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Bernice Pauahi Bishop Museum.  
Honolulu : Bishop Museum Press.

<https://hdl.handle.net/2027/uc1.32106015288456>

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# THE HAWAIIAN GERANIUMS

By

F. RAYMOND FOSBERG

BERNICE P. BISHOP MUSEUM

OCCASIONAL PAPERS

VOLUME XII, NUMBER 16

HONOLULU, HAWAII

PUBLISHED BY THE MUSEUM

October 5, 1936

# THE HAWAIIAN GERANIUMS

By F. RAYMOND FOSBERG

The native Hawaiian Geraniums, forming the section *Neurophyllodes* Gray, are characterized by a shrubby or arborescent habit, alternate parallel veined leaves and free stamens. They are of considerable phytogeographic interest as the section is endemic in the Hawaiian islands and lacks close relationships within the genus. They are members of the extremely interesting alpine and subalpine flora of the Hawaiian high mountains<sup>1</sup>

Due to their genetic variability, the diversity of habitat, and the resultant variation in growth habit, there has been much confusion in the taxonomy of the group. Following Hooker, who described the first species, *Geranium cuneatum*, every writer who has seriously discussed them has added to or perpetuated this confusion. An attempt to determine whether material which I collected in Haleakala Crater, Maui, belonged to *G. ovatifolium* or to *G. multiflorum* variety *canum* led to my study of the section *Neurophyllodes*.

An examination of these two species in the herbarium of Bernice P. Bishop Museum revealed that there are no appreciable differences between them as they are segregated in the herbarium. Considerable minor variation is apparent in both. Leaf outlines vary as much, even on the same plant, as between the descriptions of the two species. This applies to the size and shape of leaves as well as to the number and character of the serrations. In pubescence both are the same.

The size of the inflorescence varies greatly in the material examined. My three collections from Haleakala come from different plants growing in a single thicket. Two of them have large inflorescences, the specimens differing only in leaf shape. The third has a smaller inflorescence, and resembles the plant pictured and described by Gray as *G. ovatifolium*.

In addition to several minor differences Gray states that *G. ovatifolium* of Maui has the seeds minutely longitudinally reticulate while *G. multiflorum* of Hawaii has them smooth. All the Maui material

<sup>1</sup> See Skottsberg, Carl, Remarks on the flora of the high Hawaiian volcanoes: Medd. Göteborgs Bot. Trädg. VI, 1939.

with seeds mature enough for examination has the seeds reticulate. Dr. Harold St. John has kindly examined for me the type of *G. multiflorum* at the Gray Herbarium and reports that the seeds are minutely longitudinally reticulate. Thus, the only differences being in pubescence and size of inflorescence, it is evident that *G. ovatifolium* and *G. multiflorum* are not distinct species.

Hillebrand<sup>2</sup> observes that the stigmatic branches in *G. ovatifolium* are united beyond the beaked portion into a long style as in *G. arbo-  
reum*. These observations were based upon a Lydgate collection which I have not seen. There are no specimens in the herbarium of Bishop Museum or in my collections which exhibit this character, except *G. arbo-  
reum*. In *G. arbo-  
reum* the style is at least 1 cm long, whereas in all other specimens of the species of section *Neurophyl-  
lodes* which I have seen it is seldom over 1 mm long. Hillebrand's remarks on this Lydgate specimen—that the leaves are green on both surfaces and hispid, and that the dried petals are darker than those of *G. multiflorum* and lighter than those of *G. arbo-  
reum*, together with the long style—indicate that it may be a hybrid between the two. Contrary to the statement made by Hillebrand, Gray's plate shows the style branches of *G. ovatifolium*. These are quite obvious in the drawing of the flower where they resemble exactly those of *G. multi-  
florum*, though lacking in the more mature specimen.

Typical *G. multiflorum* has recently been recollected for the first time since the original collection by Mr. Pickering of the Wilkes Expedition. Mr. Robert Usinger, entomologist on the Mauna Kea Expedition of the Hawaiian Academy of Science, found a bush with white flowers growing on the slope of a cinder cone at Loaloa, east of Humuula. He preserved fragments of it, which were later determined as *G. multiflorum*. It is good to find that the live stock have not completely exterminated this variety. Perhaps other examples may be found in inaccessible places in the same region. A fence should be built around the single bush that is now known.

As the name *multiflorum* is more descriptive than *ovatifolium*, it has been retained for the species. *G. ovatifolium* becomes a synonym since *G. multiflorum* variety *canum* is the oldest varietal name for the Maui plants and must be retained.

The three species, *G. multiflorum*, *G. humile*, and *G. cuncatum*, are very closely related. It is only consideration of a number of

<sup>2</sup> Hillebrand, William, *Flora of the Hawaiian islands*, p. 56, London, 1888.

rather minute technical differences that enables one to maintain them as species. The long style and irregular flower of *G. arboreum* set it apart as a very distinct species.

### Genus GERANIUM, Section NEUROPHYLLODES

*Geranium* Linnaeus, section *Neurophyllodes*<sup>3</sup> Gray: Bot. U. S. Expl. Exped., p. 310, 1854.

Habit shrubby; leaves ovate to cuneate, parallel veined, stamens free, dilated toward the base, seeds minutely longitudinally reticulate.

Hawaiian islands: Hawaii, Maui, and Kauai.

### KEY TO THE SPECIES AND VARIETIES

- A. Leaves distinctly ovate, hirsute, flowers irregular, style 1 cm or more long beyond the beak.....**G. arboreum**
- AA. Not as above.
  - B. Leaves somewhat ovate to broadly obovate, not truncate, serrate at least one third of the way down from the apex.
    - C. Leaves densely silky or silvery beneath.....**G. multiflorum** variety **canum**
    - CC. Leaves green on both sides, pilose.....**G. multiflorum** variety **typicum**
  - BB. Leaves oblong-cuneate, truncate, serrate only at apex.
    - C. Leaves densely silky or silvery on both sides.
      - D. Leaves predominantly tridentate at apex, found on Maui.....**G. cuneatum** variety **tridens**
      - DD. Leaves predominantly 5-7 dentate at apex, found on Hawaii.....**G. cuneatum** variety **hololeucum**
    - CC. Leaves green, at least above.
      - D. Leaves green on both sides.
        - E. Nerves of leaves glabrous above, branchlets reddish.....**G. cuneatum** variety **Menziesii** form **Menziesii**
        - EE. Nerves of leaves slightly hairy above, especially when young, branchlets gray or brownish.....**G. cuneatum** variety **Menziesii** form **Rockii**
      - DD. Leaves silvery beneath.
        - E. Tall shrub growing in dry habitats, style branches filiform.....**G. cuneatum** variety **hypoleucum**
        - EE. Low shrub growing in open bogs with stems buried in moss, style branches thickened, fleshy.
          - F. Nerves of leaves silky above, found on West Maui.....**G. humile** variety **mauiensis**
          - FF. Nerves of leaves glabrous above, found on Kauai.....**G. humile** variety **kauaiensis**

<sup>3</sup> Spelled "Neurophyllodea" by Knuth in his monograph of the Geraniaceae: Pflanzenreich IV, 129, p. 216, 1912.



PLANTS OF HAWAII  
BY HERBARIUM OF THE BISHOP MUSEUM  
No. 16,486  
*Geranium arboreum* U. Gray  
No. 16,486  
Hawaii, Oahu, near  
Haleakala, near  
side of road of  
... 1927

PLATE 1.—*Geranium arboreum*.

**Geranium arboreum** Gray (pl. 1).

*Geranium arboreum* Gray: Bot. U. S. Expl. Exped., p. 315, t. 31, 1854.

Shrub or small tree; internodes on branchlets crowded, covered with dried stipules; leaves ovate, subcordate, margins serrate almost to the base, petioled, sparsely villous on both sides, hairs spreading to somewhat appressed, five main veins parallel, with network between and at sides; cymes short, few (usually 1-4) flowered, terminal on lateral branchlets, villous; flowers large, irregular; sepals 12-14 mm long, lanceolate, long-mucronate, villous; petals 2 cm long, dull magenta, the limb bluntly obovate, the upper three erect, the two lower reflexed, causing the corolla to appear curved; stamens and pistil in flower about the same length as the petals, sparsely villous; the pistil elongating to 4 cm in fruit, the style above the beak in flower a little less than 1 cm long, about 1.5 cm long in fruit, branches filiform, reflexed; body of fruit 4 mm long; seeds 2.5 cm long, oblong.

Maui, Haleakala: Puuniauniau Crater, August 1918, J. F. Rock 17145; Keokea, Kula slope, April 5, 1920, C. N. Forbes 2153.M.; east of Ukulele, July 9, 1919, C. N. Forbes 696.M.; above Waiale, July 1910, C. N. Forbes 195.M.; hill mauka of Olinda, on way to Haleakala summit, June 15, 1927, Otto Degener 10,486.

A distinct species, showing some variation in the size and shape of leaves and in the degree of hairiness of all parts. It has become very rare in recent years, and unless efforts are made to save it, will doubtless soon become extinct.

**Geranium multiflorum** Gray.

*Geranium multiflorum* Gray: Bot. U. S. Expl. Exped., p. 311, t. 29, 1854.

Shrub up to 3 meters tall, woody parts of stem grayish or brownish, herbaceous parts pinkish brown, lightly appressed villous; leaves thin, ovate to elliptical, 2-5 cm long, apex obtuse or acute, mucronate, serrate in the upper half or two thirds, base acute or obtuse, petiole slender, veins 5-8 from base, occasionally forking; cymes many flowered, varying greatly in length, from scarcely longer than the leaves to several times as long; flowers white, regular, variable in size, 1.5-2 cm across, filaments pilose in the dilated basal part; style beyond the beak 1 mm or less long, style branches 3-4 mm long, curved outward, filiform; seed cylindrical, hilum linear.

Found on the dry lava and cinder slopes of Hawaii and eastern Maui, one variety on each of these islands.

**Geranium multiflorum** Gray variety **typicum** Knuth.

*Geranium multiflorum* Gray variety *typicum* Knuth: Pflanzenreich, vol. 129, p. 219, 1912.



PLATE 2.—*Geranium multiflorum* variety *canum*.

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*Geranium multiflorum* Gray: Bot. U. S. Expl. Exped., p. 311, t. 29, 1854.

Shrub 1 meter tall, leaf bases and stipules usually congested on the branchlets, leaves green on both sides, sparsely pilose, the main veins more strongly so beneath, the hairs on the veins spreading; stipules glabrous except for ciliate margins; cymes spreading pilose, as are the exposed parts of the sepals; pistil strongly appressed-pilose except for the style branches, which are glabrous; seed approximately 2 mm long and 1 mm thick, "dull, blackish brown, closely lined with minute raised, anastomosing, longitudinal reticulations" (St. John, in litt.)

Hawaii: "District of Waimea", U. S. Expl. Exped. (type, part in Gray Herbarium, fragment in Bishop Mus.); Loa'oa, on a typical cinder cone, 3 miles east of Humu'ula, altitude 7300 feet, August 7, 1935, R. L. Usinger 692 (M. Neal).

***Geranium multiflorum* Gray variety *canum* Hillebrand (pl. 2).**

*Geranium multiflorum* Gray variety *canum* Hillebrand: Fl. Haw. Is., p. 56, 1888.

*Geranium ozatifolium* Gray: Bot. U. S. Expl. Exped., p. 314, t. 30, 1854.

Shrub up to 3 meters tall; leaf bases sometimes congested on branches, sometimes not; leaves green or slightly silky above, nerves silky, the whole leaf silky or silvery beneath, petiole densely silky; stipules lightly appressed pubescent outside, ciliate; cymes and exposed portions of sepals silky, the latter almost silvery, sepals mucronate, 6-9 mm long, petals obovate, clawed, 8-14 mm long, white; pistil silky except the style branches and ovary, the ovary sparsely pilose, the style branches glabrous; seed 3 mm long, brownish black.

Maui: "Hawaii", Pickering, U. S. Expl. Exped. (type of *G. ozatifolium*, credited to Maui by Gray); Haleakala, ex. spec. presented to Prof. Alexander, 1869, Hillebrand; Haleakala, Hillebrand and Lydgate (type of *G. multiflorum* variety *canum* ?); Haleakala Crater floor, near Bubble Cave, altitude 2250 meters, August 22, 1933, F. R. Fosberg 9925, 9926, 9927; Kaupo Gap, Haleakala Crater, October 21-22, 1910, J. F. Rock 8598; crater of Haleakala, August 1910, C. N. Forbes 281.M., 282.M.; Koolau Forest Reserve, Waialeale, altitude 2450 meters, September 19, 1926, C. S. Judd 55; Keanae Gap, crater of Haleakala, August 3, 1919, C. N. Forbes 1021.M.; Kaupo Gap, crater of Haleakala, August 14, 1919, C. N. Forbes 1131.M.; Haleaku, Keanae Gap, Haleakala, August 2, 1919, C. N. Forbes 996.M.; Puu Manu, south slope Haleakala, November 8, 1920, C. N. Forbes 1901.M.; north slope of Haleakala, August 15,

1919, C. N. Forbes 1140.M.; same locality, August 17, 1919, C. N. Forbes 1164.M., 1164a.M., 1164b.M.; east of Ukulele, July 17, 1918, C. N. Forbes 809.M.

**Geranium cuneatum** Hooker.

*Geranium cuneatum* Hooker: Ic. Pl., t. 198, 1840.

Shrub or subshrub; leaves more or less cuneate or oblong with a cuneate base, rather narrow, toothed only near the apex, which is ordinarily truncate or nearly so, veins parallel, not connected by an obvious network; cymes few to many flowered; flowers white; style less than 1.5 mm long, stigmas filiform, red to yellow; main body of follicle 2-4 mm long; seed oblong.

Occurring on the high mountains of Hawaii and eastern Maui.

*Geranium cuneatum* is closely related to *G. multiflorum*, having the leaves rather strikingly different in shape and venation. It is also closely related to *G. humile*, but with much smaller flowers, much more slender stigmas, a very different habit of growth, and a different habitat. It is very variable, especially in size and shape of leaves, slenderness of plant, degree of hairiness, size of flowers, and size of inflorescence. However, there seem to be four distinct varieties. These are the three originally recognized by Gray—varieties *Menziesii*, *hololeucum*, and *hypoleucum*, except for part of variety *hypoleucum*—and Hillebrand's *G. tridens* from Maui, included by Gray in variety *hololeucum*. Hillebrand lumped two of Gray's varieties,  $\beta$  *hypoleucum* and  $\gamma$  *hololeucum*, to form his  $\beta$  variety, out of which he segregated his variety *pauciflorum*, a few flowered form not worth naming. Skottsberg (Medd. Göteborgs Bot. Tradg. II, p. 241, 1925-26) recognizes a variety *polyphyllum* which he credits to Hillebrand, though Hillebrand apparently did not publish a variety under this name. Skottsberg probably has in mind Hillebrand's variety *pauciflorum*.<sup>4</sup>

Variety *Menziesii* Gray is the original *G. cuneatum* of Hooker and, since it is the earliest varietal name, must stand for the typical variety. Rock's variety *Menziesii* Gray, which Skottsberg makes variety *Rockii*, is a form of variety *Menziesii*, distinguished chiefly by the stouter, more branched habit and gray rather than red branches, and its geographical distribution. If recognized with a name it should be called form *Rockii*.

<sup>4</sup> See Skottsberg's use of the name *pauciflorum* in Medd. Göteborgs Bot. Tradg. II, 1925-26 and VI, p. 51, 1930.

**Geranium cuneatum** Hooker variety **Menziesii** Gray (pl. 3).

*Geranium cuneatum* Hooker variety *Menziesii* Gray; Bot. U. S. Expl. Exped., p. 312, t. 29, B, 1854.

Leaves green on both sides, glabrous or only slightly puberulent; calyx green, puberulent.

Two forms found on Hawaii.

**Geranium cuneatum** Hooker variety **Menziesii** Gray form **Menziesii** Fosberg, new name.

Erect, slender shrub, branchlets reddish in color; leaves usually very minutely and sparsely appressed puberulent beneath, especially on the nerves, glabrous above, bright green on both sides, petioles slender, ordinarily 6-10 mm long, appressed puberulent; stipules appressed puberulent, strongly ciliate on outer edges; cyme appressed puberulent, more so on pedicels; sepals green, noticeably nerved, appressed puberulent outside, ciliate.

Hawaii: Kanehaha, Kona, June 24, 1911, C. N. Forbes 252.H.; Papaloa, Kona, July 14, 1911, C. N. Forbes 307.H.; Hualalai, Hillebrand; slopes of Hualalai, June 15, 1911, C. N. Forbes 161.H.; Hualalai, near summit, 6,000 feet, June 9, 1909, J. F. Rock 3589; Mauna Loa, above Puu Lehua Ranch, altitude 8,000 feet, August 20, 1934, G. R. Ewart, III; central plateau, Mann and Brigham 307; central plateau back of Palehua, 6,000 feet, January-February 1912, J. F. Rock 10045; Puu Hualalai, Kaupulehu, altitude 6,000-7,500 feet, December 30, 1931, H. St. John, J. W. Coulter, D. D. Mitchell, and E. Y. Hashimoto 11432; Puu Hualalai, Kaupulehu, altitude 6,000 feet, December 30, 1931, H. St. John, J. W. Coulter, D. D. Mitchell, and E. Y. Hashimoto 11415; Puu Hualalai, Puuwaawaa, altitude 6,500 feet, December 29, 1931, H. St. John, J. W. Coulter, E. Y. Hashimoto, J. C. Lindsay, and D. D. Mitchell 11405.

**Geranium cuneatum** Hooker variety **Menziesii** Gray form **Rockii** (Skottsberg) Fosberg, new combination.

*Geranium cuneatum* variety *Menziesii* Gray (of Rock, not Gray)

Rock: Coll. Haw. Pub., Bull. 1, p. 8, December 1911.

*Geranium cuneatum* variety *Rockii* Skottsberg; Medd. Göteborgs Bot. Tradg. VI, p. 51, 1930.

Lower growing, heavier, more branched, branches gray or brown, not red; leaves broader, more coriaceous, less puberulent beneath, except on nerves, slightly puberulent above on nerves, petioles less puberulent, uniformly 6 mm or less long; cymes very short, not much exceeding the leaves, flowers tending to be larger.



PLATE 3.—*Geranium cuneatum* variety *Menziesii*.

Hawaii: Mauna Kea, June 1910, J. F. Rock 8329 (type).

This form might possibly be recognized as a variety were it not for the known variation in varieties *Menziesii* and *hololeucum*, and were more collections available. At present the slight puberulence on the upper side of the nerves of the leaves is the only character which might separate it from all material of form *Menziesii*.

**Geranium cuneatum** Hooker variety **hypoleucum** Gray.

*Geranium cuneatum* Hooker variety *hypoleucum* Gray: Bot. U. S. Expl. Exped., p. 312, t. 29, C, 1854.

*Geranium cuneatum* variety  $\beta$  Hillebrand: Fl. Haw. Is., p. 55, 1888, in part.

Much like variety *Menziesii*, but with leaves usually somewhat broader, densely silvery, appressed tomentose beneath, appressed puberulent, but glabrate above, hairs persistent, longer on nerves; petioles and stipules densely appressed puberulent, glabrate, stipules more strongly ciliate; cymes varying greatly in size, appressed pubescent; outer sepals and central portion of inner sepals silvery pubescent; follicle and seed averaging larger than in varieties *Menziesii* and *hololeucum*.

Hawaii, Mauna Loa: Kipuka Ahiu, June 21, 1915, C. N. Forbes 898.H.; Kipuka Waiakea, June 25, 1915, C. N. Forbes 951.H.; Aina Hou, June 12, 1915, C. N. Forbes 827.H. and 829.H.; above Kapapala, Kau, July and August, 1911, C. N. Forbes 425.H. and 435.H.; Kau, above Waiohinu, 6,000 feet, January 1912, J. F. Rock 10009.

**Geranium cuneatum** Hooker variety **hololeucum** Gray.

*Geranium cuneatum* Hooker variety *hololeucum* Gray: Bot. U. S. Expl. Exped., p. 312, t. 29, D, 1854.

*Geranium cuneatum* variety  $\beta$  Hillebrand: Fl. Haw. Is., p. 55, 1888, in part.

Habit varying from as slender as that of variety *Menziesii* to much heavier; more condensed and more branched even than form *Rockii*; stems grayish brown to black; leaves silvery or grayish pubescent on both sides, pubescence usually but not uniformly appressed; petioles and stipules appressed pubescent, somewhat silvery, stipules not as ciliate as in variety *hypoleucum*; cymes varying in length from scarcely equalling the leaves (variety *pauciflorum* Hillebrand) to several times as long; both cymes and sepals pubescent, but not quite so much so as in variety *hypoleucum*.

Hawaii, Mauna Kea: Waiki (Waikii?), August 1911, C. N. Forbes 466.H., and 471.H.; Mauna Kea, Hosmer; Humuula Trail to summit of Mauna Kea, June 14, 1915, C. N. Forbes 843.H.; Mauna Kea, August 1911, R. Hosmer; Mauna Kea, August 1910, R. L.

Hosmer (Rock 8700); Mauna Kea, May 1910, J. F. Rock 8345; Kalaeha [Kalaeha], Hillebrand; Laumaia, below tree line, altitude 9,000 feet, August 18, 1935, M. Neal and C. Hartt 863; Laumaia, above tree line, August 18, 1935, M. Neal and C. Hartt 859; east of Humuula, below Kalaeha Puu, altitude 6,200-6,400 feet, August 7, 1935, M. Neal 688; McCallister Range in silversword region, A. S. Hitchcock; Aina Hou (base of Mauna Loa), June 12, 1915, C. N. Forbes 826.H. and 831.H.; Mauna Kea, 2,500 meters, July 1909, Abbe Faurie 852; Humuula Trail to summit of Mauna Kea, June 14, 1915, C. N. Forbes 843.H.; source of Wailuku River, June 18, 1915, C. N. Forbes 883.H., 884.H., and 885.H.; "above (at right) Mauna Kea-Humuula Trail, altitude 9,500 feet, August 9, 1935." C. Hartt 756 (M. Neal).

Of the collections cited, the first eight have short cymes which would probably correspond to Hillebrand's Y variety *pauciflorum*. The others are either sterile or have longer cymes. These vary from scarcely exceeding the leaves to fully as long as those in variety *Menziesii*.

The great variation in this variety appears to be due largely to difference in habitat, many of the plants having a low, compact habit as in plants from very exposed places. Detailed field study alone will ascertain the degree of correlation between this variation and environment.

***Geranium cuneatum* Hooker variety *tridens* (Hillebrand) Fosberg,**  
new combination (pl. 4).

*Geranium cuneatum* Hooker variety *hololeucum* Gray: Bot. U. S.  
Expl. Exped., p. 312, 1854, in part.

*Geranium tridens* Hillebrand: Fl. Haw. Is., p. 55, 1888.

Shrub up to 2 cm tall, woolly parts grayish black or gray, herbaceous parts, except flower parts, silvery with a dense silky tomentum, the stems and cyme branches less so than the leaves, the inner face of the stipule glabrous; leaves oblong-cuneate, with three or rarely five sharp teeth at the apex, blade 1.5-2.5 cm long, 6-8 mm wide at widest part, petiole 5-8 mm long; stipules 3-4 mm long; cymes in the upper axils, many flowered, up to 9 cm long, usually not protruding more than 3 cm beyond the leaves; sepals silvery outside, except the edges of the inner ones, ovate or oblong, acuminate, variable in size, 6-11 mm long, 2-4 mm wide; petals white, obovate, clawed, 8-15 mm long, 4-7 mm wide, veins conspicuous in dry material, style 1 mm long above beak, style branches 3-5 mm long, yellow to dark red; follicle 3-4 mm long; seeds a trifle more coarsely reticulate than in the other varieties.



PLATE 4.—*Geranium cuneatum* variety *tridens*.

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Maui, Haleakala: Haleakala, Hillebrand (type?); "Haleakala, Maui" Hillebrand, Lydgate (type?); "in crack mauka of Puu Niau-niau Crater," altitude 6,750 feet, February 28, 1928, G. C. Munro 781; Kalialinui, Halemauu Trail to Ukulele, altitude 2,325 meters, September 20, 1926, C. S. Judd 56; Haleakala, September and October 1910, J. F. Rock 8520 and 8562; west slope of Haleakala, altitude 8,000 feet, R. S. Hosmer (Rock) 2680 (150); slopes of Haleakala above Ukulele, July 1910, C. N. Forbes 194.M. and 181.M.; Puu Niau-niau, Haleakala, September 1918, J. F. Rock and J. T. Hashimoto 16034; crater of Haleakala, August 1910, C. N. Forbes 283.M. (this collection has the smallest flowers of any examined); Haleakala, altitude 8,000 feet, February 15, 1930, H. St. John 10346; slopes of Haleakala, between the top of Halemauu Trail and Puu Niau-niau, altitude 2,375 meters, August 23, 1933, F. R. Fosberg 9974.

This variety resembles variety *hololeucum* very markedly. The denser tomentum, shorter stipules, predominantly tridentate leaves, predominantly larger flowers and larger seeds make it sufficiently distinct. Dr. Skottsberg, while remarking on its close resemblance to variety *hololeucum*, maintains it as a separate species, saying that it always has yellow stigmas, while all varieties of *G. cuneatum* have red ones. I examined fresh material brought from Maui by Mr. Judd a short time ago and found that the stigmas (style branches) varied from yellow to dark maroon-red. This variation may depend upon the age of the flowers.

This variety forms a small part of the cover on the brushy slopes of the upper third of Haleakala, and is also found in the crater. According to Hillebrand (Fl. Haw. Is., p. 55, 1888) the Hawaiian name is *hinahina*.

**Geranium humile** Hillebrand (pl. 5).

*Geranium humile* Hillebrand: Fl. Haw. Is., p. 56, 1888.

*Geranium cuneatum* Hooker variety *hypoleucum* Gray: Bot. U. S. Expl. Exped., p. 312, 1854, in part.

Subshrub, with woody stems growing embedded in moss and turf, rooting at the nodes, with short leafy and flowering branches extending above the surface; leaves oblong, contracted at base; serrate at apex, apex truncate, densely silvery, appressed villous beneath, green or reddish green above; cymes not usually more than 3- or 4-flowered; inner sepals with a short mucro at the apex, and with the membranous margins expanded into upward pointing lobes, which, in some cases, almost exceed the mucro in length, these





PLATE 5.—*Geranium humile* variety *mauiense*.

margins of a reddish color; flowers in general larger than those of *G. cuneatum*, about 2.5 cm across, petals noticeably purplish veined, otherwise white, pistil silky up to the style branches, these quite thick and fleshy, not filiform as in the other species of this section, (this fleshiness is not particularly evident in specimens in fruit); mature seeds unknown.

This species inhabits the very wet open bogs of Maui and Kauai. It has two varieties, one on each of these islands. The thick style branches, pointed out by Rock in his description of variety *kauaiense* but not noticed by him in the Maui variety, the large flowers with lobed, mucronate sepals, and the distinctive habit effectually separate this species from its closest relative, *G. cuneatum*. According to Hillebrand (Fl. Haw. Is., p. 56, 1888), the Hawaiian name for this plant is *Nohuanu*.

***Geranium humile* Hillebrand variety *mauiense* Fosberg, new name.**

*Geranium humile* Hillebrand: Fl. Haw. Is., p. 56, 1888, in part.

Leaves usually about 1.5 cm long, 1 cm wide, nerves hairy above; stipules glabrous except for ciliate margin, 5-8 mm long; cymes densely hairy; pedicels and outer sepals densely silky, inner sepals silky along midrib and quite ciliate on margin.

West Maui: top of Eeka [Eke] (Puu Kukui), Hillebrand and Lydgate, (type); "top of Mt. of W. Maui," Mann and Brigham 433; Puu Kukui, altitude 4,900 feet, December 20, 1928, E. H. Bryan, Jr. 647; Puu Kukui, altitude 5,300 feet, H. St. John 10268; Puu Kukui, September 25, 1916, G. C. Munro 415; Mauna Kukui (Puu Kukui), May 1910, C. N. Forbes 65.M.; Puu Kukui, August 21, 1910, J. F. Rock 8147; Puu Kukui, between Nakalalua and summit, altitude 1,675 meters, August 24, 1933, F. R. Fosberg 10038a; Eeke, Honokahau drainage basin, September 25 to October 17, 1917, C. N. Forbes 366.M.; Mauna Eeke, August 1918, J. F. Rock and I. Hashimoto.

***Geranium humile* Hillebrand variety *kauaiense* Rock.**

*Geranium humile* Hillebrand variety *kauaiense* Rock: Coll. Haw. Pub., Bull. 1, p. 9, December 1911.

*Geranium humile* Hillebrand: Fl. Haw. Is., p. 56, 1888, in part.

*Geranium cuneatum* Hooker variety *hypoleucum* Gray: Bot. U. S. Expl. Exped., p. 312, 1854, in part.

Smaller plant than variety *mauiense*; leaves usually about 1 cm long, 0.5 cm wide, not at all hairy above; stipules slightly pilose on margins, 3-4 mm long; cymes usually fewer flowered, less hairy; stigmas bright red.

Kauai: top of Waialeale, altitude 5,000 feet, September 24, 1909, J. F. Rock 4931 (type) and 4926 (probably same collection); Kauai, October 1916, J. F. Rock; J. F. Rock 8886; "Lehua Macanui," Mrs. Sinclair (Indig. Fl. Haw. Is., pl. 35); Alakai Swamp, near Kilohana Lookout, altitude 1,250 meters, January 3, 1936, F. R. Fosberg 12757.

This variety was mentioned but not described by Gray under *G. cuneatum* variety *hypoleucum* and by Hillebrand under *G. humile*. It is easily distinguished by its shorter stipules and smaller leaves, not at all hairy above.

The presence of this variety and of *Argyroxiphium gymnoxiphium* on Kauai suggests that in prehistoric times when the condition of the Kauai volcanic dome was somewhat similar to the present condition of the more recent volcanoes on Maui and Hawaii, Kauai may have had a correspondingly similar flora of arid land and high montane plants. This variety may be a relict of those times, persisting because even then perhaps it had migrated from the dry summits into the wet, boggy regions below.