ellensburg, Okanogan County; Loomiston; near Wenatchee; Silverton; Mount Rainier Forest Reserve; Blue Mountains; Walla Walla County; Cascade Mountains; Yakima Region; Grand Coulee; Douglas County; Egbert Springs; Ellensburg; Olympic Mountains; Falcon Valley; Horseshoe Basin; near Egbert Spring; Douglas County; mountains near upper valley of the Nesqually; Montesano, Chehalis County; Mount Stewart.

OREGON: Portland; Jackson County; Elk Mountain, Wallowa County; Mount Hood; Steins Mountain; Crater Lake; Crook County; The Dalles; near Wimer, Jackson County; Quinn Meadows, Lane County; Buck Lake, Klamath County; Azaba Creek; Wallowa National Forest; Imnaha National Forest; near Wallowa.

IDAHO: Boise; Silver City; Trinity Lake Region; Twilight Gulch; Martin, Blaine County; 4 miles south of Ketchum; Pettit Lake Inlet; between St. Joe and Clearwater River (form near *flavescens*); Big Butte Station.

CALIFORNIA: Near Truckee; Crystal Springs Lake, San Mateo County; Tassajara Hot Springs, Monterey County; below Genesee, Plumas County; Goosenest, Siskiyou County; Pit River Ferry, Shasta County; Sopago, Eldorado County; Round Valley, Mendocino County; Mount Hood, Sonoma County; Stevens Creek Canyon, Santa Clara County; Modoc County; Mount Breckinridge, Kern County; Emigrant Gap.

NEVADA: Centerville; near Blaine post office, Elko County; Hunter Creek Canyon, Washoe County; Kings Canyon, Ormsby County; Little Lakes Canyon, Elko County; Calientes; Ely; vicinity of Reno; west of Franktown; Star Canyon, southeast of Deeth; Unionville; East Humbolt Mountains; Hawthorne, Big Indian Canyon; Star Peak; Cumberland; Lake Tahoe.

UTAH: Mount Ibapah; Hillman Ranch, Juab County; Aquil Mountains; "southern Utah."

*Aquilegia formosa* is the representative of the Rhodanthæ most widely distributed in the northwestern part of North America. In the northern part of its range it is a quite uniform and homogeneous species, but in the southern and more arid regions of California, Nevada, and Utah it breaks up into an endless number of forms and subspecies. Some of these forms have been thought sufficiently peculiar to deserve specific names, such as *A. tracyi*, *A. shockleyi*, and *A. wawawensis*. Other plants, differing from *formosa* in several ways, but showing more points of intergradation with that species, have been treated as subspecies. *Aquilegia columbiana* Rydb. has been reduced to *A. formosa* rather than the subspecies *truncata*, which it in fact most closely resembles. This was done because it was not believed to be genetically related to the subspecies *truncata*. It is a rather similar form which has arisen separately. Unlike *truncata* it does not become the dominant form in any region, but is found with typical *formosa*.

The present species is a plant of a lower altitude than *A. flavescens*. In the few regions where the two grow near together the typical *A. flavescens* will be found on the higher areas and *A. formosa* in the river bottoms. This was noticed by the author in Custer County, Idaho. There, near the town of Challis, at an altitude of 1,620 meters, was found nearly typical *formosa*, while on the slopes of Parker Mountain, about 25 miles away and at an altitude of 2,400 to 2,700 meters, was found nearly typical *flavescens*. Intermediate forms were met along Challis Creek between these altitudes.

The following key will aid in separating the type and the subspecies:

Leaves biternate.

Laminæ over 1 mm. long.

Plants tall and branching.....6. *A. formosa*.

Plants subcaulescent and tufted.....6b. *A. formosa pauciflora*.

Laminæ less than 1 mm. long. Plant of California..6a. *A. formosa truncata*.

Leaves triternate.

Leaflets narrow; spurs thick.....6c. *A. formosa dissecta*.

Leaflets suborbicular; spurs slender.....6d. *A. formosa caelifax*.

6a. *Aquilegia formosa truncata* (Fisch. & Mey.) Jones, Zoe 4: 259. 1893.

*Aquilegia truncata* Fisch. & Mey. Ind. Sem. Hort. Petrop. 9: Suppl. 8. 1843.

*Aquilegia californica* Lindl. Gard. Chron. 1854: 836. 1854.

*Aquilegia eximia* Van Houtte; Planch. Fl. Serr. Jard. II. 2: 15. 1857.

*Aquilegia canadensis formosa* Torr.; S. Wats. in King, Geol. Expl. 40th Par. 5: 10. 1871.

*Aquilegia hypolasia* Greene, Leaflets 2: 141. 1911.

*Aquilegia adiantoides* Greene, Leaflets 2: 142. 1911.

Although long kept as a distinct species, this subspecies seems to differ from *A. formosa* only by the very short laminæ (1 mm. long or less). While replacing the species in southern California it is also found with it throughout the southern part of its range. Everywhere occur many intermediate forms that make determination difficult.

TYPE LOCALITY: Fort Ross.

REFERENCES: Robinson, Syn. Fl. 1: 44. 1895. Merritt, Erythea 4: 102. 1896. Jepson, Fl. Calif. 517. 1914.

## SPECIMENS EXAMINED (localities only).

CALIFORNIA: Butte County; Pacific Grove; San Bernardino Mountains; San Bernardino County; San Antonio Mountains; Santa Clara County; San Jacinto Mountains; San Diego; "on San Carlos"; Mount Shasta; Bodega Bay, Sonoma County; Yosemite; Redding; San Antonio Canyon near Claremont; near Pit River Ferry, Shasta County; Colby, Butte County; Sopago, Eldorado County; Chico Meadows, Butte County; Crystal Springs, San Mateo County; Big Meadows, Lassen County; Webber Lake; Los Gatos, Santa Clara County; Los Angeles; San Mateo County; Monterey; Inyo Mountains, Inyo County; valley of Kaweah River, Sierra Nevada; Santa Lucia Mountains; Green Horn Mountains; Kern County; Emigrant Gap; Silver Creek; Bolinas Ridge, Marin County; Mount Hamilton; southeast of Monte Diablo; Sherwood Valley; Obsolescent Valley, San Francisco Valley; Humboldt County; Half Moon Lake; Swartout Canyon, San Gabriel Mountains; San Bruno Mountains, San Mateo County.

OREGON: Willamette Hills; near Ashland, Jackson County.

IDAHO: Florida Mountain.

NEVADA: Galena Creek, Washoe County.

**6b. *Aquilegia formosa pauciflora* (Greene).**

*Aquilegia pauciflora* Greene, Leaflets 1: 76. 1904.

*Aquilegia truncata pauciflora* Jepson, Fl. Calif. 517. 1914.

A subcaulescent plant and more compact than the species; leaves mostly basal and tufted; flowers few; blade of petal distinct but short.

TYPE LOCALITY: Hacketts Meadows, Tulare County, California.

RANGE: "High montane in the Sierra Nevada, observed in its extreme form at Conness Creek and elsewhere in the Yosemite Park" (Jepson).

**6c. *Aquilegia formosa dissecta* subsp. nov.**

Stems 60 to 80 cm. high, glabrous, branching and many-flowered; basal leaves on long petioles, distinctly triternate; leaflets narrow, deeply cleft, glabrous; flowers pale red or yellow; sepals spreading; laminae 6 to 7 mm. long; spurs rather stout, straight, exceeding the sepals.

Type in the U. S. National Herbarium, no. 855674, collected at Mile 16, Meadow Valley Wash, Nevada, April 28, 1904, by M. E. Jones.

RANGE: Known only from the type locality.

**6d. *Aquilegia formosa caelifax* subsp. nov.**

PLATE 9.

Stems 50 to 70 cm. high, puberulent and somewhat viscid, the upper portions quite naked; basal leaves triternate; leaflets small, in type almost suborbicular, puberulent on both surfaces, glutinous beneath; flowers about 4 cm. long, 3 cm. across; sepals with a slender claw about 3 mm. long, broadly elliptic, obtuse or acute, bright red, reflexed, shorter than the spurs; laminae yellow, about 4 mm. long, truncate at apex; spurs red, extremely slender for about 10 mm. from apex, about 2 cm. long, the knob of nectary large; stamens long-exserted, about 1.7 cm. long; ovaries densely pubescent; follicles about 2 cm. long.

Type in the herbarium of M. E. Jones, collected at Panaca, Nevada, September 5, 1912, by M. E. Jones. Mr. Jones's specimen from Comet Peak, Pioche, August 30, 1912, and Heller's no. 11040 from Lee Canyon, Charleston Mountains, though not exactly similar to the type, are referred here. The name is given because of a fancied resemblance to a shooting star.

EXPLANATION OF PLATE 9.—*Aquilegia formosa caelifax* Payson. From the type specimen. About one-half natural size.

**7. *Aquilegia shockleyi* Eastw. Bull. Torrey Club 32: 193. 1905.**

Stems branching, glabrous on the lower part, viscid-pubescent on the upper, clothed at base with the persistent bleached remains of the leaves, about 40 cm. high; basal leaves triternate, varying in length from much shorter than the stem, scarcely reaching the lowest branches, to 50 cm. high with long, stout petioles; leaflets pale green, glabrous, but under the lens densely covered with shining yellow glands, cuneate in outline, 3-lobed with cuneate, deeply crenate lobes, the middle leaflet broad, petioluled, the lateral generally unequal-sided, often sessile; cauline leaves with short sheathing petioles, less compound, the upper ones 3-cleft, with narrowly linear, acute divisions; bracts simple, linear-acuminate; sepals lanceolate, obtuse, somewhat undulate, especially toward the short curved claw; blade 17 mm. long, 6 mm. broad; claw somewhat more than 2 mm. long; laminæ truncate or rounded at apex, 5 to 6 mm. long, 4 mm. wide; spurs about 3 cm. long, attenuate for 6 mm. about the globular honey gland, then gradually dilating to the throat; ovaries pubescent; follicles spreading but little; seeds reddish brown.

Known only from the type collection, *Shockley* 504, from Soda Spring Canyon, Esmeralda County, western Nevada.

*Aquilegia shockleyi* is rather doubtfully distinct specifically from *A. formosa*. It is another of those perplexing forms into which *A. formosa* is seen to merge. Its characteristic peculiarities are the long spurs and the triternate leaves.

**8. *Aquilegia wawawensis* sp. nov.**

PLATE 10.

Stems erect, slender, glabrous or puberulent, about 40 cm. high; basal leaves on slender, rather weak petioles 15 to 20 cm. long, biternate or triternate; petiolules filiform, puberulent, rather short; leaflets small, very thin, glabrous, glaucous beneath, 3-lobed, each lobe rather sharply incised; cauline leaves few, similar; bracts of 1 to 3 incised leaflets clothing the upper portions of the stem; flowers on short, slender pedicels, 3 to 3.5 cm. long and about as wide, nodding; sepals pale red, ovate-elliptic, obtuse, reflexed, about 2 cm. long; laminæ yellow, rounded, about 3 mm. long; spurs pale red, very slender, straight or slightly hooked at apex, about 2 cm. long, the nectary small; styles 10 mm. long; ovaries puberulent.

Type in the U. S. National Herbarium, no. 763898, collected at Wawawai, Washington, on the south bank of the Snake River, "in dripping water," May 26, 1906, by Rex Hunt (no. 203).

*Aquilegia wawawensis* is similar in many ways to *A. formosa*, and though no doubt an offshoot from that species, is apparently deserving of specific rank. It is of unusual appearance because of the almost membranous texture of the leaflets, the peculiar bracts which clothe the upper parts of the stem, and the small, pale red flowers with very slender spurs.

EXPLANATION OF PLATE 10.—*Aquilegia wawawensis* Payson. From the type specimen. About one-half natural size.

**9. *Aquilegia tracyi* Jepson, Fl. West. Mid. Calif. ed. 2. 165. 1911.**

PLATE 11.

Puberulent and viscid throughout; stems 50 to 100 cm. high; basal leaves triternate; leaflets variable in shape, rather large, glabrous beneath, the lobes often acute or pointed; flowers 4 to 6 cm. long, 3.5 to 4.5 cm. across, nodding; sepals red, reflexed, acute, 20 to 25 mm. long; laminæ obsolete; spurs red, stout, spreading, 2.5 to 3.5 cm. long, the throat very broad, its orifice cut backward obliquely and not horizontally, abruptly contracted near apex; styles 13 to 18 mm. long; ovaries pubescent; follicles about 2 mm. long, the tips spreading.

TYPE LOCALITY: Flat Creek, Howell Mountain, California.

RANGE: North coast ranges of California from Marin to Napa and Mendocino counties.

REFERENCE: Jepson, Fl. Calif. 518. 1914.

## SPECIMENS EXAMINED.

CALIFORNIA: Near Hullville, on the ridge between Eel River and Rice Creek, Lake County, *Heller* 6014. Crystal Springs Lake, San Mateo County, *Elmer* 4952, 4271. San Anselmo Canyon, Marin County, *Eastwood*. On San Carlos, *Brewer* 773. "Southeast California," *Palmer*.

This Californian species of peculiar aspect is related most closely to *A. formosa truncata*, but seems to be quite distinct. It is very different in appearance from any other American *Aquilegia*, and when once seen it is not to be confused with the closely related species. The broad orifices of the spurs with the obsolete laminæ, the long stamens and styles, and the distinctly triternate leaves are its most distinctive peculiarities.

EXPLANATION OF PLATE 11.—*Aquilegia tracyi* Jepson. From the specimen collected by Miss Alice Eastwood in San Anselmo Canyon. One-half natural size.

10. *Aquilegia lithophila* sp. nov.

Stems tufted, more or less irregularly ribbed, decidedly viscid throughout, 30 to 40 cm. high; leaves biternate, the petioles and petiolules viscid-pubescent; lateral leaflets sessile or short-petioluled, the terminal ones on slender petiolules about 1.5 cm. long, rather broad (in type specimen suborbicular, 3 to 4 cm. across), more or less finely pubescent and viscid, especially beneath, scarcely glaucous, the lobes rounded; flowers nodding, 4 to 4.5 cm. long, about 3 cm. across; sepals yellow or tinged with red, 1.5 to 2 cm. long, spreading; laminæ as well as the spurs bright yellow, less than 10 mm. long, rounded; spurs nearly 3 cm. long, gradually tapering from a broad base to a slender apex; ovaries pubescent; styles about 10 mm. long.

Type in the U. S. National Herbarium, no. 718898, collected in the canyon of the Dolores River above Mesa Creek, western Colorado, altitude about 1,500 meters, June 11, 1914, by E. B. Payson (no. 406).

An additional specimen seen is *Jones* 5298i, from near the head of Pahria Canyon, Utah.

An interesting and little known plant, collected, apparently, only in these two localities. The type grew from the crevices of a ledge in the bottom of a small side canyon over which trickled a tiny stream and from between whose strata the water was oozing. To see the plants in such a place, surrounded by huge sandstone cliffs, rocky, sun-baked hills, and a scattering forest of junipers, was a striking novelty to one accustomed to associating plants of this genus with the verdant meadows and cool groves of the higher mountain regions.

The sand is still clinging to the under side of the leaflets in the herbarium specimens, giving evidence of a peculiarity shared by two other species of this region found in similar habitats, namely, *A. ecalcarata* and *A. pallens*.

11. *Aquilegia canadensis* L. Sp. Pl. 533. 1753.

*Aquilegia variegata* Moench, Meth. Pl. 311. 1794.

*Aquilegia elegans* Salisb. Prodr. Stirp. 374. 1796.

*Aquilegia coccinea* Small, Bull. N. Y. Bot. Gard. 1: 280. 1899.

*Aquilegia australis* Small, Bull. Torrey Club 25: 466. 1899.

*Aquilegia latiuscula* Greene, Repert. Nov. Sp. Fedde 13: 320. 1914.

*Aquilegia eminens* Greene, Repert. Nov. Sp. Fedde 13: 321. 1914.

Stems 30 to 70 cm. high, frequently pubescent throughout; basal leaves biternate, usually rather large, glaucous and often pubescent beneath; flowers 3 to 4 cm. long, 2 to 3 cm. across, nodding; sepals red, lanceolate, usually acute or acuminate, slightly spreading, 15 to 20 mm. long, exceeding the laminæ 5 to 9 mm; laminæ yellow, rounded and more or less truncate at apex, the spurs red, straight, rather stout, about 20 mm. long, their tips often connivent; styles 12 to 15 mm. long; follicles usually 5, 2 to 2.5 cm. long, the tips spreading.

TYPE LOCALITY: "Habitat in Virginia, Canada."

**RANGE:** In rocky woods of Canada from Nova Scotia to the Northwest Territory, and throughout most of the eastern part of the United States nearly to the base of the Rocky Mountains.

**REFERENCES:** Jones, *Zoe* 4: 258. 1893. Robinson, *Syn. Fl.* 1: 44. 1895. J. Schneck, *Bot. Gaz.* 32: 304. 1901. Davis, *Minn. Bot. Stud.* 2: 335. 1899. Small, *Fl. Southeast. U. S.* 433. 1903. Robins. & Fern. in A. Gray, *New Man. Bot.* 405. 1908. Britt. & Brown, *Illustr. Fl. ed. 2.* 2: 92. 1913.

SPECIMENS EXAMINED (localities only).

CANADA: Kingston, Ontario; Algonquin Park, Ontario.

MAINE: Orono; Veazie.

NEW HAMPSHIRE: Hanover.

VERMONT: Smugglers Notch; Barnett.

MASSACHUSETTS: Weston; Shakes Glen; Fairmouth; Melrose.

CONNECTICUT: New Haven.

NEW YORK: Ithaca.

PENNSYLVANIA: Mount Ville; Glen Mills; Lancaster; Little Conestoga; Germantown; Allegheny River, Clarion County; Athens; Sayre; Locust Ridge; Pocono Plateau.

DISTRICT OF COLUMBIA: National Zoological Park.

VIRGINIA: Blue Ridge near Luray; Johnson County; Staunton.

NORTH CAROLINA: Tryon; side of Tryon Mountains, Polk County.

OHIO: Oxford; Benton; Canton; Hinckley, Medina County.

KENTUCKY: Bowling Green.

TENNESSEE: Knoxville.

MICHIGAN: Benton Harbor.

INDIANA: Notre Dame; Brookville, Franklin County; Great Falls.

ILLINOIS: Beach; St. Clair County; Bluff Lake; Proviso; Augusta; Peoria.

WISCONSIN: Ephraim.

MINNESOTA: Winona; Minneapolis; Mallory; Hennepin County.

NORTH DAKOTA: Fargo; Turtle Mountains, Rolette County.

SOUTH DAKOTA: Vermilion; Rockerville; Oakswood; Warrens Woods, Brookings County.

NEBRASKA: South Bend; Longpine; Gage.

KANSAS: Riley County; near Manhattan.

MISSOURI: Courtney; Monteer; Pulaski County; Cass County; Scott County; Jefferson County; Webb City; Allenton; Kennswick; Jerome; Victoria.

ARKANSAS: Corning, Benton County.

TEXAS: Temple.

A variable but on the whole quite homogeneous species, with the widest range of all North American Aquilegias. Segregates have been proposed, but they do not seem to represent constant differences, nor do they occur in restricted localities.

The variety *flaviflora* (Tenney) Britton<sup>1</sup> is only a yellow form of the species. Such forms are to be expected in all the red species. The variety *phippinii* J. Robinson<sup>2</sup> is a salmon-colored form found near Salem, Massachusetts.

12. *Aquilegia triternata* sp. nov.

Stems many from a thick, branched caudex, slender, usually densely pubescent throughout, 30 to 60 cm. high; basal leaves long-petioled, very markedly triternate, the leaflets borne on filiform pubescent petiolules 2 to over 10 mm. in length; leaflets small (13 to 18 mm. long), cuneate or even truncate at base, the lobes rounded or obtusely pointed, pubescent or glabrous above, usually densely white-pubescent beneath but not at all viscid; flowers about 4 cm. long, 2.5 to 3 cm. broad, nodding; sepals broadly ovate-lanceolate, acute, about 20 mm. long, light red, slightly spreading, exceeding the laminae 6 to 7 mm.; petals yellowish or pale red, about 7 mm. long,

<sup>1</sup> Bull. Torrey Club 15: 97. 1888.

<sup>2</sup> Bull. Torrey Club 15: 166. 1888.

rounded or truncate at apex; spurs light red, stout, 22 to 24 mm. long, contracted rather abruptly 6 or 7 mm. from apex, the knob of nectar gland large, the tips often more or less incurved; styles about 12 mm. long; ovaries viscid-pubescent.

Type in the U. S. National Herbarium, no. 718899, collected in moist places in Outlaw Canyon, Chiricahua Mountains, southern Arizona, July 30, 1907, by L. N. Goodding (no. 2325).

RANGE: At lower elevations in southern Arizona and western New Mexico, north into western Colorado. .

SPECIMENS EXAMINED.

ARIZONA: Between Barfoot and Idas peaks, Chiricahua Mountains, *Blumer* 1475. Asplenium Canyon, Mule Mountains, *Goodding* 998. Barfoot Peak, Chiricahua Mountains, *Blumer* 1441. Manning Camp, Rincon Mountains, *Blumer* 3591. Sitgreaves Camp, White River, *Goodding*. Near Flagstaff, *Leiberg* 5858, *MacDougal* 134 (?).

NEW MEXICO: Bear Mountain, near Silver City, *Metcalfe* 162. Balsam Park, Sandia Mountains, *Ellis* 47. Sandia Mountains, *Wooton*.

COLORADO: Glenwood Springs, *Osterhout* 1951.

This seems to be one of the most distinct species of the *canadensis* group of the *Rhodantheae*. Strangely enough, the less well marked forms have been the first to be characterized, and although this species has been collected from time to time, it has always been placed under other names. The extreme differentiation of *A. triternata* occurs in southern Arizona. This species is chiefly characterized by its extremely triternate leaves, its large, light red flowers, resembling those of *A. canadensis* in form, its stout, abruptly contracted spurs, and its copious pubescence. This last character is well marked and quite constant in appearance in the specimens from southern Arizona, but is often almost entirely lacking in plants from New Mexico and western Colorado. The species may be found to merge into *canadensis* in New Mexico.

13. *Aquilegia desertorum* (Jones) Cockerell, *Muhlenbergia* 1: 27. 1901.

*Aquilegia formosa desertorum* Jones, *Contr. West. Bot.* 8: 2. 1898.

Stems slender, glandular-hairy above, about 30 cm. high; basal leaves biternate, rarely over one-third as long as the stems; leaflets small, rather thick, pubescent, glaucous on both surfaces; cauline leaves several; bracts once or twice ternate; flowers nodding, 3.5 to 4 cm. long, 1.5 to 2 cm. across; sepals dark red, elliptic-lanceolate, about 1 cm. long, spreading, exceeding blade of petals about 3 mm.; laminae yellow, rounded, about 5 mm. long; spurs light red, straight, slender, 22 to 25 mm. long; ovaries pubescent; styles about 10 mm. long; follicles 1.5 to 2 cm. long, the tips widely spreading.

Known only from the type specimen, *Jones*, August 29, 1884, Flagstaff, Arizona, and from *MacDougal* 327, Walnut Canyon, same vicinity.

Grows in rock crevices near springs. A close relative of *A. elegantula*, but distinguished from it by the smaller leaflets which are glaucous on both surfaces, the presence of true cauline leaves in addition to the bracts, and the dark red, spreading sepals. Professor Cockerell says, in comparing this species and *A. elegantula*, that "*A. elegantula* is properly a forest loving species of higher altitudes, essentially a mesophytic plant. *A. desertorum*, as its name indicates, is xerophytic, living on rocky slopes in the transition zone, and is remarkable for its enormous root and long life \* \* \* the plant comes into flower long before the other Rocky Mountain species \* \* \*."

Professor Cockerell has published<sup>1</sup> a hybrid between *desertorum* and *chrysantha*. In color of flowers and time of flowering the hybrid is intermediate between the two parents, but Professor Cockerell says that "the form of the flowers departs from both parents in the direction of the *A. vulgaris* group."

<sup>1</sup> *Bot. Gaz.* 62: 413. 1916.

**14. *Aquilegia rubicunda* Tidestrom, Amer. Mid. Nat. 1: 168. 1910.**

More or less viscid-puberulent throughout, the stems few from a branched caudex, the crowns densely clothed with the petiole bases of old leaves; basal leaves mostly biternate though often approaching the triternate condition; leaflets rather small, narrow, mostly cuneate at base, the lobes rounded; stem leaves wanting; flowers about 3 cm. long, scarcely 2 cm. across, nodding; sepals oval, acute, pinkish, 1 cm. long or more, exceeding the laminæ by 6 or 7 mm.; laminæ light yellow, slightly spatulate, 5 mm. long or more; spurs pale red, slender, mostly less than 2 cm. long; stamens twice as long as the petals; ovaries glabrous.

Known only from the type specimen, collected by Mr. I. Tidestrom along "Link Trail," near Emery, Manti National Forest, Utah.

Other collections are necessary to establish this species with certainty, but on the whole its characters seem fairly good. It is closely related to *A. elegantula* and if reduced to subspecific rank should be placed under that species. It differs from *elegantula* in the viscid character of the pubescence, the somewhat more dissected leaves, the narrow segments of the leaflets, and the lighter colored flowers with longer sepals and more slender spurs.

**15. *Aquilegia elegantula* Greene, Pittonia 4: 14. 1899.**

PLATE 12.

*Aquilegia canadensis* L. err. det. Coulter, Man. Rocky Mount. 10. 1885.

Stems slender, usually not more than 30 cm. high, mostly glabrous; basal leaves biternate, the stem leaves few, the leaflets small, glabrous, glaucous beneath; flowers 3 to 3.5 cm. long, 1.2 to 1.8 cm. across, nodding; sepals entirely red or with yellowish or greenish tips, ovate-oblong, erect, 10 mm. long, exceeding the laminæ by only 1 to 3 mm.; laminæ yellow, about 8 mm. long; spurs scarlet, straight, somewhat inflated above and abruptly narrowed about 5 mm. from the apex, 20 mm. long; styles 12 to 15 mm. long; ovaries pubescent; follicles 5, 1.5 to 1.8 cm. long, the tips erect or spreading.

TYPE LOCALITY: Near Mancos, Colorado.

RANGE: In the mountains of southwestern Colorado, adjacent Utah, northern New Mexico, and probably Arizona, at elevations between 2,250 and 3,300 meters.

REFERENCES: Davis, Minn. Bot. Stud. 2: 334. 1899. Rydb. Colo. Agr. Exp. Sta. Bull. 100: 136. 1906. A. Nels. in Coulter, New Man. Rocky Mount. 191. 1909. Woot. & Standl. Contr. U. S. Nat. Herb. 19: 248. 1915.

## SPECIMENS EXAMINED.

COLORADO: Slide Rock Canyon near Mancos, *Baker, Earle & Tracy* 237 (type collection). Silverton, San Juan County, *Crandall* 609. Minturn, Eagle County, *Osterhout* 2563. Black Canyon of the Gunnison River, *Payson* 13. Tabeguache Basin, Montrose County, *Payson* 472. Near Cimarron, *Baker* 211. Sapinero, Gunnison County, *Wheeler* 560. Telluride, *Jones*. La Plata Mountains, *Tweedy* 503. Dry Creek, Uncompahgre National Forest, *Tidestrom* 1542. Vicinity of Mount Carbon, Gunnison County, *Eggleston* 5687. Ouray, *Shear* 4918. Head of Vallecito, *Knowlton* 51.

UTAH: Sierra La Sal, *Purpus* 6570. West Indian Creek, *Rydberg & Vreeland* 6207.

Dark Canyon, San Juan County, *Walker* 260. La Sal Mountains, *Jones*.

NEW MEXICO: *Fendler*. Hematite, *Berg*. Sacramento Mountains, Otero County, *Wooton*. Beulah, *Cockerell* 89. Winsor Creek, Pecos National Forest, *Standley* 4031. Vicinity of Cloudcroft, Otero County, *Wooton*. White Mountains, Lincoln County, *Wooton*. Eagle Creek, Lincoln County, *Wooton*. Luna, *Wooton*. Nine miles east of Santa Fe, *Heller* 3691.

This beautiful species of the Transition and Canadian zones of the southern Rocky Mountains is one of the smallest-flowered and one of the daintiest of American *Aquilegias*. Though evidently most nearly related to *A. canadensis* of the eastern hills, it is easily distinguished from that species by its smaller, more graceful habit of growth

and especially by its much more slender, more truly scarlet flowers with their short, closely appressed sepals.

EXPLANATION OF PLATE 12.—*Aquilegia elegantula* Greene. From Payson 13, Black Canyon of the Gunnison River, Colorado. One-half natural size.

16. *Aquilegia skinneri* Hook. in Curtis's Bot. Mag. 68: pl. 3919. 1842.

*Aquilegia mexicana* Hook. in Curtis's Bot. Mag. 68: pl. 3919. 1842.

*Aquilegia madrensis* Rose, Contr. U. S. Nat. Herb. 12: 265. 1909.

Stems 60 to 100 cm. high; basal leaves long-petioled, triternate, the leaflets on slender petiolules or sessile, relatively small, the lobes rounded, more or less pubescent beneath; flowers 5.5 to 7 cm. long, 3.5 to 4 cm. across, nodding; sepals greenish yellow, lanceolate, acuminate, 18 to 24 mm. long, more or less spreading, exceeding the laminae by 7 to 10 mm.; laminae yellowish, truncate or rounded, 8 to 10 mm. long; spurs pale red, straight, uniformly or abruptly tapering from base to apex, 3.5 to 5 cm. long; styles, in fruit, 18 to 20 mm. long; ovaries pubescent; follicles about 3 cm. long, the tips slightly spreading.

TYPE LOCALITY: "In the mountains of Guatemala."

RANGE: In the Sierra Madre of northern Mexico.

REFERENCES: S. Wats. Gard. & For. 1: 31. 1888. Davis, Minn. Bot. Stud. 2: 339. 1899.

#### SPECIMENS EXAMINED.

MEXICO: Sierra Madre, Chihuahua, Pringle 1182. West of Bolaños, Jalisco, Rose 2954. Guanacevi, Durango, Nelson 4762. Colonia García, Chihuahua, Townsend & Barber 78. Southwestern Chihuahua, Palmer 336. Largo Canyon, Chihuahua, Jones.

*Aquilegia skinneri* is the longest spurred as well as the southernmost known species of the section Rhodanthæ, and is of peculiar appearance because of its light greenish sepals and laminae and its pale red spurs. It has been introduced into cultivation to some extent and is a beautiful plant.

The above description was based on specimens collected in northern Mexico. These, according to Dr. J. N. Rose, should be called *A. madrensis*, which, he says, "must be distinct, judging from the descriptions and colored figure of that species" (*skinneri*). According to Dr. Rose the plants from northern Mexico differ from *A. skinneri* (as described and illustrated) in their taller stature, pubescent stems and leaves, broader sepals, different leaf segments, and paler flowers. However, it is better to retain the name *A. skinneri* for the plants of northern Mexico for the present at least, since it seems probable that the type came from Chihuahua instead of Guatemala, and that labels were mixed in England. Neither can the characters by which *A. madrensis* was separated from *A. skinneri* be considered specific in this genus.

17. *Aquilegia jonesii* Parry, Amer. Nat. 8: 211. 1874.

Densely tufted and cespitose, the stems very short or wanting; leaves tufted at apex of branches of rootstock, 3 to 6 cm. high, biternate, the primary divisions with very short, if any, partial petioles, the leaflets sessile or confluent at base, much congested, thick, pubescent on both surfaces, deeply divided into 3 or 4 entire, narrowly oblong, obtuse segments; flowers erect, solitary, borne on naked, softly pubescent scapes 3 to 8 cm. long, exceeding the leaves; sepals blue, oblong, obtuse, equaling or exceeding the spurs and twice the length of laminae and head of stamens; laminae blue; spurs gradually tapering, straightish; styles about 1 cm. long; ovaries smooth; follicles 5, 2 to 2.5 cm. long, the tips slightly spreading.

TYPE LOCALITY: Phlox Mountain, northern Wyoming.

RANGE: Alpine in the mountains of northern Wyoming, Montana, and adjacent Canada.

REFERENCES: Rose, Bot. Gaz. 15: 63. 1890. Jones, Zoe 4: 258. 1893. Robinson, Syn. Fl. 1: 43. 1895. Rydb. Contr. U. S. Nat. Herb. 3: 482. 1896. Davis, Minn. Bot. Stud. 2: 335. 1899. Rydb. Mem. N. Y. Bot. Gard. 1: 154. 1900.

## SPECIMENS EXAMINED.

CANADA: Sheep Mountain (lat. 59° 05'), *Macoun*.

MONTANA: Little Belt Mountains, *Flodman* 451. Upper Marias Pass, *Canby* 13. Yogo, Belt Mountains, *Williams* 764. Park County, *Tweedy*.

WYOMING: Northwest Wyoming, *Parry* 3. Whisky Mountain, *Cary* 31. Summit of Hunt Mountain, Big Horn Range, *Jack*.

An anomalous and very remarkable species of this section, showing some relationship to the section *Cyrtoplectrae*, to the species of which it has heretofore been thought to be related. This has resulted, no doubt, from the fact that *A. jonesii* possesses very short spurs. The large, erect flowers, the long styles, and the straight spurs show that it is really much closer to *A. caerulea* than to the *brevistyla* group. Its extremely cespitose habit, its very small leaves with their closely clustered leaflets, and its large flowers on very short scapes give this species an entirely different aspect from all other columbines, except, perhaps, *A. scopulorum*.

18. *Aquilegia caerulea* James in Long, Exped. 2: 15. 1823.

*Aquilegia macrantha* Hook. & Arn. Bot. Beechey Voy. 317. pl. 72. 1839-40.

Stems 40 to 80 cm. high, usually glabrous below, more or less viscid-pubescent in the inflorescence; leaves mostly basal, biternate, reduced upward and occasionally becoming entire in the inflorescence, the leaflets glabrous, glaucous beneath, variable in size but usually large; flowers 6 to 8 cm. long, 6 to 10 cm. across, usually erect; sepals typically a deep blue purple, ovate-oblong, acute or obtuse, spreading, 30 to 40 mm. long, exceeding the laminae about 10 mm.; laminae white, ovate-spatulate, rounded at apex; spurs usually pale blue, slender, straight or spreading, 35 to 45 mm. long; styles 7 to 9 mm. long; ovaries densely pubescent; follicles 5 to 8, 2 to 3 cm. long, the tips spreading.

TYPE LOCALITY: On the divide between the Platte and the Arkansas, Colorado.

RANGE: At higher elevations in the Rocky Mountains from northern New Mexico to Montana.

REFERENCES: Hook. in Curtis's Bot. Mag. 90: pl. 5477. 1864. Jones, Zoe 4: 256. 1893. Robinson, Syn. Fl. 1: 44. 1895. Davis, Minn. Bot. Stud. 2: 342. 1899. Rydb. Colo. Agr. Exp. Sta. Bull. 100: 136. 1906. A. Nels. in Coulter, New Man. Rocky Mount. 191. 1909. Woot. & Standl. Contr. U. S. Nat. Herb. 19: 248. 1915.

## SPECIMENS EXAMINED (localities only).

COLORADO: Larimer County; Uncompahgre Divide; Telluride; Arapahoe Peak; Tolland; Poudre River, Larimer County; North Cheyenne Canyon; Clear Creek; Mount Baldy; Mount Ouray; near Georgetown; Middle Park; Cameron Pass; Uncompahgre Canyon; Estes Park; Leadville; Berthoud Pass; Hahns Peak; Como and vicinity; Florissant; above Beaver Creek; forks of Poudre and Big Tooth Rivers; Horsetooth Gulch; Table Rock; Graymont; Rist Canyon; Manitou; Pikes Peak; near Breckenridge; Mount Hesperus; Anita Peak; Bob Creek, Montezuma County.

MONTANA: Lima.

WYOMING: Laramie Hills; Telephone Canyon; Medicine Bow Mountains.

UTAH: Geyser Canyon; Beaver Creek; Big Cottonwood Canyon; Dyer Mine, Uintah Mountains; Thousand Lake Mountain; Mount Nebo; Mount Ellen; La Sal Mountains.

NEW MEXICO: Pecos River National Forest; "northern New Mexico."

*Aquilegia caerulea* is without doubt the most showy and splendid American species of this genus. While it is found in most of the Rocky Mountain States, it was chosen as the State flower of Colorado, and in that State it reaches its finest development. There, in the Canadian zone, among the aspens, spruces, and firs, it is not uncommon to see a hillside meadow so completely covered with *A. caerulea* as to hide all other vegetation and to make it seem a fairyland of huge, dancing, blue and white stars;

nor is it a view soon to be forgotten. This species is probably the most representative one of its group and from some *caerulea*-like ancestor we may imagine the related species to have sprung.

The type and several subspecies may be distinguished by the aid of the key below. There are, besides, two forms characterized by Professor Cockerell,<sup>1</sup> both found about the "Lakes of the Clouds" in Custer County, Colorado. These are: The forma *pallidiflora*, described as with smaller, paler flowers and larger leaves than the species, and as having 5 pods; and the forma *glandulosa*, with 6 pods, the pods and peduncles pubescent and glandular-viscid.

Sepals blue.

Spurs present.

Petals yellow. Plant of northwestern Wyoming. .18c. *A. caerulea alpina*.

Petals white.....18. *A. caerulea*.

Spurs wanting.....18d. *A. caerulea daileyae*.

Sepals white.

Spurs about 7 cm. long.....18b. *A. caerulea pinetorum*.

Spurs not over 6 cm. long.....18a. *A. caerulea albiflora*.

**18a. *Aquilegia caerulea albiflora*** A. Gray; Robinson, Syn. Fl. 1: 44. 1895.

*Aquilegia leptocera* Nutt. Journ. Acad. Phila. 7: 9. 1834.

*Aquilegia caerulea ochroleuca* Hook. in Curtis's Bot. Mag. 90: pl. 5477. 1864.

*Aquilegia caerulea leptocera* A. Nels. in Coulter, New Man. Rocky Mount. 191. 1909.

RANGE: Mostly west of the Rocky Mountains in Utah, Nevada, and Idaho, and at lower elevations.

REFERENCES: S. Wats. in King, Geol. Expl. 40th Par. 5: 10. 1871. A. Gray, Pl. Wright. 2: 9. 1853. Tidestrom, Amer. Mid. Nat. 1: 171. 1910.

#### SPECIMENS EXAMINED.

IDAHO: Palisade National Forest, *Ryder* 13. Lost River Mountains, west of Clyde, Blaine County, *Macbride & Payson* 3113.

WYOMING: Pine Mountain, *Nelson* 3557. North Fork Lake, *Warren* 8. Between Baggs and Rawlins, *Osterhout* 2634.

COLORADO: Cameron Pass, *Baker*. Sangre de Cristo Creek, *Rydberg & Vreeland* 6211.

UTAH: Provo, *Jones* 5569. Uintah Mountains, *H. Engelmann*. Vicinity of Clayton Peak, Wasatch Mountains, *Stokes*. Alta, Wasatch Mountains, *Jones* 1212. Black Mountain, Manti, *Jones*. Head of Bullion Creek, *Jones*. Aqui Mountains, *Jones*. Little Cottonwood Canyon, *Jones*. Henry Mountains, *Jones* 5695a.

NEVADA: Piermont, *Jones*. Schell Creek Mountains, *Jones*.

This subspecies might perhaps be regarded as a color form if it were not for its peculiar relationship to *A. caerulea*. Though it seems to differ from the species only in its color, this difference is more significant than in most color forms. This subspecies seems to show a higher plane of evolution than the species; it is the form that has migrated westward, has become adapted, in general, to a more arid habitat, and has made the first advance to the yellow color which, under some circumstances, is the forerunner of red, the most specialized color of all. One would suppose if these flowers are pollinated by moths that the white flowers would have a decided advantage over the blue.

**18b. *Aquilegia caerulea pinetorum*** (Tidestrom).

*Aquilegia pinetorum* Tidestrom, Amer. Mid. Nat. 1: 166. 1910.

Stems and leaves as in *A. caerulea*; flowers white, resembling those of the subspecies *albiflora*, somewhat smaller than in typical *caerulea*; spurs slender, straight, about 7 cm. long.

TYPE LOCALITY: Buckskin Mountains, Arizona.

RANGE: Northern Arizona and southern Utah.

<sup>1</sup> Bull. Torrey Club, 18: 168. 1891.

## SPECIMENS EXAMINED.

ARIZONA: *Pinus ponderosa* area, Warm Spring Canyon, Buckskin Mountains, Tidestrom 2329 (type).

UTAH: Sevier National Forest. Mount Ibapah, Jones.

This plant is to be distinguished from the subspecies *albiflora* by the very long, slender spurs. The length of the spurs in this subspecies, though otherwise unusual in the species, can scarcely be considered of specific value, since the spurs of the typical form occasionally exhibit an equal length. I have at hand a specimen of *A. caerulea* from the La Sal Mountains of Utah (Jones, June 13, 1913), with dark blue sepals and with spurs quite as long as those of this subspecies. A specimen from the Laramie Hills, Albany County, Wyoming (Nelson 249, June 22, 1894), also has spurs nearly 7 cm. in length. The altitudes at which this form grows are somewhat lower than those at which the species is found (about 2,100 meters).

**18c. *Aquilegia caerulea alpina* A. Nels. First Rep. Fl. Wyo. 78. 1896.**

*Aquilegia oreophila* Rydb. Bull. Torrey Club 29: 146. 1902.

Stems 40 to 60 cm. high; lower leaves biternate, the leaflets large, thin; flowers few, 3 to 5 cm. long, erect; sepals pale blue; petals yellow or ochroleucous.

TYPE LOCALITY: Union Peak, Wind River Mountains, Wyoming.

RANGE: Northwestern Wyoming, at high elevations.

## SPECIMENS EXAMINED.

YELLOWSTONE NATIONAL PARK: Snake River, A. & E. Nelson 6412.

WYOMING: Union Peak, Nelson 894. Teton Pass, Merrill & Wilcox 979.

Differing from the species by such slight characters that it is often difficult to decide as to the identity of a particular specimen. The color of the flowers of this reminds one of the flowers of *A. scopulorum*, but, unlike *scopulorum*, it has no distinguishing habit of growth.

**18d. *Aquilegia caerulea daileyae* Eastw. Proc. Calif. Acad. III. 1: 76. 1897.**

Spurs entirely wanting; sepals and petals similar, flat, blue.

Type from Estes Park, Colorado. These so-called "stellate" forms seem to occur occasionally in most of the species.

**19. *Aquilegia ecalcarata* Eastw. Zoe 2: 226. 1891.**

*Aquilegia micrantha mancosana* Eastw. Proc. Calif. Acad. III. 1: 77. 1897.

*Aquilegia micrantha ecalcarata* Davis, Minn. Bot. Stud. 2: 336. 1899.

*Aquilegia eastwoodiae* Rydb. Bull. Torrey Club 29: 146. 1902.

*Aquilegia mancosana* Cockerell, Torreya 11: 75. 1911.

Stems 30 to 50 cm. high, pubescent and viscid throughout, more or less irregularly ribbed; basal leaves triternate, the leaflets sessile or short-petioluled, rather small and narrow, the lobes obtuse or acute, thick, densely pubescent and viscid beneath; flowers about 2 cm. across, erect (?); sepals creamy white, ovate, acute, 10 mm. long, 4 mm. broad; laminae creamy white, truncate or slightly retuse, about 7 mm. long and 5 mm. broad; spurs white, reduced to saclike outgrowths at the base of the petals; styles 5 to 7 mm. long; ovaries viscid-pubescent; follicles 4 or 5, about 15 mm. long, the tips spreading.

TYPE LOCALITY: Johnston Canyon, Mesa Verde National Park, Colorado.

RANGE: Known only from the type locality.

REFERENCES: Eastw. Zoe 2: 226. 1891. Jones, Zoe 4: 259. 1893. Robinson, Syn. Fl. 1: 43. 1895. Davis, Minn. Bot. Stud. 2: 336. 1899. A. Nels. in Coulter, New Man. Rocky Mount. 191. 1909.

Miss Eastwood says that this plant has been seen in but one nichelike cavern, where the sun never comes and where the supply of water is so slight during the hot, dry summer that it is forced to cling close to the damp rocks, even climbing up the sides of the cave with its slender, threadlike stems. While the species has been found in only one locality, the subspecies is said to be common in the canyons of the San Juan River system in southwestern Colorado and southeastern Utah at altitudes of less than 2,100 meters.

After this species was discovered (in 1891), Mr. Jones<sup>1</sup> made the section *Pseud-aquilegia* to contain it, based on its spurless flowers and triternate leaves. Later, when the subspecies was found (in 1894), Miss Eastwood made the characterization of this new section to read, "leaves triternate, spurs irregular or abortive, flowers small." There seems to be no occasion to consider this species as representing a new section. Triternate leaves are known to occur in at least two sections of the genus and the character of the spur does not appear to be significant of more than specific individuality. On the other hand, its erect, white or cream-colored flowers, its comparatively large, dilated laminæ, its outwardly curved, rather than hooked, slender spurs, and even its fragrance, seem to ally it to the *caerulea* group.

**19a. *Aquilegia ecalcarata micrantha* (Eastw.)**

*Aquilegia micrantha* Eastw. Proc. Calif. Acad. II. 4: 559. 1895.

Differs from the species in no significant way except by the development of the spurs, these straight or curved outward, 12 to 18 mm. long.

TYPE LOCALITY: Near Bluff City, southeastern Utah.

RANGE: In canyons of southwestern Colorado and adjacent Utah, in the Upper Sonoran Zone.

SPECIMENS EXAMINED.

UTAH: Near Bluff City, *Eastwood*. Armstrong and White canyons, near the Natural Bridges, *Rydberg & Garrett* 9488.

**20. *Aquilegia pallens* Payson, Bot. Gaz. 60: 375. 1915.**

PLATE 13.

Stems tufted, pubescent, glandular, sparsely villous throughout, 30 to 60 cm. high; basal and lower cauline leaves long-petioled, biternate; petioles and particularly the petiolules more or less glandular and villous with spreading hairs; leaflets rather small, broadly cuneate to suborbicular, thickish, glabrate or finely pubescent above, densely pubescent and viscid beneath; flowers about 3 cm. across, 5 cm. long, erect or merely inclined; sepals white or very pale blue, rather broad, mostly obtuse, spreading horizontally or slightly reflexed, about 20 mm. long; laminæ white, 8 to 10 mm. long, somewhat spatulate, broadly rounded or truncate at apex; spurs white, slender, straight or spreading, about 3 cm. long, the knob of nectary small; styles about 10 mm. long; ovaries pubescent and viscid; follicles less than 2 cm. long.

TYPE LOCALITY: Canyon of La Sal Creek, Utah, near the Colorado boundary.

RANGE: In the Upper Sonoran Zone of western Colorado and adjacent Utah.

SPECIMENS EXAMINED.

COLORADO: Near Grand Junction, *Payson* 712.

UTAH: La Sal Creek Canyon, *Payson* 443 (type). Moab, *Jones*. Green River, *Jones*.

A relative of *A. caerulea* and retaining the biternate leaves of that species although growing in a hot, arid region. Distinguished from it by its much smaller flowers and the viscid-pubescent leaflets and stems, to which grains of sand may usually be found clinging.

Found usually beneath cliffs where the soil is moist with oozing ground water in the early summer, but is quite dry later in the year.

EXPLANATION OF PLATE 13.—*Aquilegia pallens* Payson. From the specimen collected by M. E. Jones at Moab, Utah. Slightly less than one-half natural size.

<sup>1</sup> *Zoe* 4: 259. 1893.

**21. *Aquilegia scopulorum*** Tidestrom, Amer. Mid. Nat. 1: 167. 1910.*Aquilegia caerulea calcarea* Jones, Proc. Calif. Acad. II. 5: 619. 1895.*Aquilegia scopulorum* forma *calcarea* Tidestrom, Amer. Mid. Nat. 1: 170. 1910.

Cespitose alpine perennial, the stems 8 to 15 cm. long, more or less viscid-pubescent, especially above; basal leaves forming a dense tuft on the apices of the large caudex, biternate; cauline leaves mostly reduced to 1 or 2 entire or 3-lobed bracts; leaflets small, about 1 cm. broad, coriaceous, rounded, the base truncate; flowers solitary, erect, about 5 cm. long; sepals pale blue, broadly oblong, obtuse or acute, 3 to 4 cm. long; petals yellow or white, oblong, the apices rounded; spurs straight, 3 to 4 cm. long; ovaries densely pubescent; styles about 5 mm. long; follicles about 2 cm. long, the tips spreading.

TYPE LOCALITY: Wasatch Peak, central Utah.

RANGE: High altitudes in Utah, Nevada, and southwestern Wyoming.

## SPECIMENS EXAMINED.

WYOMING: Bridger Peak, *Cary* 635.

UTAH: Wasatch Peak, *Tidestrom* 1788 (type). Divide between Sevier and Beaver rivers, near Belknap Peak, *Rydberg & Carlton* 7334. Canyon above Tropic, *Jones* (type of *A. caerulea calcarea*). Gold Mountain, near Marysvale, *Jones*.

NEVADA: Bunker Hill, Lander County, *Kennedy* 4181, *Hitchcock* 884.

An alpine relative of *A. caerulea*, differing from that species by its low, one-flowered stems, its very small, congested, coriaceous leaflets, and its smaller, light blue and yellow flowers. It is extremely difficult, if at all possible, to separate the form *calcarea* from the species *scopulorum*.

**22. *Aquilegia pubescens*** Coville, Contr. U. S. Nat. Herb. 4: 56. *pl.* 1. 1893.

Stems 20 to 30 cm. high, glabrous below or minutely pubescent throughout; basal leaves from once to twice ternate; leaflets medium in size, glabrate to densely pubescent beneath, the lobes rounded; stem leaves few or none, passing into linear tripartite bracts; flowers few, canary yellow throughout, erect, 4 to 5.5 cm. long, 4.5 to 6 cm. across; sepals linear-oblong, bluntly acute, 20 to 25 mm. long, spreading horizontally; laminae 8 to 14 mm. long, truncate or retuse at apex; spurs 35 to 40 mm. long, straight or spreading; styles 10 to 15 mm. long; ovaries pubescent.

TYPE LOCALITY: White Chief Mine, Mineral King, Tulare County, California (*Coville* 1513).

RANGE: Alpine in the Sierra Nevada of California from Tulare County to Mariposa County.

## SPECIMENS EXAMINED.

CALIFORNIA: White Chief Mine, Tulare County, *Hall* 5654. "Sierra Nevada,"*Muir* 4259. Olancha Mountain, Tulare County, *Hall & Babcock* 5230. MountGoddard, *Hall & Chandler* 671. Hacketts Meadow, Tulare County, *Baker* 4378.Kearsarge Pass, Fresno County, *Clemens*. Vicinity of Lundy, Mono County,*Minthorn*. Bloody Canyon, *Brewer* 1811. Mono Pass, *Bolander*.

This species of the high California Sierra is somewhat similar to *A. chrysantha* of the warmer and drier mountains of New Mexico and Arizona, but is distinguished from it by the much less dissected leaves, lower habit of growth, and fewer, smaller flowers. The illustration accompanying the description of this species is excellent. *Jepson*<sup>1</sup> says: "The typical pubescent form occurs south of Kings Canyon; the specimens received by us from north of Kings Canyon are glabrous or nearly so."

<sup>1</sup> Fl. Calif. 518. 1914.

**23. *Aquilegia chrysantha* A. Gray, Proc. Amer. Acad. 8: 621. 1873.***Aquilegia leptocera flava* A. Gray, Pl. Wright. 2: 9. 1853.*Aquilegia leptocera chrysantha* Hook. f. in Curtis's Bot. Mag. 99: pl. 6073. 1873.*Aquilegia thalictrifolia* Rydb. Bull. Torrey Club 29: 145. 1902.

Stems 90 to 120 cm. high, much branched above, more or less pubescent; basal leaves usually triternate; leaflets usually rather small, often densely pubescent, beneath; flowers 6 to 9 cm. long, 4.5 to 7 cm. across, erect, of a clear yellow color throughout; sepals widely spreading, 3 to 3.5 cm. long, mostly narrow and long-acuminate; laminae of petals 1 to 2 cm. long, somewhat dilated above and rounded at apex, widely spreading; spurs very slender, straight or spreading, 5 to 7 cm. long; styles 10 to 13 mm. long; ovaries densely viscid-pubescent; follicles about 2.5 cm. long, the tips widely spreading.

TYPE LOCALITY: "Wet places in a ravine," Organ Mountains, New Mexico.

RANGE: In the mountains of southern Colorado, New Mexico, and adjacent Texas, Mexico, and Arizona.

REFERENCES: Coulter, Contr. U. S. Nat. Herb. 2: 9. 1891. Rothr. in Wheeler, Rep. U. S. Surv. 100th Merid. 6: 58. 1878. Jones, Zoe 4: 257. 1893. Davis, Minn. Bot. Stud. 2: 341. 1899. A. Nels. in Coulter, New Man. Rocky Mount. 191. 1909. Woot. &amp; Standl. Contr. U. S. Nat. Herb. 19: 248. 1915.

## SPECIMENS EXAMINED.

COLORADO: Colorado Springs, *Soth, Osterhout* 788. Cheyenne Mountain, *Broadhead*. Near Canyon City, *Brandegee*. Cheyenne Canyon, *Jones* 936b. Bear Creek Canyon, El Paso County, *Sheldon* 334.

NEW MEXICO: Organ Mountains, *Wooton* 628, *Vasey, Parry, Standley, Wright* 1306. Mogollon Mountains, Socorro County, *Wooton*.

ARIZONA: Miller Canyon, Huachuca Mountains, *Goodding* 175. Chaperon Canyon, Chiricahua Mountains, *Blumer* 1545. Aspen Gulch, Rincon Mountains, *Blumer* 3375. Monument Peak, Chiricahua Mountains, *Blumer* 1454. Flagstaff, *Purpus* 8077. Fort Whipple, *Coues & Palmer* 27. Santa Rita Mountains, *Pringle* 13612. Oro Blanco, *Kempton*. Fort Huachuca, *Wilcox, Patzky* 64. Rincon Mountains, *Nealley* 124. Fort Whipple, *Coues*. Santa Rita Mountains, *Thorner* 277. Prisal Mountains, *Jones*. San Francisco Mountains, *MacDougal, Knowlton* 73. Mint Valley, *Smart* 303. Bradshaw Mountains, *Toumey* 38a. Near Leroux Spring, *Leiberg* 5572. Natural Bridge, *Chamberlain* 58. Little Spring, *Goldman* 2113. Prescott, *Kunze*. Gila Canyon, *Mohr*.

MEXICO: Mabibi, Sonora, *Thurber* 434. San Luis Mountains, *Mearns* 1. San José Mountains, Sonora, *Mearns* 1679. Canyon near Chuchuchupa, Chihuahua, *Hartman* 725.

A variable species, resembling *A. caerulea*, but easily distinguished from it, although differing in but few constant technical characters except color. The spurs are, as a rule, longer and more slender, the sepals acuminate instead of acute or obtuse and narrower, the basal leaves more divided (triternate instead of biternate), and the plant taller and more floriferous. Its range, too, is farther south and the stations at which it is found at lower altitudes.

**24. *Aquilegia chaplinei* Standley, sp. nov.**

Stems slender, glabrous except in the inflorescence, about 35 cm. high; basal leaves borne on slender petioles 7 to 10 cm. long, scarcely triternate; leaflets small, suborbicular or somewhat narrowed, 10 to 12 mm. long, glabrous, thickish and firm; flowers about 3 cm. across, 5 to 6 cm. long, mostly erect; sepals spreading, yellow or slightly tinged with blue, broadly lanceolate, acute or obtuse, 13 to 15 mm. long, equaling or but little exceeding the laminae of the petals; laminae yellow, dilated, truncate or rounded; spurs very slender, straight or spreading, 3.5 to 4 cm. long, the

knob of nectary small; stamens well exerted; styles 10 to 12 mm. long; ovaries pubescent and glandular; mature follicles unknown.

Type in the U. S. National Herbarium, no. 537658, collected at Sitting Bull Falls, Alamo National Forest, southern New Mexico, altitude about 1,650 meters, May 25, 1916, by W. R. Chapline (no. 544).

This species is closely related to *A. chrysantha* and is probably no more than a local offshoot from that species. It is apparently deserving of specific rank, this to be based on its small flowers with subequal sepals and laminae and on the small leaflets. The altitude suggests that this plant is native in a more arid region than is its parent, *A. chrysantha*. It probably blooms earlier than the related plant does.

**25. *Aquilegia longissima* A. Gray, Proc. Amer. Acad. 17: 317. 1882. PLATE 14.**

Stems about 90 cm. high; basal and lower stem leaves similar, triternate, the partial petioles very long; leaflets deeply lobed, with narrow segments; flowers erect, pale yellow; sepals narrowly lanceolate, acuminate, broadly spreading, about 2.5 cm. long, exceeding the narrowly spatulate petals by 2 to 3 mm.; laminae spreading horizontally, rounded at apex; spurs filiform, hanging, 10 to 15 cm. long, the orifice narrow (about 2 mm.).

TYPE LOCALITY: Caracol Mountains, south of Monclova, Coahuila, Mexico.

RANGE: Ravines in the mountains of southwestern Texas and adjacent Mexico.

REFERENCES: A. Gray, Bot. Gaz. 8: 295. 1883. S. Wats. Gard. & For. 1: 31. 1888. Coulter, Contr. U. S. Nat. Herb. 2: 9. 1891. Jones, Zoe 4: 257. 1893. Robinson, Syn. Fl. 1: 45. 1895. Davis, Minn. Bot. Stud. 2: 341. 1899.

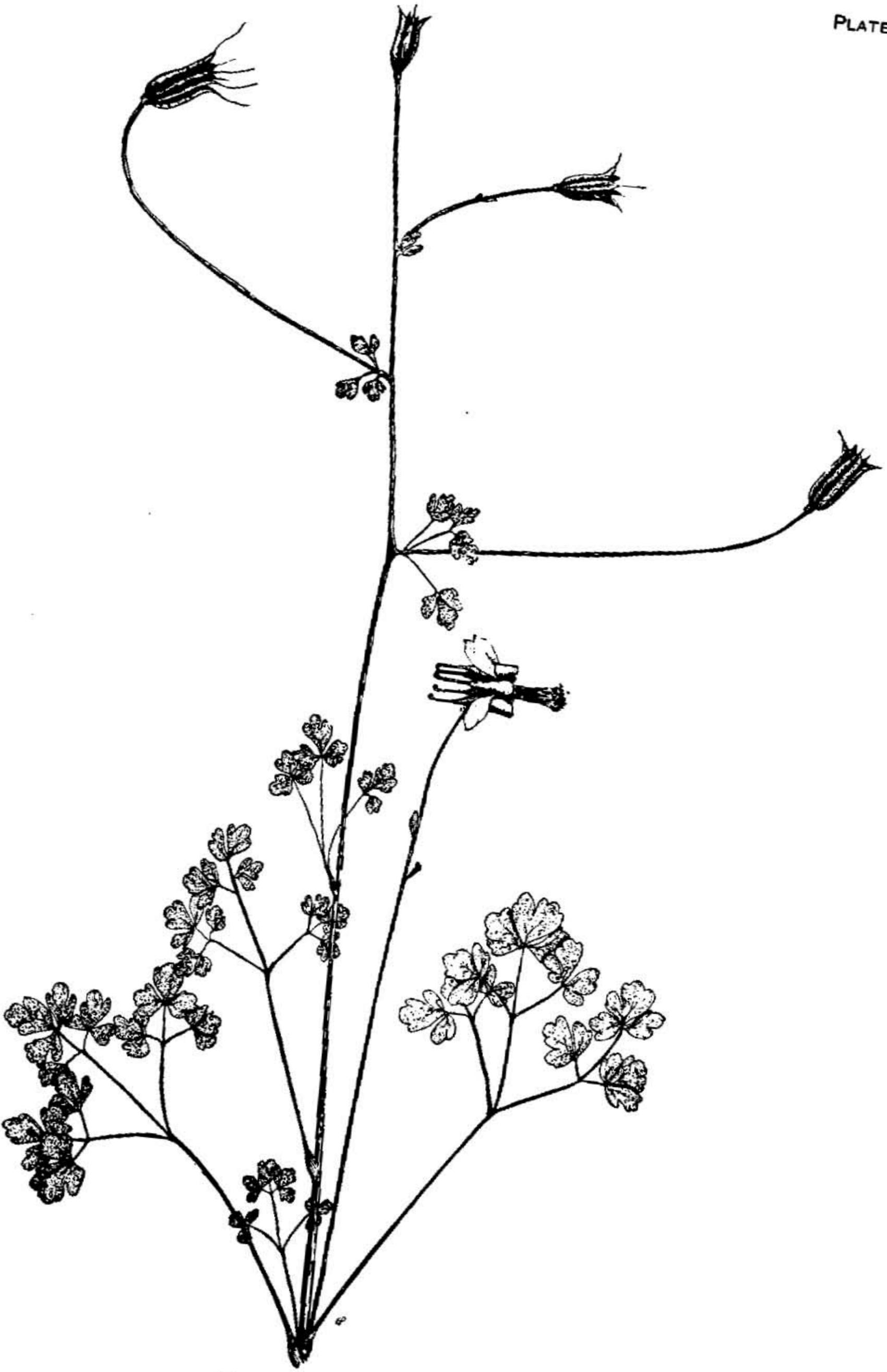
The only specimen seen was collected by Edward Palmer in Coahuila, Mexico.

*Aquilegia longissima* is most closely related to *A. chrysantha*, yet it differs from it in several important respects besides the length of the spurs. The blades of the petals, which in *A. chrysantha* are often widely spreading, in this species are bent nearly at right angles to the spurs and so assume a horizontal position. The sepals in *longissima* are narrower and exceed the petals by much less than in *chrysantha* and the flowers in *longissima* are produced in the fall when the flowers of the related species are much past their prime.

*Aquilegia longissima* is probably the most peculiar and interesting as well as the most highly developed species of *Aquilegia*. It is the southernmost known species of the section *Macrolepterae*. Its most remarkable character is, of course, its extraordinary spur length. This unusual length must have been developed in conjunction with the proboscis of some insect, and in this connection Doctor Trelease<sup>1</sup> says that the spurs of this, as well as the very long tubes of some other southwestern plants, might well be drained by *Amphonyx antaeus* Drury, a moth which possesses a proboscis over 5 inches in length. It would be interesting if some one who has an opportunity would test the truth of Doctor Trelease's conjecture. In the eastern United States *A. longissima* will not develop seeds unless artificially pollinated, thus showing its dependence on some animal not native to this section of the country.

EXPLANATION OF PLATE 14.—*Aquilegia longissima* A. Gray. From a cut in Garden and Forest 1:31. 1888. Slightly less than natural size.

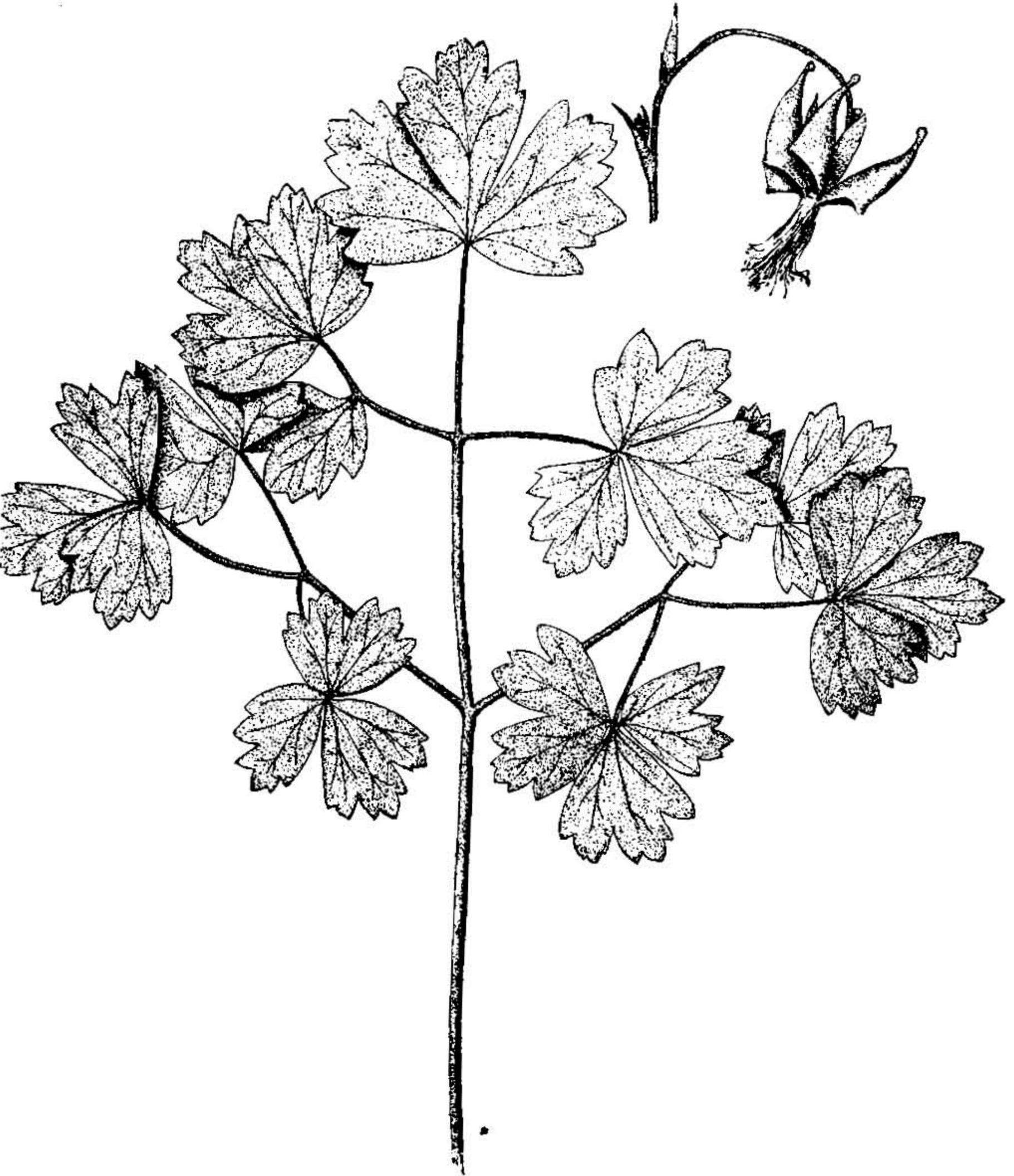
<sup>1</sup> Bot. Gaz. 8: 319. 1883.



AQUILEGIA FORMOSA CAELIFAX PAYSON.



AQUILEGIA WAWAWENSIS PAYSON.



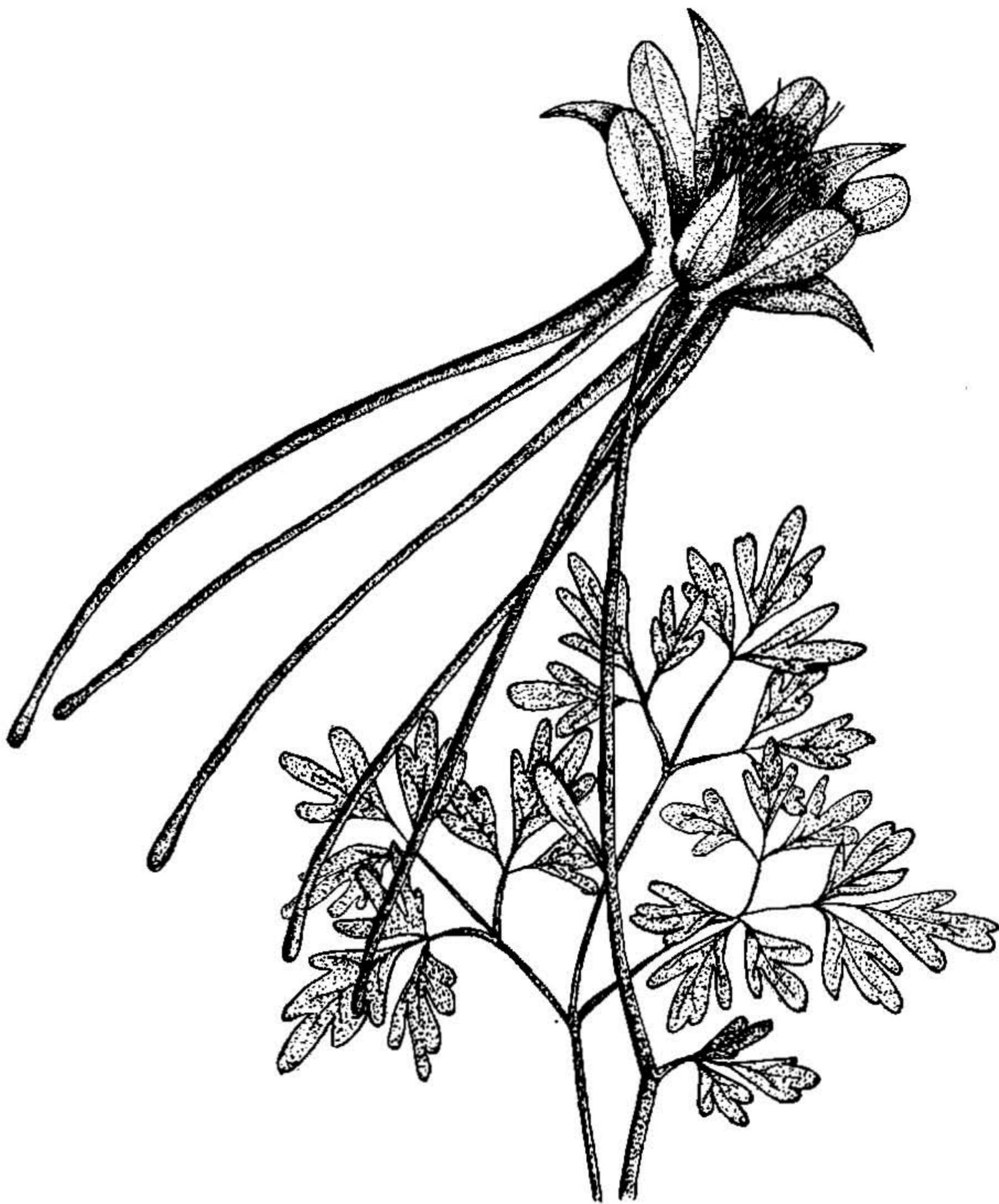
AQUILEGIA TRACYI JEPSON.



AQUILEGIA ELEGANTULA GREENE.



AQUILEGIA PALLENS PAYSON.



AQUILEGIA LONGISSIMA A. GRAY.