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A new species of Hawaiian *Geranium* (Geraniaceae).

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**ABSTRACT.** A new species of *Geranium* is described, endemic to northeast Haleakala, Maui, Hawaiian Islands. The role of this taxon is examined in relation to the evolutionary history of the genus in Hawai'i.

**INTRODUCTION.** The genus *Geranium* is a cosmopolitan group comprising some 300 species worldwide, distributed through the temperate and warm temperate zones (Cronquist 1981). The Hawaiian representatives constitute a distinct section of the genus, named *Neurophyllodes* by Gray (1854). Degener (1937) elevated this section to the status of genus. Modern workers have predominately included the Hawaiian representatives in the broad genus, *Geranium*. The section *Neurophyllodes* is characterized by shrubby, woody habit, entire toothed leaves with parallel venation, and distinct stamens. It is generally agreed that the Hawaiian *Geranium* species have evolved from a common ancestor representing a single long-distance dispersal and colonization (Fosberg 1948).

Depending on the taxonomic treatment, there are from four (Fosberg 1936, St. John 1973) to nine endemic Hawaiian species of *Geranium*. (Degener and Greenwell 1952). In recent works, four Hawaiian species is generally accepted (Cronquist and Bissing 1976, Wagner, Herbst and Sohmer ined.). The description of this new taxon raises the current number to five endemic Hawaiian *Geranium* species.

*Geranium hanaense* species novum (fig. 1) TYPE: In montane bogs and at bog margins at 5500 ft. elevation within Haleakala National Park on the outer NE rift zone of Haleakala., East Maui, Hawaii. Evangeline Funk 207. (holotype, BISH-\_\_\_\_\_, photo \_\_\_\_; isotypes US, Rancho Santa Ana.)

#### LATIN DESCRIPTION:

#### DESCRIPTION

Woody spreading shrub to 1.5 m in height but usually less than .5 m, woody branch parts dark brownish with conspicuous petiole scars, herbaceous parts red to pinkish-brown sericeous with prominent stipules. These prostrate buried branches have extensive adventitious rooting with individual roots as long as 30 cm. Lower woody parts brownish with conspicuous ring-like petiole scars. Upper herbaceous and young woody stems pink to red, usually with silvery sericeous pubescence. Leaf blades variable in size and shape, obovate to oval-elliptical 11-(27-40)-50 mm long, 8-(10-20)-30 mm wide. Leaf

bases shortly to gradually tapering into slender ( 1 mm wide ) petiole, 7-(15)-20 mm long. Leaf tips rounded to obtuse with usually 3-(5)-7 shallow serrations in the apical third (mostly clustered at the tip) of leaf blades. Rarely in some large-leaved individuals, there are up to 19 shallow serrations, scattered in the upper 2/3's of the leaf blade. In some individuals, each of these serration is tipped with red. Upper and lower leaf surfaces as well as petioles are silvery sericeous with silky pubescence, the lower leaf surface pubescence thicker than above. Leaf blades with 5-8 veins, parallel at the apical tip, the central veins anastomosing in the lower third of the leaf blade. Senescent leaves prior to abscission are pale yellow beneath, reddish on upper surfaces. Leaf stipules prominent, 5-11 mm long, sparsely sericeous with broad sheathing bases narrowing to an elongated, acuminate tip. Young stipules with underlying bright red to pink coloration with scant silver sericeous pubescence; older stipules curling and brownish. Stipules often persistent for some time after abscission of the associated leaves. Inflorescence is a 3-(6)-10 flowered cyme, usually extending just beyond the foliage. Peduncles and pedicels with thick white sericeous pubescence. Flowers regular, 1.75-3 cm across, perfect, with five individual petals (give l x w dimensions here). Flower color variable in different individuals, most are white streaked with purple-magenta lines irradiating from the center of the flower. Irradiating lines are most crowded at the petal base, hence the purple color is darkest at the base of the petal, the center of the bowl-like flower. Some individuals have all white flowers. Anthers, filaments and style purple-magenta in color. Outer sepals surfaces sericeous, within mostly glabrous with a few scattered hairs. Sepals 5-9 mm long, 2-3.5 mm wide broad at base narrowing to an narrowly acuminate tip.

The species name hanaense is derived from the Hawaiian land district name, Hana, in which the new species is found.

#### DISTRIBUTION.

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Haleakala National Park. This taxa forms large spreading patches in sedge-dominated montane bog comprised of Carex svenonis, Carex alligata, Oreobolus furcatus, Vaccinium cf. pahalae, Plantago pachyphylla mauiensis, Styphelia sp., Argyroxiphium grayanum. Bryophytes include Trachypodopsis auriculata, Dicranum speirophyllum.

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Betsy Harrison-Gagne colls.  
other Evangeline Funk colls.

#### DIAGNOSIS:

The closest relative of Geranium hanaense appears to be the Geranium cuneatum alliance. In both the ssp. tridens (fr: East Maui) and the ssp. hololeucum (fr: Hawaii island) of G. cuneatum, the leaves are canescent on both upper and lower faces just as in G. hanaense. At the same time however G. hanaense shares other characters with other of the Hawaiian Geranium species, such as G. humile and G. multiflorum. In some ways, G. hanaense expresses characters intermediate between those of G. cuneatum and G. multiflorum.

Geranium hanaense differs from G. cuneatum ssp. tridens in generally having larger leaves and flowers, longer stipules, petioles, peduncles and pedicels, different flower color, differing habit.

The flowers of G. hanaense are larger than in the ssp. tridens, and though sometimes white, are most often streaked with magenta-purple. In the ssp. tridens, the flower color is not true white, but cream colored; this holds true even in herbarium specimens. Individuals of the ssp. tridens can also be found with reddish-purple irradiating patterns, though this trait is uncommon.

Leaf shape in G. hanaense is oval to obovate, while in ssp. tridens, the leaf shape is oblong-cuneate. In the new taxa, there are usually 3-7 leaf serrations, mostly five; in the ssp. tridens there are predominately three, rarely five. The leaf serrations of G. hanaense are shallower than the prominent incised apex that characterizes the ssp. tridens. This lack of deep serration also makes the leaf tip of G. hanaense acuminate versus the bluntish apex of ssp. tridens.

The stipules of Geranium hanaense are longer and more acuminate than in the G. cuneatum. In the new taxa, the stipules are sparsely appressed tomentose while those of ssp. tridens are less acuminate and densely silvery sericeous.

The inflorescence of the new taxon is much longer than is normally found in the G. cuneatum group. The longer pedicel and peduncle lengths are closer to those of G. multiflorum.

Geranium hanaense grows within a thick turf of interwoven sedges and bryophytes, having long submerged runner branches that root adventitiously. These liana-like branches are woody but flexible, scandent with erect tips. This vegetative reproduction by natural layering, in addition to the normal establishment of seedlings gives the species a greater capacity for occupying substantial vegetative cover. G. cuneatum tridens on the other hand, grows in rocky substrates in high elevation shrublands as a stiff, erect shrub, diffusely branched in the upper sections. G. cuneatum in the high altitude rocklands does not form adventitious roots and does not reproduce vegetatively, but does establish seedlings readily.

#### DISCUSSION:

Regarding the evolution of this genus in Hawaii, Carlquist and Bissing (1976) state that circumstantial evidence would indicate that Maui island may have been the original site of introduction of Geranium into the Hawaiian Islands. The age of East Maui has been conservatively estimated as 0.86 million years; West Maui at 1.63 million years (Macdonald, Abbott, and Peterson 1983).

Besides for the newly described G. hanaense, Maui contains populations of all four other Hawaiian species. G. hanaense, G. multiflorum and G. arboreum are found only on Haleakala. G. cuneatum occurs on Haleakala and Hawaii, but is much more abundant on the former island. G. humile occurs on West Maui and Kauai, but is extremely rare on the latter island. The combination of evidences would support the theory that Maui perhaps represents the center of evolution of the Hawaiian Geraniums. Carlquist and Bissing (1976) state, "...Hawaiian Geraniums may represent one of several instances that contain exceptions to the predominant and well documented west-to-east routes most genera of plants and animals in the Islands have followed."

This new species has most likely arisen relatively recently from a high-elevation Geranium, such as G. cuneatum that has dispersed into and adapted to the relatively young and emergent montane bogs of Haleakala. The closest geographical population of the G. cuneatum alliance and most likely ancestral seed source are the large populations of G. cuneatum ssp. tridens of the high altitude rocklands around Haleakala.

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Within this area however G. hanaense is one of the primary shrub species that occupies the open bogs. Though also at bog margins, this species is not found in the surrounding closed Metrosideros forest. This area receives greater than 400 inches of precipitation annually. Feral pigs threaten status of montane bog habitat, and hence ultimately the existence of Geranium hanaense.

The National Park Service is currently undergoing a program of fencing off some its more pristine montane bogs. These small edaphically defined areas contain high concentrations of unique endemic biota. The next scheduled fencing effort should permanently protect at least part of this species habitat from perturbations of feral pigs.

In 1982, seeds of this taxon were observed in the field to have germinated viviparously, still contained within their carpels. The seeds were collected and grown at park headquarters of Haleakala National Park, Maui. The plantings at park headquarters were at 7000 ft. elevation and were grown concurrently with the ssp. tridens for comparison.

Plants of the new species grown under cultivation at Haleakala National Park within the habitat of G. cuneatum tridens retained many of the characters that mark the taxon in the wild. Greenhouse specimens of Geranium hanaense were much more scandent in form, with less canescent, larger, more ovate leaves with greater leaf serrature than plants of G. cuneatum tridens grown under similiar conditions. Flowers of the new species were much larger than those of the ssp. tridens and retained their pronounced irradiating patterns. Cultivated plants of this species after three years of growth have started to root adventiously where their prostrate branche sections touch the ground. From these areas of adventitious rooting, young ascendent herbaceous shoots have emerged. Geranium cuneatum grown under similiar conditions have failed to develop such roots.

#### ACKNOWLEDGMENTS

WW, DH, LLL, CHL, GC, EF

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