

Monograph of *Trematolobelia* (Lobeliaceae). Hawaiian Plant Studies 107¹

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ABSTRACT: The genus *Trematolobelia* (Lobeliaceae) is endemic to the Hawaiian Islands. It resembles *Lobelia*, except for its peculiar dehiscence. On ripening the capsules shed their epidermis and soft mesocarp, exposing the outer bony endocarp which is pierced by numerous holes. On the exposed ridges or cliff faces, the slender stem is whipped back and forth by the wind. Centrifugal force ejects the seeds through the holes of the endocarp.

This monograph presents nine species and three varieties of the genus, five on Hawaii, two on Oahu and Molokai, and one each on Kauai, Lanai, east Maui, and west Maui. Eight of them are new or are new placements.

OF THE SEVEN GENERA OF LOBELIACEAE in the Hawaiian flora, one, *Lobelia*, is indigenous, and six are endemic. A very interesting one, *Trematolobelia*, is a beautiful flowering shrub. It is not easy to cultivate, as its natural habitat is clefts of precipices, or crests of mountains, exposed to gusty winds, or high bogs in the mountains, in areas above the rain forest, and typically with rainfall of 100 inches a year or more.

The shrubs have a single stem, bearing a plume of slender, straplike leaves. On growing to maturity (probably eight years or more), they then flower on numerous, terminal, radiating racemes, each bearing a spray of 50 or more rosy, 5–6 cm flowers. As the fruit develops, the leaves all fall, leaving the radiating, fruiting racemes naked on top of the single, bare stem. After the seeds ripen, the plant dies. Thus its years of growth produce a single stem, a glorious flowering, followed by fruiting and death.

It is a splendid flowering plant, but biologically its greatest interest is in its fruit dehiscence, the character that separates it from the genus *Lobelia* (Plate 1). This character lies in the fact that the green, subglobose capsule on maturity has the epidermis

and mesocarp soften, and fall or wash away by the frequent rains. The outer endocarp is a sclerenchyma, subglobose, but the sides are pierced by numerous rounded holes. Within each cell is a papery endocarp enclosing the placenta and its numerous small seeds. A slender two-meter plant is lashed by the gusty trade winds, and as it whips back and forth, the centrifugal force expels the ripe, winged seeds. These are freed from the placenta a few at a time, they fall down through the basal suture of the papery endocarp and are flung out through the holes of the sclerenchyma, just as salt is flung through the holes of a salt shaker. This process was well known and was documented by previous botanists, but now histological studies of the fruit and its development have been made by Carlquist (1962).

NOMENCLATURE

The original species of this genus was published in 1832 by Hooker and Walker-Arnott (1830–1841), as *Lobelia macrostachys*, based on a collection from Oahu by Lay and Collie. Later, Zahlbruckner (1891), by study in the herbarium, detected the unique fruit character and dehiscence, and upon this character published it as the new genus *Trematocarpus*. When it was noted that this was a later homonym of *Trematocarpus* Kuetz., Phyc. Gen. 410, 1843, for a genus of algae, Zahlbruckner

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PLATE 1. *Lobelia kauaiensis* (Rock) Skottsbo., Waialeale, Kauai, photo by Dr. S. Conant, Aug. 1979.

renamed the plant *Trematolobelia* (1913:45–46).

According to Rock (1919:141) neither Gaudichaud nor Hillebrand had available fruiting specimens of this species. It remained for Zahlbruckner, working in the herbarium in Vienna, to detect the unique fruiting and the seed dispersal of the plant. In his new generic names, he employed the Greek word *trema*, hole or aperture, which was descriptive of the structure of the fruit. Immediately, Hemsley (1892:154, 1893:289) disputed Zahlbruckner's view, and argued that the holes in the ripe fruit were due to chewing by insects. Stapf (1893:396–398), after studying the specimens in the Kew herbarium, also disputed Zahlbruckner's interpretation and reduced his genus to *Lobelia*.

All doubt on this question was resolved by the field observations, collections, and publications by Rock (1913:46, 1919:140–148, pl. 70–73), who described, illustrated, and proved that the fenestration of the bony endocarp in the fruits was the natural development, and that when exocarp and mesocarp sloughed away, that the wind shook the seeds out through those holes. Rock accepted

Trematolobelia macrostachys as occurring on Oahu, Molokai, Maui, Lanai, and Hawaii, but in 1913 had added var. *grandifolia* from Hawaii and var. *kauaiensis* from Kauai.

Subsequent publications were by Presl, who (1836:47), with doubt, transferred the species to *Delissea*; and in 1934 *T. sandwicensis* Degener, an invalid renaming of *T. macrostachys*; in 1936 *T. sandwicensis*, var. *kaalae* Degener; in 1934 *T. grandifolia* (Rock) Degener; in 1953 *T. macrostachys*, var. *kaalae* (Deg.) Wimmer; in 1968 *T. Wimmeri* Deg. & Deg.; and in 1971 *T. macrostachys*, var. *haleakalaensis* St. John.

As a result of his present studies, the author now accepts nine species and three varieties of *Trematolobelia*, five on Hawaii, two on Oahu and Molokai, and one each on Kauai, east Maui, west Maui, and Lanai. Distinctive characters have been found in the size and shape of the corolla, the pubescence of the filament tube, the size and pubescence of the anthers, the size and shape of the calyx lobes, the color and pubescence of the inflorescence rhachis, the size and shape of the rhachis bracts, the pubescence of the stem, and the size and shape of the leaf blades.

KEY TO SPECIES OF *Trematolobelia*

- A. Inflorescence axis and stem glabrous,
 - B. Corolla glabrous; calyx lobes lanceolate,
 - C. Anthers hirsute at base,
 - D. Stem at first black or red,
 - E. Stem at first black; calyx lobes 4–9 mm long, entire, obtuse, apiculate; inflorescence bracts 10–32 mm long, lanceolate; corolla scarlet to deep purplish red.
 - Kauai *T. kauaiensis*.
 - E. Stem at first red; calyx lobes 8–9 mm long, red, serrulate, obtuse or acute; corolla white. Hawaii *T. grandifolia*.
 - D. Stems not black or red,
 - F. Rhachis and upper stem dark purplish; calyx lobes 6–7 mm long, 4.5–5 mm wide, lanceolate, obtuse; inflorescence terminal, solitary, the bracts 15–30 mm long, linear lanceolate; corolla magenta. Oahu *T. singularis*.
 - F. Rhachis and upper stem green,
 - G. Calyx lobes 3.5–7 mm long; apex of filament tube hirsute,
 - H. Bracts 15–35 mm long, ligulate lanceolate; calyx lobes 3.5–5.5 mm long, ovate to lanceolate; corolla 5–6 cm long. Oahu *T. macrostachya*, var. *macrostachya*.
 - H. Bracts 20–25 mm long, ligulate; calyx lobes 5.5–7 mm long, ligulate, sub-acute. Molokai var. *ligulata*.

- G. Calyx lobes 8.5–10 mm long, elliptic-oblong, acute; apex of filament tube pilose; inflorescence bracts 15–40 mm long, lanceolate. E. Maui. var. *haleakalaensis*.
- C. Anthers glabrous below the apex; filament tube glabrous; corolla 40 × 4 mm, pink; inflorescence bracts 10–20 mm long, ligulate; capsules 7–8 mm in diameter; leaves 1.4 cm wide. W. Maui *T. Forbesii*.
- B. Corolla pubescent, 50–55 × 3–4 mm,
- I. Calyx lobes 10–15 mm long, ligulate; leaves 13–17 × 1.5–2.2 cm; filament tube pilose in lines; capsules 8–17 mm in diameter. E. Maui. *T. macrostachys*, var. *haleakalensis*.
- I. Calyx lobes 9–11 mm long, narrowly oblong, subacute, auriculate at base; leaves 13–25 × 2.1–3.3 cm; filament tube puberulent; capsules 8–10 mm in diameter. Lanai. *T. auriculata*.
- A. Inflorescence axis pubescent; corolla 5–6.5 cm long,
- J. Leaves sessile,
- K. Calyx lobes obtuse, 6–8 mm long,
- L. Calyx lobes elliptic, 7–8 mm long; leaves 20–26 × 1.9–2.2 cm; inflorescence bracts 15–22 mm long, lanceolate. Hawaii *T. Rockii*, var. *hawaiiensis*.
- L. Calyx lobes oblong, 6–7 mm long; inflorescence bracts 15–50 mm long, narrowly lance ligulate; leaves 10–23 × 1–1.4 cm. Molokai *T. Rockii*.
- K. Calyx lobes lanceolate, 5–8 mm long; corolla 6.5–8 cm long, white; filament tube glabrous; anther base glabrous. Hawaii *T. Wimmeri*.
- J. Leaves with petioles 2–40 mm long,
- M. Petioles 2–4.5 mm long,
- N. Calyx lobes 7–9 mm long,
- O. Calyx lobes narrowly elliptic lanceolate; corolla creamy, 4.5 cm long, 10–11 mm in diameter at base; floral bracts 15–50 mm long, lanceolate; leaves 28–35 × 4–7 cm; stem glabrous. Hawaii. *T. grandifolia*.
- O. Calyx lobes elliptic; leaves 20–25 × 1.9–2.2 cm; floral bracts 15–25 mm long, lanceolate. Hawaii *T. Rockii*, var. *hawaiiensis*.
- N. Calyx lobes 4–5 mm long, deltoid, apiculate; corolla 4.5 cm long, 6–7 mm in diameter at widest point, rose pink, puberulent; leaves 9–14 × 1.6–1.8 cm. Hawaii. *T. lustrialis*.
- M. Petioles 20–40 mm long; calyx lobes 7–9 mm long, narrowly elliptic lanceolate; corolla 6 cm long, creamy with rose streaks; filament tube with puberulent lines; anthers pilose on lower 1/3; leaves 22.5–24 × 2.1–2.2 cm. Hawaii. *T. kohalaensis*.

***Trematolobelia auriculata* sp. nov.**

Figures 1*d–h*; 8. no. 6; photo by Hitchcock, Sci. Monthly 5:420, fig. 31, 1917.

DIAGNOSIS HOLOTYPE: Frutex est, caule glabro viridi varie obscure subpurpureo, foliis alternatis glabris, petiolis 20–25 mm longis anguste alatis, laminiis 15–21 × 2.8–3.5 cm subcoriaceis anguste oblanceolatis apice acuto basi anguste cuneata marginibus undulatis supra obscure viridibus laevisque infra pallide viridibus, inflorescentia cum

ramis apicalibus ascendentibus divergentibus compluribus basi 15 cm longa cum foliis bracteosi 3–6 cm longis, racemis secundis glabris, rhachidi 25 cm longo et cum bracteis reflexis conspicuis 10–27 × 4–6 mm anguste lanceolatis foliaceis, pedicellis 12–20 mm longis gracilibus et in tertia infera cum 2 bracteolis 2 mm longis, hypanthio 3–4 mm longo subgloboso 10-costato, lobis calycis 9–11 × 2–2.7 mm anguste oblongis subacutis hirsutulo-ciliatis, corollis 5.5 cm longis ut videtur subrubris tubo 3 cm longo 3–4 mm

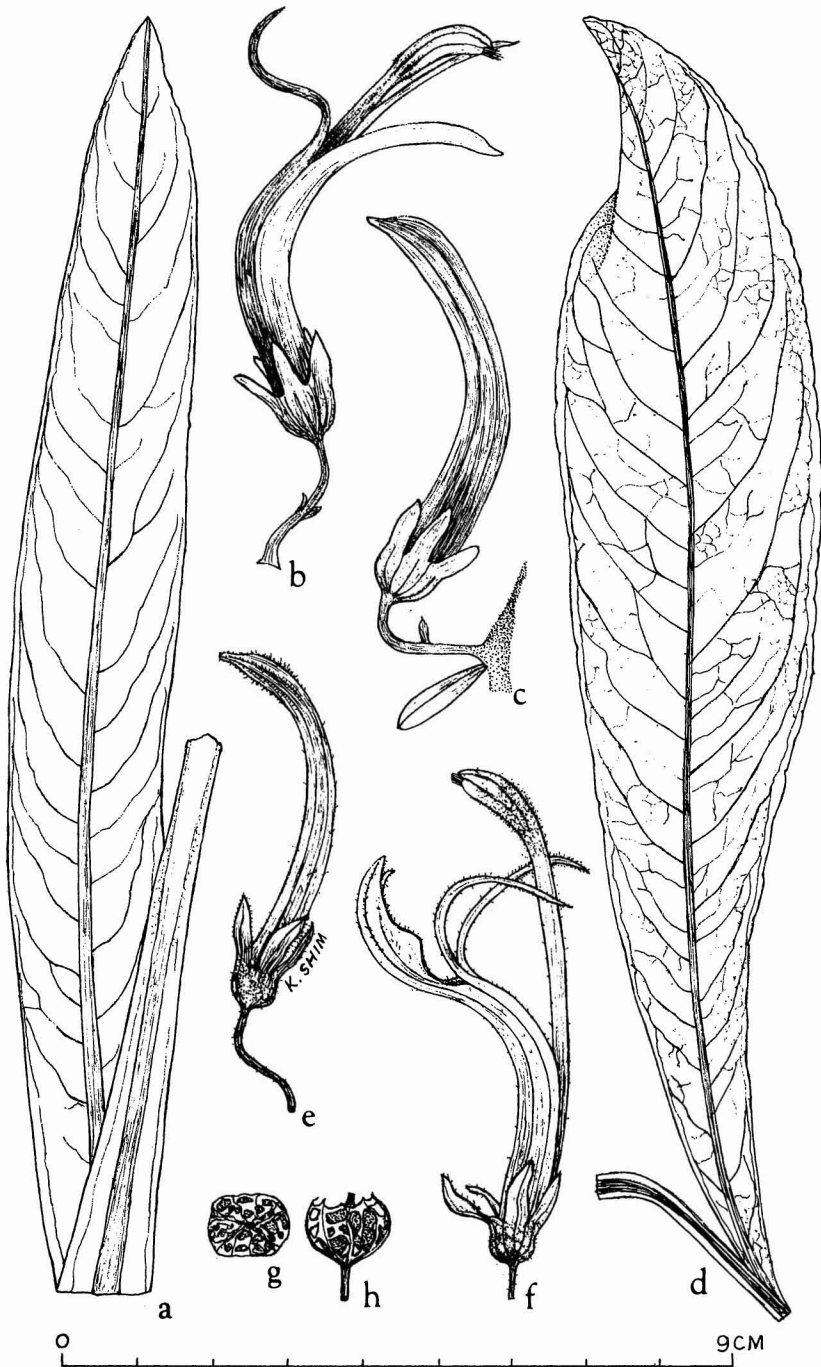


FIGURE 1. *Trematolobelia kohalaensis* St. John, holotype. *a*, leaf $\times 1$; *b*, flower, $\times 1$; *c*, bud, $\times 1$. *T. auriculata* St. John, holotype. *d*, leaf $\times 1$; *e*, bud, $\times 1$; *f*, flower, $\times 1$; and from Munro 414, *g*, *h*, fruit, $\times 1$.

diametro arcuate decurvato in basi puberulo et proxima apicem in suturis puberulis, 5 lobis 25×1.7 mm ligulatis ciliolatis reflexis, tubo filamentarum 4.5–5 cm longo secus suturis puberulis, antheris usque ad medium hirsutululis eis superis 11 mm longis illis inferis 9 mm longis et in apice a setis rigidis albis 1.5 mm longis penicillatis.

DIAGNOSIS OF HOLOTYPE: Shrub; stem glabrous, green to dark purplish; leaves alternate, glabrous; petioles 20–25 mm long, narrowly winged; blades 15–21 \times 2.8–3.5 cm, subcoriaceous, narrowly oblanceolate, the apex acuminate, the base narrowly cuneate, the margins undulate, above dark green and smooth, below pale green; inflorescence of several divergent ascending apical branches, the base 15 cm long, with bracteal leaves 3–6 cm long; racemes secund, glabrous; rhachis 25 cm long, with conspicuous reflexed bracts 10–27 \times 4–6 mm, narrowly lanceolate, foliaceous; pedicels 12–20 mm long, slender and at the lower third with two 2 mm bracteoles; hypanthium 3–4 mm long, subglobose, 10-ribbed; calyx lobes 9–11 \times 2.0–2.7 mm, narrowly oblong, subacute, hirsutulous ciliate; corolla 5.5 cm long, apparently reddish, the tube 3 cm long and 3–4 mm in diameter, arcuate downcurved, puberulent at base and along the sutures near the tip, the 5 lobes 25×1.7 mm, ligulate, ciliolate, reflexing; filament tube 4.5–5 cm long, puberulent along the sutures; anthers hirsutulous up to the middle, the upper ones 11 mm long, the lower ones 9 mm long, and at apex penicillate with white bristles 1.5 mm long.

DESCRIPTION: Dehisced capsules 6–7 mm high, 7–8 mm in diameter, slightly oblate globose, with numerous apertures and narrow intervals.

HOLOTYPE: Hawaiian Islands, Lanai Island, Lanaihale, 10/14/16, *G. C. Munro 628* (BISH).

SPECIMENS EXAMINED: Hawaiian Islands, all from Lanai Island, head of Hookio Valley, Jan. 14, 1964, *O. & I. Degener 34,719* (w); Puu Alii, 3,200 ft alt., *Munro 225*; on ridge to Lanaihale, 3/29/15, *Munro 414*; Lanaihale, 10/4/16, *Munro 430*; Lanaihale, 3,200 ft alt.,

Munro 460; Haalelepaakai, Nov. 11, 1916, *Munro*, s. n.

DISCUSSION: *T. auriculata* is most closely related to *T. macrostachys* (H. & A.) Zahlbr., var. *haleakalaensis* St. John, a variety with the leaves 13–17 \times 1.5–2.2 cm, linear oblanceolate; calyx lobes 10–15 mm long, ligulate, subacute; filament tube glabrous; and the anthers nearly glabrous. *T. auriculata* has the leaves 13–25 \times 2.1–3.3 cm, oblanceolate, auriculate at base; calyx lobes 9–11 mm long, narrowly oblong, subacute; filament tube puberulent at base; and the anthers hirsute up to the middle.

The new epithet is the Latin adjective, *auriculata*, with little ears, and it refers to the auriculate calyx lobes.

Trematolobelia Forbesii sp. nov.

Figures 2a–f; 8, no. 4.

DIAGNOSIS HOLOTYPE: Frutex glaber est, foliis sessilibus 26 \times 2 cm subcoriaceis ligulatis sed in apicibus ambis deminuentibus marginibus minute undulatis supra obscure viridibus infra pallidis et glaucis, ramis floriferis apicalibus 47 cm longis viridibus, pedunculo 22 mm longo et cum bracteis foliosis paucis, rhachidi glabro, bracteis inflorescentiae 15–25 mm longis lanceo-linearibus, pedicellis 10–15 mm longis gracilibus, hypanthio 4–5 mm longo cupulato, 5 lobis calycis 4–5 mm longis lanceolatis obtusis, corollis 40 \times 4 mm rosaceis in alabastro apice crebre decurvato, 5 lobis 2 cm longis 1 mm latis ligulatis, tubo filamentarum glabro, antheris infra apices glabris, antheris superis 10–11 mm longis, illis inferis 8 mm longis et in apice a setis albis 1.5 mm longis penicillatis.

DIAGNOSIS OF HOLOTYPE: Glabrous shrub; leaves sessile, 26 \times 2 cm, subcoriaceous, ligulate, but tapering to each end, the margins minutely undulate, above dark green, below pale and glaucous; flowering apical branches 47 cm long, green; peduncle 22 mm long, with a few leafy bracts; rhachis glabrous; inflorescence bracts 15–25 mm long, lance-linear; pedicels 10–15 mm long, slender; hypanthium 4–5 mm long, cupulate; 5 calyx lobes 4–5 mm long, lanceolate, obtuse; corolla 40 \times 4 mm, glabrous, pink, in bud the apex sharply down-

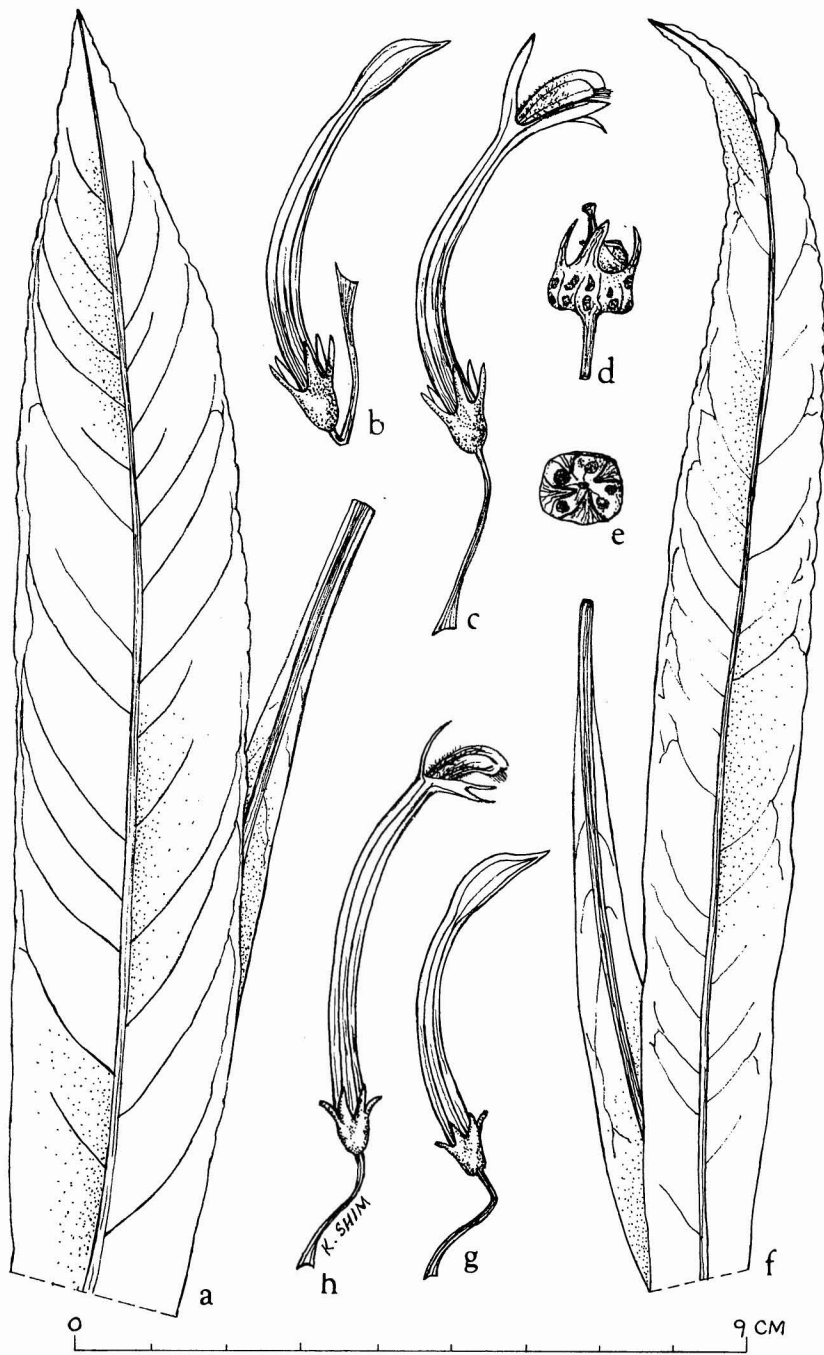


FIGURE 2. *Trematolobelia macrostachys* (H. & A.) Zahlbr. in Rock, var. *ligulata* St. John, holotype. *a*, leaf, $\times 1$; *b*, bud, $\times 1$; *c*, flower, $\times 1$; *d*, *e*, fruit, $\times 1$. *T. Forbesii* St. John, holotype. *f*, leaf, $\times 1$; *g*, bud, $\times 1$; *h*, flower, $\times 1$.

curved, the 5 lobes 2 cm long, 1 mm wide, ligulate; filament tube glabrous; anthers glabrous below the apex; upper anthers 10–11 mm long; lower anthers 8 mm long, penicillate with white bristles 1.5 mm long.

SUPPLEMENTARY DESCRIPTION: Leaf blades 19–26 × 1.4–2 cm; capsules 7–8 mm long, subglobose, the calyx lobes persistent.

HOLOTYPE: Hawaiian Islands, West Maui Island, ridge to Eeka, main ridge, upper part, Honokahau Drainage Basin, Sept. 25 to Oct. 17, 1917, *C. N. Forbes 362.M.* (BISH).

SPECIMENS EXAMINED: Hawaiian Islands, West Maui Island, Kamaalaea Bay, *H. Mann Jr. & W. T. Brigham 463* (NY); w. ridge of Mt. Eke, near top, VIII/29/27, *O. Degener 18,063* (NY); near Mt. Eke on Waihee side, VII/2/27, *Degener 7,974* (NY); n. of summit of Puu Kukui, April 5, 1959, *Ward Fleming* (Degener no.) 25,176 (W); Haelaau-Puu Kukui trail, opening in rain forest, 4,300 ft alt., Dec. 18, 1928, *G. R. Ewart III 134* (BISH).

DISCUSSION: *T. Forbesii* is most closely related to *T. macrostachys* (H. & A.) Zahlbr., var. *haleakalaensis* St. John, of east Maui, a variety with the leaves 13–17 × 1.5–2.2 cm; calyx lobes 10–15 mm long, lanceolate, subacute, revolute, subauriculate; corolla 5.5 cm long, puberulent at base; and the capsules 8–17 mm in diameter. *T. Forbesii* has the leaves 19–23 × 1.4 cm; calyx lobes 5–6 mm long, lanceolate, obtuse; corolla 4 cm long, glabrous; and the capsules 7–8 mm in diameter.

The new epithet is chosen to honor the collector, Charles N. Forbes (1883–1920), an active, capable explorer and botanist, who was the first botanist on the staff of the Bishop Museum.

Trematolobelia grandifolia (Rock?) Degener, Fl. Haw. fam. 339:

4/20/34, in key only, without basionym; Wimmer, Engler's Pflanzenreich IV, 276b II, 758, 1953; 276c:901, 1968; Skottsbo., Göteborgs Bot. Trädgård, Meddel. 15:484, 1944.

T. macrostachys (H. & A.) Zahlbr., var. *grandifolia* Rock, Coll. Hawaii, Bull.

2:46, 1913; Bishop Mus., Mem. 7(2): 147–148, pl. 73, 1919.

Figures 3; 8, no. 8.

ORIGINAL DIAGNOSIS: “Plant erect, branching as in the species; stem dark reddish, leaves large, obovate-oblong, subentire or faintly crenulate with callous glands, pale green, midrib dark, blackish, acute or obtuse at the apex, gradually narrowing at the base into broad, margined petioles of 2–5 cm, 20–30 cm long, 5–7 cm broad; racemes longer than in the species, robust 50–60 cm long, bracts broad, foliaceous; calyx twice as large as in the species, corolla not of even width, somewhat sigmoid, pure white, broader and longer than in the species.”

REVISED DIAGNOSIS: Plant glabrous; stem erect, dark reddish, 2 cm in diameter near the base of the radiating flowering racemes; leaves 28–35 cm long, 5–6 cm wide (including the 2–5 cm winged petiole), narrowly oblanceolate, subentire, green above, pale green below, the thickened midrib dark; racemes more than 43 cm long, secund; peduncles 15 cm long, curving; bracts foliaceous, the lower ones 4–5 cm long, 1.5 cm wide, lanceolate, the upper ones 15 mm long, 8 mm wide; pedicels in flower 2 cm long, bibracteolate near the middle, in fruit 3–3.5 cm long; hypanthium subglobose, glabrous, in flower 7 mm in diameter, in fruit 13 mm; calyx lobes 8–9 mm long, deltoid-lanceolate, red-serrulate; corolla 5.5–6 cm long, curved, 7 mm in diameter at the middle, narrowed above that, white (vide Rock 1913:46), though when dried it appears dark reddish; filament tube 4.2–5 cm long, sparsely pilose; upper anthers 13 mm long, densely pilose at base; lower anthers 10–11 mm long, at apex penicillate with stiff white hairs 1.8–2 mm long; stigmas densely white pilosulous, the hairs 1 mm long.

LECTOTYPE: Hawaiian Islands, Hawaii Island, S. Kohala Mts., 4,200 ft alt., Oct. 1909, *R. S. Hosmer 6,090* (BISH), the specimen with mature leaves, and marked type by Rock, and illustrated by him (1919: pl. 73).

SPECIMENS EXAMINED: Hawaiian Islands, Hawaii Island, Kohala Mts., Waimea, Sept.

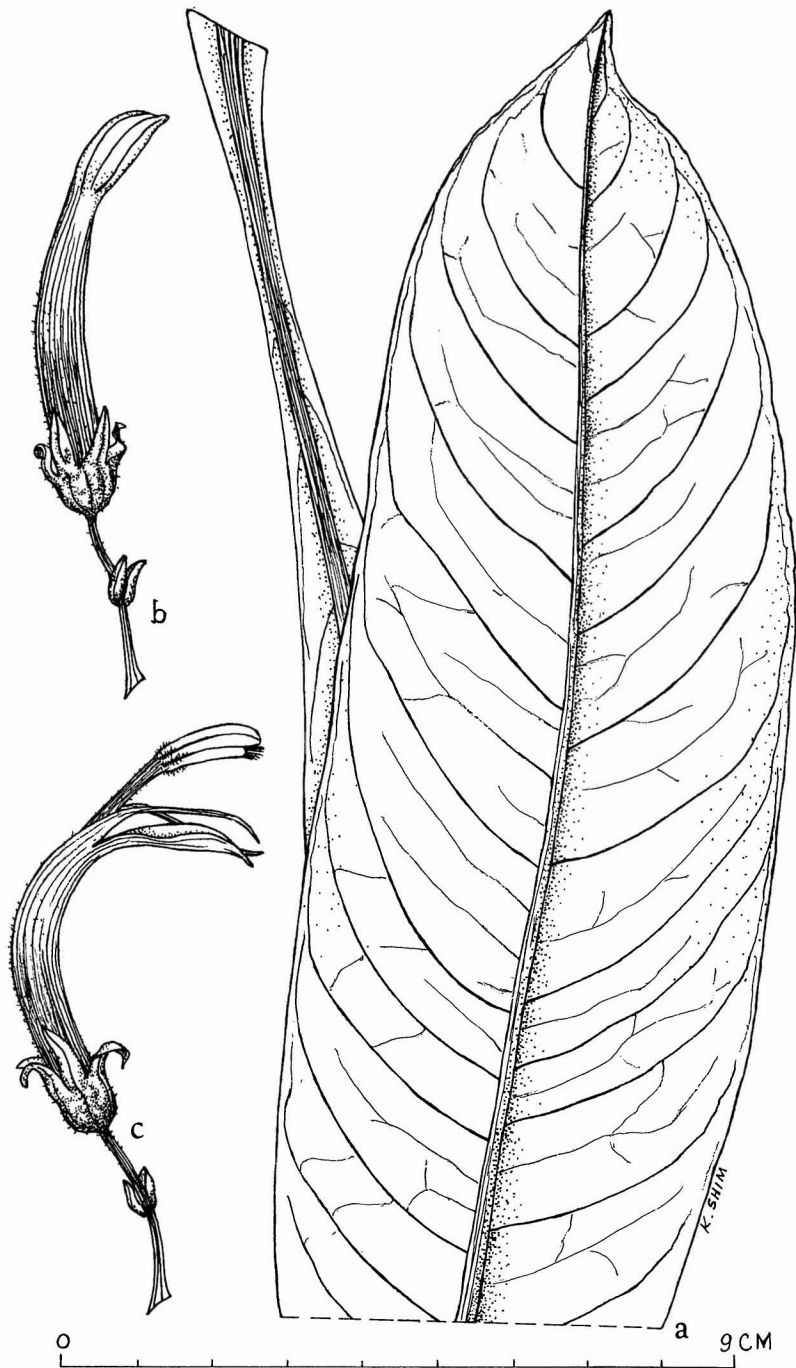


FIGURE 3. *Trematolobelia grandifolia* (Rock) Deg., lectotype. a, leaf, $\times 1$; b, bud, $\times 1$; c, flower, $\times 1$.

1911, *C. N. Forbes 489.H.* (BISH); Kohala, sphagnum bogs, 4,000 ft alt., Oct. 4, 1958, in part, *J. F. Rock* (BISH).

DISCUSSION: The type specimens were not collected by Rock, but by R. S. Hosmer of the Yale Forestry School, temporarily serving the Hawaiian Board of Agriculture and Forestry. It was received by J. F. Rock, numbered 6,090, and deposited in the Board of Agriculture and Forestry herbarium, later transferred to the College of Hawaii, and later to the Bishop Museum. Besides the leafy specimen that Rock illustrated and which is above chosen as lectotype, there are two other specimens, consisting of flowering racemes, lacking leaves, and differing in having puberulent rhachis and other characters. These are here renumbered 6,091, and determined as *T. kohalaensis* St. John.

Trematolobelia kauaiensis (Rock) Skottsbo., Göteborgs Bot. Trädgård, Meddel. 15: 484, figs. 519, 520, 1944; E. Wimmer, Pflanzenreich IV, 276c: 901, 1968.

T. macrostachys (H. & A.) Zahlbruckn., var. *kauaiensis* Rock, (as *Kauaiensis*), Coll. Hawaii, Bull. 2: 46–47, 1913; E. Wimmer, Pflanzenreich IV, 276b: 758, 1953.

Figures 4a–e; 8, no. 1; pl. 1.

ORIGINAL DIAGNOSIS: “Plant much smaller than the species, stems black; leaves linear oblong, acuminate at both ends, dark green, glossy with red veins, midrib and callous glands, 16 cm long, 3 cm wide; racemes short, 24–34 cm long, flowers very strongly arched, the apex returning to the level of the base, of a scarlet red; otherwise as in the species.”

EXPANDED DIAGNOSIS OF HOLOTYPE: Plant 1.5 m tall; glabrous; stem at first black, 13–15 mm in diameter, later brown; leaf scars 5–6 mm in diameter, oblate shield-shaped to hemispheric; bundle scar single, cylindrical, central; leaves 14–17 cm long, 17–21 mm wide (including the 18–20 mm slender petiole), linear oblanceolate, the margins low undulate from one red saccate gland to the next, the apex acute, the base long cuneate, above

smooth shiny green, below pale green, the midrib red, the secondary veins 18–20 in each half, curved long ascending, and connected by an intramarginal vein 1–2 mm from the margin; racemes apparently 6–8, secund, half ascending; peduncle 9–20 cm long, leafy bracted; rhachis in flower 12–21 cm long; bracts 10–23 mm long, lanceolate, foliaceous, red callous crenulate; pedicels 17–20 mm long, near the flower bent upwards, bibracteolate below the middle; hypanthium 6–7 mm long, obovoid, dark; calyx lobes 6–7 mm long, oblong lanceolate, obtuse; corolla in bud and in anthesis arched in a semicircle, 5–5.5 cm long, 5–6 mm wide, and of nearly equal width throughout, “scarlet red,” filament tube 5 cm long, sparsely pilose throughout; anthers densely pilose on the lower third; upper anthers 15 mm long; lower anthers 11 mm long and at apex densely penicillate with stiff white hairs 2.3 mm long; fruit subglobose, 11–13 mm in diameter, green, smooth, 10-ribbed, crowned by the calyx lobes.

SUPPLEMENTARY DESCRIPTION: Plant 1.5–2 m tall; sap barely milky; leaves 14–23 cm long, 17–24 mm wide (including the 12–33 mm petiole); racemes 6–9; rhachis in fruit 17–26 cm long; fruit after sloughing off the exocarp with the mesocarp 9–10 mm in diameter, longer than broad or broader than long, and with few apertures, when observed from a side there are about 4 rounded ones near the base and 4 tiny circular ones above it; seeds 1.2 mm long, 0.5 mm wide, narrowly obovate, flat, pale brown.

HOLOTYPE: Hawaiian Islands, Kauai Island, “summit of Mt. Waialeale, elevation 5,200 feet, in the open flat swamps in company with *Lobelia kauaiensis*, *Tetraplasandra Waialealae*, *Geranium humile* var. *Kauaiense*, etc. Also along Kailiili and Kaluiti streams and near Keaku cave; flowering Oct. 20, 1911. Coll. *J. F. Rock*; type in the College of Hawaii Herbarium, no. 8877.” Now in (BISH). Type examined.

There is a confusion in the data of the type collection. There are three sheets (BISH), labeled by Rock, and with the correct locality data, but the number is 8,077. Rock published

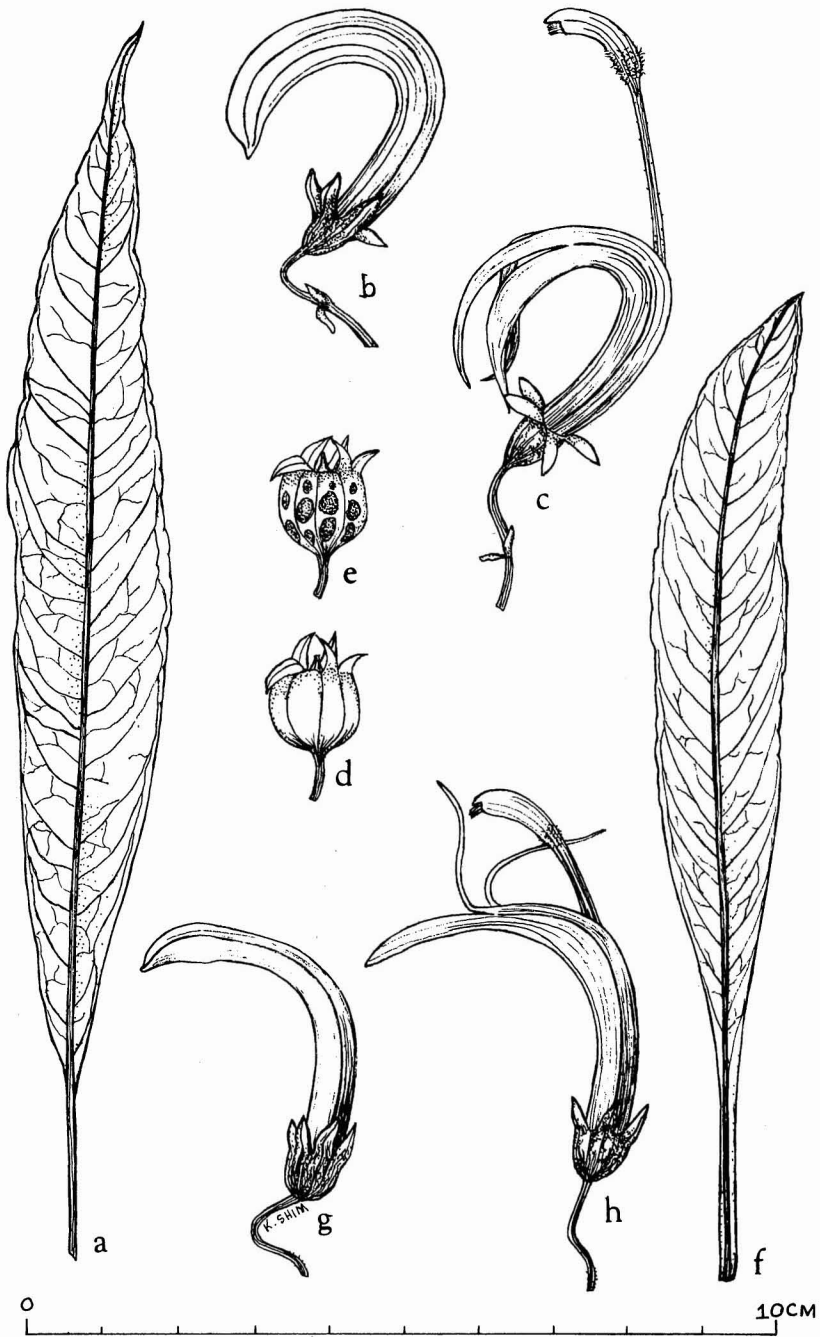


FIGURE 4. *Trematolobelia kauaiensis* (Rock) Skotts., holotype. *a*, leaf, $\times 1$; *b*, bud, $\times 1$; *c*, flower, $\times 1$; *d*, *e*, fruit, $\times 1$. *T. lustralis* St. John, holotype. *f*, leaf, $\times 1$; *g*, bud, $\times 1$; *h*, flower, $\times 1$.

it as 8,877, and it so appears in his handwritten and also in his typed number list. There are also two of his sheets from the same place and date, but they are unnumbered. The writer now changes all these to the number of the holotype, 8,877.

SPECIMENS EXAMINED: Hawaiian Islands, all from Kauai Island, along Power Line, Alakai Swamp, very local at top of wind-swept shrubby ridge, Jan. 12, 1952, *O. Degener & A. Greenwell 21,726* (BISH, NY); summit of Kahili, Aug. 1909, *C. N. Forbes 296.K.* (BISH); Alakai Swamp, July 3 to Aug. 18, 1917, *Forbes 917.K.* (BISH); near summit of Kahili, in shady understory, Nov. 21, 1968, *R. W. Hobdy 32* (BISH); Wahiawa Mts., *J. M. Lydgate* (BISH); above Wahiawa, wet ground near bog, 700 m alt., Feb. 8, 1927, *L. H. MacDaniels 611* (BISH); Waialeale summit, Oct. 20, 1912, *Rock 8,031* (BISH); Waialeale, Sept. 1909, *Rock* (BISH); Kilohana Lookout, n.w. end of Alakai Swamp, Na Pali-Kona Forest Res., in woods, 4,023 ft alt., Dec. 27, 1930, *H. St. John et al. 10,748* (BISH); Wahiawa Bog, head of Wahiawa Stream, Lihue-Koloa Forest Res., 2,100 ft alt., Dec. 29, 1930, *St. John et al.* (BISH).

DISCUSSION: Skottsberg (1944:484) when establishing this as a species, stated that, "The capsule is smaller and more or less distinctly higher than wide in *kauaiensis*, ..." With more collections available, it is now evident that the capsules are sometimes higher than wide, but more commonly wider than high. Skottsberg well points out, and illustrates, that the capsules have fewer and smaller apertures than those of *T. macrostachys*.

***Trematobelia kohalaensis* sp. nov.**

Figures 1a–e; 8, no. 9.

DIAGNOSIS HOLOTYPE: Foliis 22.5–24 cm longis 2.1–2.2 cm latis lineari-oblancoelatis petiolis 2–4 cm longis alatis additis acutis integribus sed intra marginem rubri-glandulosi-saccatis, racemis fere 30 cm longis compluribus terminalibus radiatis, rhachidi dense puberulenti, bracteis 1.5–2.5 cm longis 3–5 mm latis anguste ellipticis glabris crenula-

tis, floribus secundatis, pedicellis 18–24 mm longis gracilibus glabris proxima medium minute bibracteolatis, hypanthio glabro hemisphaerico 6–7 mm longo, lobis calycis 7–9 mm longis anguste elliptici-lanceolatis glabris integribus, corolla 6 cm longa 6–7 mm diametro "spuma-lacti-coloratis cum striis rosaceis pallidis," tubo filamentarum 5 mm longo ad apicem in lineis puberulis, antheris albis in tertia infera pilosis, antheris superioribus 13 mm longis, illis inferioribus 10 mm longis in apice penicillatis cum pilis 2.5–3 mm longis rigidis albis, lobis stigmatis 1.8–2 mm longis late ovatis, fructu incognito.

DIAGNOSIS OF HOLOTYPE: Leaves 22.5–24 cm long, 2.1–2.2 cm wide, linear oblanceolate, including the 2–4 cm winged petiole, acute, entire, but just within the margin red glandular saccate; racemes about 30 cm long, several, terminal, radiating; rhachis densely puberulent; bracts 1.5–2.5 cm long, 3–5 mm wide, narrowly elliptic, glabrous, crenulate; flowers secund; pedicels 18–24 mm long, slender, glabrous, minutely bibracteolate near the middle; hypanthium glabrous, hemispheric, 6–7 mm long; calyx lobes 7–9 mm long, narrowly elliptic lanceolate, glabrous, entire; corolla 6 cm long, 6–7 mm in diameter, "cream colored with faint rose streaks"; filament tube 5 mm long, puberulous in lines near the apex; anthers white pilose on the lower 1/2; upper anthers 13 mm long; lower anthers 10 mm long, penicillate at apex with stiff white hairs 2.5–3 mm long; stigmatic lobes 1.8–2 mm long, broadly ovate; fruit unknown.

HOLOTYPE: Hawaiian Islands, Hawaii Island, Kohala Mts., above Waimea, boggy ground, 29/9/22, *Carl S. Skottsberg 711* (BISH).

SPECIMENS EXAMINED: Same locality, Oct. 1909, *R. S. Hosmer 6,091* (BISH); South Kohala Dist., Kohala Bog, 100 yd from access road near Alakahi cliffs, with stunted *Metrosideros* and *Cheirodendron* trees, 3,000 ft alt., flower color red-purple, 5 ft shrub, June 2, 1981, *Bitty Roy & Mycol Doyle ESP 320* (Hilo).

DISCUSSION: Skottsberg (1926:264; 1936:189) discusses this plant and gives floral details.

T. kohalaensis is most closely related to *T. grandifolia* (Rock?) Deg., also of the Kohala Mountains, a species with the leaves 25–30 × 5–7 cm, narrowly oblanceolate; racemes 50–60 cm long; inflorescence bracts 15–25 mm long, lanceolate; corolla 5–5.5 cm long, white; filament tube glabrous; and the lower anthers penicillate with bristles 2.5 mm long. *T. kohalaensis* has the leaves 22.5–24 × 2.1–2.2 cm, linear oblanceolate; racemes 30 cm long; inflorescence bracts 15–25 mm long, narrowly elliptic; corolla 6 cm long, cream colored with faint rose streaks; filament tube puberulous in lines near the apex; and the lower anthers penicillate with bristles 2.5–3 mm long.

The new epithet is formed from the name of the type locality, Kohala, and *-ensis*, the Latin adjectival place ending.

***Trematolobelia lustrialis* sp. nov.**

Figures 4f–h; 8, no. 10.

DIAGNOSIS HOLOTYPE: Frutex 1.3 m altus erectus cum caule unico est, caule obscure rubri proxima apicem 7–8 mm diametro dense albi-puberulenti, foliis 9–14 cm longis 16–18 mm latis glabris oblanceolatis integris sed in apicibus venularum obscure saccatis, petiolis 3–4.5 cm longis anguste alatis ad basim puberulentis, racemis compluribus terminalibus radiatis 25–30 cm longis, pedunculis 12–15 cm longis foliosis, floribus secundatis, bracteis floralibus 10–18 mm longis lanceolatis, pedicellis 10–25 mm longis in tertia infera bibracteatis in basi puberulentis, hypanthio 6–7 mm longo cupulato glabro, lobis calycis 4–5 mm longis deltoideis apiculatis, corollis 4.5 cm longis 6–7 mm diametro glabris hamatis rosaceis sed dimidio infero subalbi-luteo, tubo filamentarum 4.5 cm longo proxima apicem sparse piloso, antheris in basi pilosis, eis superis 12 mm longis illis inferis 10 mm longis in apice penicillatis cum pilis 2.5 mm longis rigidis albis, lobis stigmatibus 2 mm longis sphaericis, fructibus incognitis.

DIAGNOSIS OF HOLOTYPE: Shrub 1.3 m tall, erect, single stemmed; stem dark red, 7–8 mm in diameter near the apex, densely white puberulent; leaves 9–14 cm long, 16–18 mm wide, glabrous, oblanceolate, entire, but dark

saccate at the veinlet ends; petioles 3–4.5 cm long, slender, narrowly winged, puberulent at base; racemes several, terminal, radiating; rhachis densely puberulent, 25–30 cm long; the leafy peduncle 12–15 cm long; flowers secund; floral bracts 10–18 mm long, lanceolate; pedicels 10–25 mm long, bibracteolate at the lower third, puberulent at base; hypanthium 6–7 mm long, cupulate, glabrous; calyx lobes 4–5 mm long, deltoid, apiculate; corolla 4.5 cm long, 6–7 mm in diameter at the widest part, hamate, glabrous, rose-pink, except for the whitish yellow lower half; filament tube 4.5 cm long, sparsely pilose near the apex; anthers pilose at base, upper anthers 12 mm long; lower anthers 10 mm long, penicillate at apex with stiff white hairs 2.5 mm long; stigmatic lobes 2 mm long, spherical; fruit unknown.

HOLOTYPE: Hawaiian Islands, Hawaii Island, Kohala Mts., summit swamp, in Sphagnum, May 7, 1961, J. F. Rock (BISH).

The new epithet is coined from the Latin *lustrum*, bog; and *-atilis*, place of growth.

DISCUSSION: *T. lustrialis* is most closely related to *T. kohalaensis* St. John, also of the Kohala Mountains, a species with the leaves 22.5–24 × 2.1–2.2 cm, linear oblanceolate; floral bracts 15–25 × 3–5 mm, narrowly elliptic; pedicels glabrous; calyx lobes 7–9 mm long, narrowly elliptic lanceolate; corolla 6 cm long, cream colored with faint rose streaks; and the filament tube puberulous in lines near the apex. *T. lustrialis* has leaves 9–14 × 1.6–1.8 cm, oblanceolate; floral bracts 10–18 × 3–5 mm, lanceolate; pedicels puberulent at base; calyx lobes 4–5 mm long, deltoid, apiculate; corolla 4.5 cm long, rose pink above, but the lower half whitish yellow; and the filament tube sparsely pilose near the apex.

***Trematolobelia macrostachys* (H. & A.)**

Zahlbr. in Rock, var. *macrostachys*, College of Hawaii Publ., Bull. 2:45, pl. XI, XII, 1913; Rock, Bishop Mus., Mem. 7(2):145, 147, pl. 70, 71, 1919; Hosaka, Bishop Mus., Occas. Papers 13: 229, 1937; Fagerlund & Mitchell, Check-

list Pl. Haw. Natl. Park 58, 1944, as to type and Oahu plants; Harrison in Kjargaard, Sci. Rept. Waihoi Val. Proj. 88, fig. on p. 111, 1972, as to type and Oahu plants; Arakawa & Char, Pacif. Trop. Bot. Gard., Bull. 6:29, 1976, as to type and Oahu plants.

Trematolobelia sandwicensis Deg., Fl. Haw. 339:10/15/34; and var. *kaalae* Deg., Fl. Haw. 339:1/15/36.

Lobelia macrostachys H. & A., Bot. Beechey Voy. 88, 1832; Gaudichaud, Voy. Bonite, Bot. t. 46, 1842; Gray, Am. Acad. Arts Sci., Proc. 5:150, 1862; Wawra, Flora 56:48, 1873, (p. 34 in reprint); Hillebrand, Fl. Haw. Is. 237, 1888; Drake, Ill. Fl. Ins. Mar. Pacif. 7:223, 1892.

Delissea ? *macrostachys* (H. & A.) Presl, Prodr. Lobel. 47, 1836.

Trematocarpus macrostachys (H. & A.) Zahlbr., Naturhist. Hofmus. Wien, Ann. 6:432, 1891, non *Trematocarpus* Kuetz., Phyc. Gen. 410, 1843.

Figures 5f-k; 9.

ORIGINAL DIAGNOSIS: "Glaberrima, caule elato stricto, foliis lineari-lanceolatis utrinque attenuatis subcrenatis, racemo simplici terminali longissimo, pedicellis simplicibus secundis horizontalibus apice sursum vergentibus, bractea lineari pedicello brevior, calycis tubo hemisphaerico, limbi lacinis obtusis, corolla pedicello duplo longiore.

Calyx ovario arcte adnatus; limbus liber, 5-partitus; laciniis oblongis, obtusis, tubum aequantibus. Corolla tubulosa, duas ad tres uncias longa, arcuata; tubus cylindraceus 5-fidus, hinc fissus. *Stamina* 5; menta in tubum liberum connata. *Antherae* cohaerentes, duae inferiores barbatae, ceterae glabrae. *Stigma* bilobum; lobis planis crassis, cartilagineis, rotundatis, divaricatis imberbibus. *Fructus* immaturus. The flowers are of a whitish colour, but were probably bluish when recent."

DESCRIPTION: Erect, glabrous, single-stemmed shrub, 1-4 m tall; stem 0.7-3.5 cm in diameter, terete, green, becoming brown; the elevated, crowded leaf scars 4-5 mm wide,

lunate, pale brown; the single large bundle scar central; leaves 15-30 cm long, narrowing imperceptibly into the 2-4 cm margined petiole; blades 13-26 × 1.2-2.5 cm, thick chartaceous, narrowly oblance ligulate, sub-obtuse, towards the apex minutely crenulate and with a sunken gland under each tooth, green above, paler green below; inflorescence terminal, of 5-20 racemes which ascend at 45°, these 25-58 cm long, the lower part leafy bracted, the flowering part with bracts 2-4 cm long, 2-4 mm wide, ligulate; raceme secund, the flowers ascending; pedicels 2-3 cm long, bibracteolate below the middle; hypanthium 5-7 mm long, subglobose; calyx lobes 3.5-5.5 mm long, lanceolate; corolla 5-6 cm long, 4-6 mm in diameter, pink, arcuate upcurved, glabrous, lobed half way, the 2 upper lobes ligulate, outcurving, the lower lip tridentate; staminal column 4-5 cm long, sparsely hirsute at tip; anthers hirsute at base, the upper anthers 12 mm long, the lower ones 9.5-10 mm long, and at apex penicillate with white bristles 1 mm long; 2 stigmas 2 mm long, elliptic, recurving; capsules 8-10 mm in diameter, oblate globose, 10-ribbed, green, at maturity the exocarp and mesocarp slough off, exposing the fenestrated endocarp; seeds 1 mm long, ellipsoid, compressed, dark brown, with a narrowly white membranous wing.

HOLOTYPE: Sandwich (= Hawaiian) Islands, Oahu, *Lay & Collie* (K). Type examined.

SPECIMENS EXAMINED: Hawaiian Islands, all from Oahu Island, Koolau Range, head of Poamoho Trail, lip of pali overlooking Punaluu Valley, 800 m alt., Dec. 22, 1940, *E. H. Bryan Jr. 1,498*; at head of Helemano Valley, overlooking Punaluu Valley, 800 m alt., Dec. 22, 1940, *Bryan 1,499*; Konahuanui, May 1912, *Ceresole* (BISH, NY); Waianae Mts., top of Kaala, wet forest, May 10-15, 1931, *E. Christophersen & E. Hume 1,790*; ditto, Dec. 25, 1925; Poamoho Trail, Paalaa-Wahiawa, 2,500 ft alt., Oct. 20, 1946, *R. S. Cowan 251* (BISH, P); summit of Pig-God Trail, Punaluu, rainy mountain tops, Jan. 17, 1932, *O. Degener & M. Kwon 7,802* (BISH, NY); Pupukea-Kahuku, Jan. 24, 1932, *Degener 7,889* (BISH, NY); Anahulu Trail, rain-swept

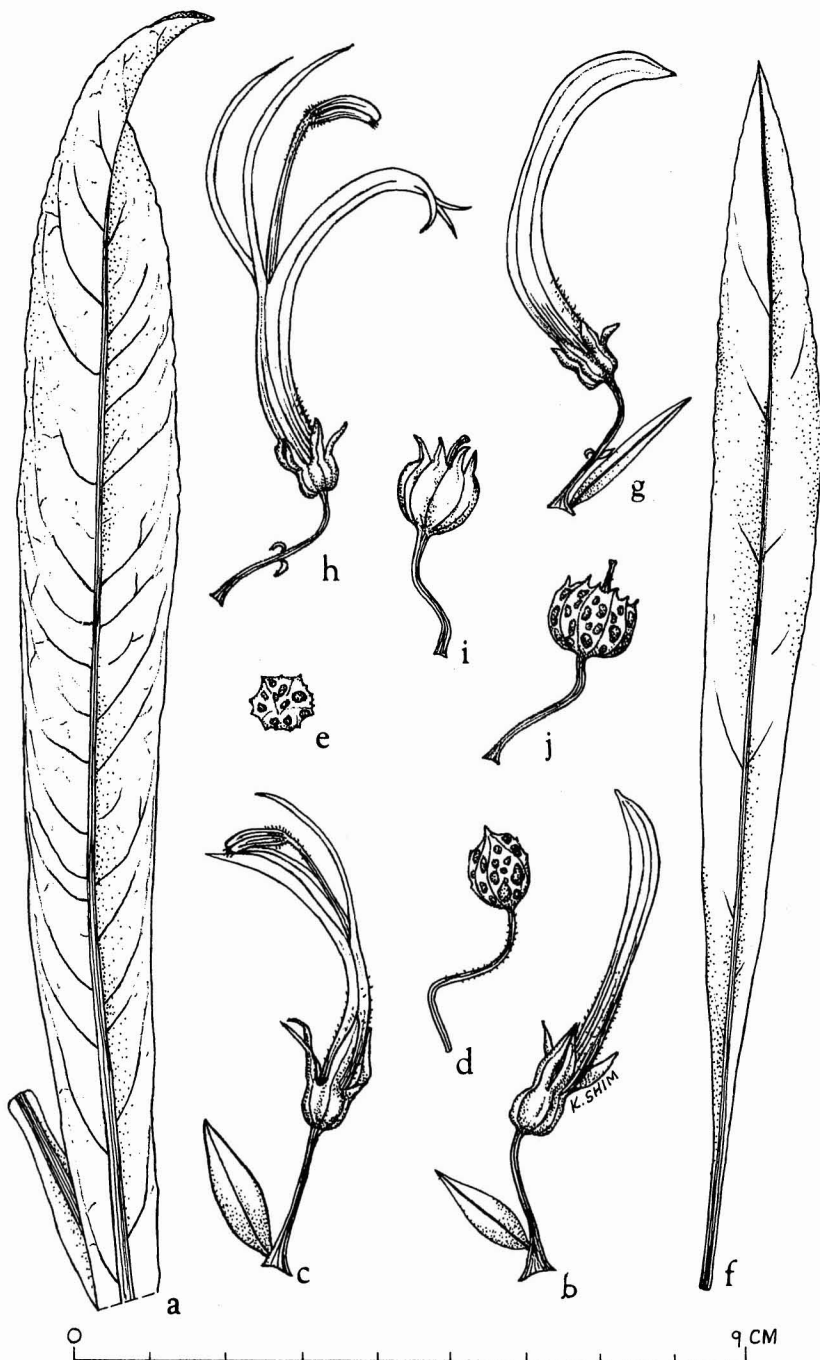


FIGURE 5. *Trematolobelia macrostachys* (H. & A.) Zahlbr. in Rock, var. *haleakalaensis* St. John, from Lamoureux 3,859. *a*, leaf, $\times 1$; *b*, bud, $\times 1$; *c*, flower, $\times 1$; *d*, *e*, fruit, $\times 1$. *T. macrostachys*, var. *macrostachys*, from Degener 7,802. *f*, leaf, $\times 1$; *g*, bud, $\times 1$; *h*, flower, $\times 1$; *i*, *j*, fruit, $\times 1$.

top, March 23, 1939, *Degener & J. Foster 12,299* (BISH, NY); Waianae Mts., slopes of Kaala, Mokuleia, April 26–May 16, 1912, *C. N. Forbes 1,834.0* (BISH, NY, P); top of Poamoho Trail, crest at head of Punaluu Valley, wet brush, 800 m alt., Nov. 22, 1936, *F. R. Fosberg 13,331*; Mt. Olympus, 1 Feb. 1920, *D. W. Garber 211*; Waianae Mts., Mt. Kalena, forest, 3,500 ft alt., 30 Sept. 1934, *M. L. Grant 7,417*; Honolulu Watershed, Sept. 10, 1924, *J. A. Harris C242245*; Kawailoa trail, rain forest, Oct. 31, 1937, *C. E. Hartt*; Waikane-Schofield Trail, cloud zone, 2,400 ft, Oct. 30, 1955, *N. H. Higgins 14*; Kipapa Gulch, s. ridge, wet denuded ridge, 2,200 ft el., April 16, 1933, *E. Y. Hosaka 969*; ditto, 1,800 ft el., Dec. 10, 1933, *Hosaka 1,235*; and *1,236*; Waianae-Ka'ala trail, one-half mile from the summit, June 18, 1978, *R. H. Inouye*; Konahuanui-Olympus, top of pali, open wet ground, Nov. 1, 1926, *L. H. MacDaniels 91*; Lanihuli ridge trail, Jan. 23, 1927, *MacDaniels 186*; ridge between Punaluu and Kaluanui, Jan. 1927, *MacDaniels 389*; Waianae Mts., Kaala, Waiialua side, 4,000 ft el., June 1932, *A. Meebold 7,803* (BISH, NY), type of *T. sandwicensis* Deg., var. *kaalae* Deg.; ridge s. of Kipapa Gulch, Waipio, forest, 2,300 ft alt., Dec. 10, 1933, *H. Morley 80*; Waikane-Schofield Ditch Trail, Hauula For. Res., rain forest, 2,400 ft alt., Jan. 28, 1934, *Morley 115*; Koolau Range, Manana Trail, steep cliff face, 2,000 ft alt., Dec. 15, 1974, *J. Obata 262*; Halawa Trail, cloud zone, 2,300 ft alt., *E. T. Ozaki 69*; Punaluu Mts., Dec. 24–29, 1908, *J. F. Rock 468* (BISH, NY); Konahuanui, Jan. 8, 1910, *Rock 6,083* (BISH, P); and May 1912, *12,841*; Mt. Olympus, May 1918, *Rock 17,070*; Kaala, Makaha, Nov. 17, 1946, *D. P. Rogers* (NY); Kaluanui, open woods, 2,200 ft alt., Nov. 30, 1929, *H. St. John 10,100* (BISH, NY); Waikane-Schofield Trail, Kahana, main divide, Jan. 19, 1930, *St. John 10,169* (BISH, P); Kalihi-Nuuanu ridge, wooded, 2,100 ft alt., Nov. 29, 1931, *St. John 11,189*; Hauula-Kaluanui ridge, wind-swept thicket on ridge, 2,200 ft alt., Oct. 31, 1937, *St. John 18,403*; Haiku Valley, North Halawa-Heeia Divide, cloud zone, 2,400 ft alt., Dec. 12, 1943, *St. John 20,418*; ridge above Kahana Bay, Sept. 17, 1926, *C. Skottsberg 1,864*; Punaluu, Castle

Trail, 25 Nov. 1956, *B. C. Stone 1,446*; Kaipapau, near top of 3rd ridge, Oct. 15, 1933, *A. Suehiro*; Waikane-Schofield Trail, near main divide, 2,400 ft alt., Oct. 16, 1932, *Suehiro*; Kahana Bay, Nov. 28, 1931, *O. H. Swezey*; Waianae Mts., Mt. Kaala, June 14, 1925, *D. L. Topping 3,193*; Halawa Trail, among sedges, 2,400 ft alt., Dec. 14, 1952, *U. Urata*.

Oahu: *W. Hillebrand* (BISH, BM); *H. Mann & W. T. Brigham 463* (BISH, CU, GH); 1851–55, *J. Remy 297* (P); U. S. Exploring Expedition, (NY).

Îles Sandwich: *D. F. Didrichsen* (BM); *C. Gaudichaud* (P).

DISCUSSION: Various botanists have considered that *T. macrostachys* occurs not only on Oahu, but also on various other Hawaiian Islands. By the present classification, it is seen to be restricted to Oahu.

Trematolobelia macrostachys (H. & A.)
Zahlbr., var. *haleakalaensis* St. John,
Pac. Sci. 25: 67–68, fig. 14, 1971.

Figures 5a–e; 8, no. 5.

ORIGINAL DIAGNOSIS: “A specie differt in foliis minus anguste lanceolatis, laminiis 12–16 cm longis 15–22 mm latis, petiolis 8–12 mm longis, pedicelis 1.5–2.0 cm longis, lobis calycis 10–15 mm longis 2 mm latis ligulatis subacutis, corollis subcurvatis rosaceis 5 cm longis, tubo minime puberulo, columna filamentarum in 5 lineis remote pilosa, antheris in basi pilosis.”

DISCUSSION: The var. *haleakalaensis* differs from var. *macrostachys* by having the leaves less narrowly lanceolate, the blades 12–16 cm long, 15–22 mm wide; petioles 8–12 mm long; pedicels 1.5–2 cm long; calyx lobes 10–15 mm long, 2 mm wide, ligulate, subacute; corolla gently curved, pink to deep rose-colored, 5 cm long, the tube finely puberulous; filament column remotely pilose in 5 lines and anthers at base pilose tufted; capsules 8–10 mm in diameter. The var. *macrostachys* has the leaves very narrowly lanceolate, the blades 11–27 cm long, 14–22 mm wide; petioles 25–60 mm long, pedicels 2.5–3 cm long; calyx lobes 3–6 mm long, 2–3 mm wide, ovate to

lanceolate, obtuse; corolla 5–6 cm long, the tube glabrous; filament column pilose in lines; anthers densely pilose at base.

HOLOTYPE: Hawaiian Islands, Maui Island, Kipahulu Valley, west part of valley, sites exposed to wind, 3,200 ft alt., Aug. 6, 1967, *C. H. Lamoureux & R. E. DeWreede 3,895* (BISH).

SPECIMENS EXAMINED: Hawaiian Islands, Maui Island, mauka of Makawao, June 26, 1927, *O. Degener 7,975* (NY); Olinda, Pipe Line Trail, June 20, 1927, *Degener 7,976* (NY); Ukulele, lower trail, Sept. 4, 1919, *C. N. Forbes 2,521*; Waihoi Valley, n. side, under *Metrosideros* on steep bank, July 12, 1972, *Betsy Harrison 75*; Waihoi Valley, Puu Hoolio, open ridge with *Lycopodium cernuum* and *Dicranopteris*, 2,950 ft alt., July 20, 1972, *Harrison & D. Herbst 2,539*; Waikamoi Forest Reserve, above no. 1 dam, July 26, 1951, *H. Inciong*; Haiku Uka, edge of Waikamoi Gulch, below dam, 4,400 ft alt., Aug. 4, 1943, *H. St. John 20,356*.

Trematobelia macrostachys (H. & A.)
Zahlbr., var. *ligulata* var. nov.

Figures 2a–e; 8, no. 3.

DIAGNOSIS HOLOTYPE: A specie differt in inflorescentia cum bracteis 20–25 mm longis ligulatis, lobis calycis 5.5–7 mm longis ligulatis subacutis.

DIAGNOSIS OF HOLOTYPE: Differs from the species by having the bracts of the inflorescence 20–25 mm long, ligulate; calyx lobes 5.5–7 mm long, ligulate, subacute.

HOLOTYPE: Hawaiian Islands, Molokai Island, 1 mile from Waikolu Lookout, Hanalililo Trail, epiphyte in very wet forest of ohia and olapa, Jan. 12, 1972, *Thane Pratt* (BISH).

SPECIMENS EXAMINED: Hawaiian Islands, all from Molokai Island, top of Wailau ridge, Sept. 19, 1938, *L. M. Cranwell 3,427* (BISH); along Papaali Pali, on brink of Waikolu Valley, windswept cloud belt, March 15, 1952, *Degener & C. Tousley 22,141* (BISH, NY); Kamolo, *U. Faurie 500*; 559; and 560 (P); Pelekunu ridge, Aug. 21, 1941, *P. Flavius*

(BISH); Poholua, June 1912, *C. N. Forbes 94.Mo.* (BISH); Kalapamoa, Aug. 1912, *Forbes 446.Mo.* (BISH, NY, P); Pukoo, Oct. 8, 1916, *A. S. Hitchcock 15,068* (BISH).

The new epithet is the Latin adjective, *ligulata*, strapshaped, and it is given with reference to the shape of the bracts and the calyx lobes.

Trematobelia Rockii sp. nov.

Figures 6a–b; 8, no. 2.

DIAGNOSIS HOLOTYPE: Frutex est, caule dense puberulo, foliis sessilibus 10–23 × 1.0–1.4 cm anguste lineari-lanceolatis glabris, inflorescentiis compluribus in ramis terminalibus lateralibus ascendentibus et dense puberulis, eis cum foliis 9–13 cm longis, racemis 11–16 cm longis in alabastro parvo 4–5 cm diametro, rhachidi obscure subpurpureis et dense puberulis, bracteis florum 20–45 × 3–5 mm anguste lanceo-ligulatis acutis glabris, pedicellis 10–13 mm longis remote puberulis plerumque infra bracteolarum conjugentiarum 1–1.5 mm longis, lobis calycis 6–10 mm longis 1–1.8 mm latis ligulatis subacutis, hypanthio juvenali 3–4 mm longo obovoideo glabro, alabastris juvenalibus 5–10 mm longis infra glabris sed marginibus apicalibus lobarum puberulo ciliatis, (fructibus incognitis).

DIAGNOSIS OF HOLOTYPE: Shrub; stem densely puberulent; leaves sessile, 10–23 × 1–1.4 cm, narrowly linear oblanceolate, glabrous; inflorescences several on terminal, lateral, ascending, densely puberulent branches, these bearing leaves 9–13 cm long; racemes 11–16 cm long, 4–5 cm in diameter when still in small bud; rhachis dark purplish, and densely puberulent; floral bracts 20–45 × 3–5 mm, narrowly lance ligulate, acute, glabrous; pedicels 10–13 mm long, remotely puberulent, mostly below the pair of 1–1.5 mm bracteoles; calyx lobes 6–10 mm long, 1–1.8 mm wide, ligulate, subacute; young hypanthium 3–4 mm long, obovoid, glabrous; young corolla buds 5–10 mm long, glabrous below, but puberulous ciliate along the apical margins of the lobes; (fruit unknown).

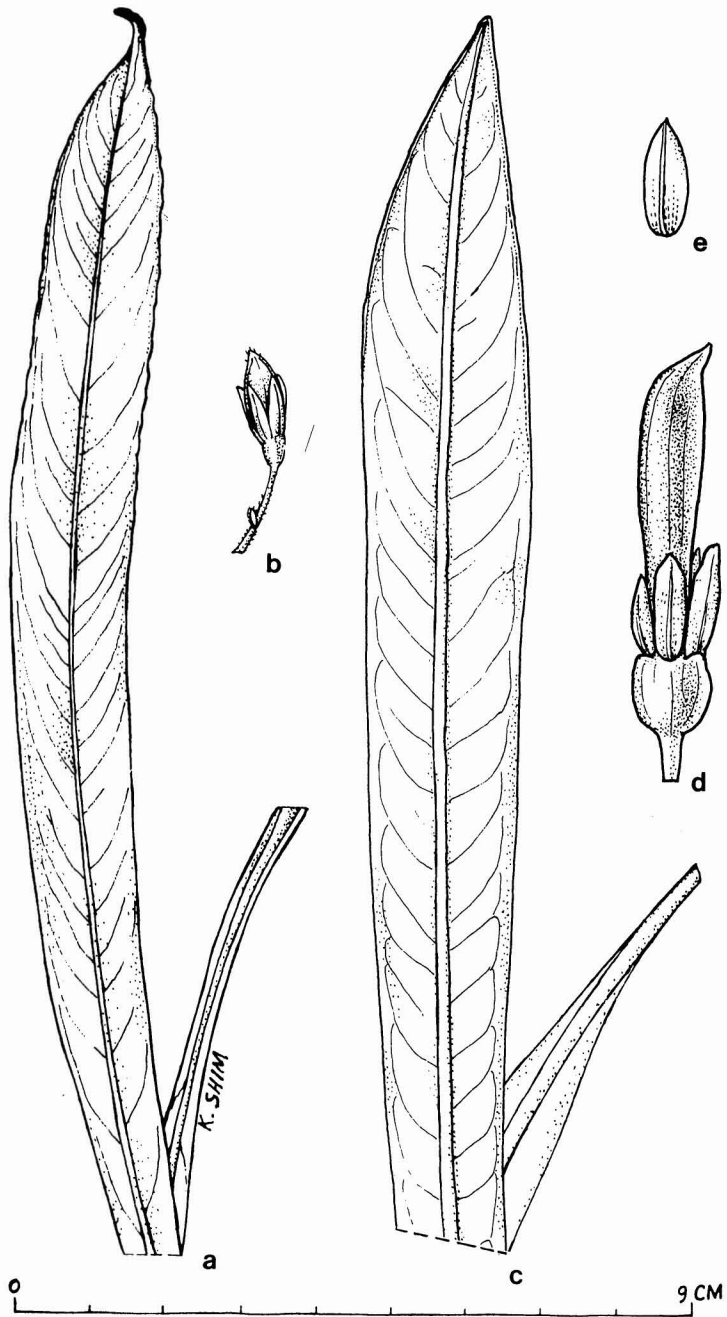


FIGURE 6. *Trematobelia Rockii* St. John, holotype. a, leaf, $\times 1$; b, bud, $\times 1$. *T. Rockii*, var. *hawaiiensis* St. John, holotype. c, leaf, $\times 1$; d, bud, $\times 1$; e, calyx lobe, $\times 1$.

HOLOTYPE: Hawaiian Islands, Molokai Island, Waikolu, April 1910, *J. F. Rock 8,819* (BISH).

DISCUSSION: *T. Rockii* is most closely related to *T. Wimmeri* Deg. & Deg., of Hawaii, a species with the leaves 20–44 × 1.9–3.4 cm, linear oblanceolate, acute; rhachis green; floral bracts 13–40 mm long, lanceolate; pedicels 12–23 mm long; calyx lobes 5–8 mm long, lanceolate; and the corolla glabrous. *T. Rockii* St. John has the leaves 10–23 × 1–1.4 cm, narrowly linear lanceolate; rhachis dark purplish; floral bracts 20–45 mm long, narrowly lance ligulate; pedicels 10–13 mm long; calyx lobes 6–10 mm long, ligulate, subacute; and the corolla lobes puberulous ciliate.

The new epithet is chosen to honor the collector, Joseph Francis Rock (1884–1962), forester, professor of botany at the College of Hawaii, explorer, photographer, linguist, and scientist extraordinary.

Trematobelia Rockii St. John, var. *hawaiiensis* var. nov.

Figures 6a–e; 8, no. 11.

DIAGNOSIS HOLOTYPE: Frutex est, caule et rhachidibus puberulis; foliis 20–25 × 1.9–2.2 cm sessilibus ligulate anguste oblanceolatis subacutis, bracteis inflorescentiae 15–22 mm longis lanceolatis, lobis calycis 7–8 mm longis ellipticis acutisque.

DIAGNOSIS OF HOLOTYPE: Stem and rhachis puberulent; leaves 20–25 × 1.9–2.2 cm, sessile, coriaceous, ligulate narrow oblanceolate, subacute; peduncles 25–40 cm long, with a few leafy bracts; inflorescence bracts 15–22 mm long, lanceolate; pedicels 15–25 mm long; calyx lobes 7–8 mm long, elliptic, acute; corollas immature.

HOLOTYPE: Hawaiian Islands, Hawaii Island, along Saddle Road, 16 miles from Hilo, edge of Kipuka, Aug. 30, 1949, *O. Degener, T. Murashige & M. Kerr 20,006* (NY).

DISCUSSION: The close relative of this new variety is *T. Rockii*, var. *Rockii*, a variety which differs in having the leaves 10–22 × 1–1.4 cm; inflorescence bracts 15–50 mm long,

narrowly lance ligulate; and the calyx lobes 6–7 mm long, oblong, subacute.

The new epithet is formed from the name of the type locality, Hawaii, and *-ensis*, the Latin adjectival place suffix.

Trematobelia singularis sp. nov.

Figures 7a–h; 9; Carlquist (1970: color figure 212D).

DIAGNOSIS HOLOTYPE: Frutex glaber est, caule 0.6–1.2 m alto solitario eramoso erecto parte vetustiore nuda viridi 6–8 mm diametro, parte foliosa et rhachidi purpureis, foliis sessilibus 10–16 × 1.2–1.7 cm lineari-ellipticis acutis in apicibus ambis deminuentibus marginibus minute undulatis apicibus venularum rubris supra viridibus nitidis midnervo rubro infra pallide viridibus, inflorescentia terminali solitaria erecta, pedunculo 16–20 cm longo, racemo 20–22 cm longo 6–7 cm diametro secundo, rhachidi glabro, bracteis 1.5–3 cm longis lineari-lanceolatis viridibus sed marginibus magentis, pedicellis 15–25 mm longis purpureis, hypanthio 5–6 mm longo subgloboso violaceo, 5 lobis calycis 6–7 mm longis 4.5–5 mm latis late lanceolatis obtusis viridibus sed marginibus subpurpureis, corollis coccineis glabris 5 cm longis 5–6 mm diametro in alabastro arcuate decurvato, tubo filamentarum 32–35 mm longo magento proxima apicem sparse hirsuto, saccis antherae violaceis connectivo griseo, antheris superis 12 mm longis illis inferis 9 mm longis et in apice a setis albis 1.5 mm longis penicillatis, capsulis 9 mm altis 12 mm diametro oblate globosis denique endocarpio fenestrato exposito.

DIAGNOSIS OF HOLOTYPE: Glabrous shrub; stem 0.6–1.2 m tall, single, unbranched, erect, the older naked part green, 6–8 mm in diameter; the younger leafy stem and the rhachis “Mulberry Purple” (Ridgway, pl. XI); leaves sessile 10–16 × 1.2–1.7 cm, linear elliptic, acute, tapering to each end, the margins minutely undulate, and red maculate at the veinlet tips, above shiny green, the midrib red, below pale green; inflorescence terminal, solitary, erect; peduncle 16–20 cm long; raceme 20–22 cm long, 6–7 cm in diameter, secund;



FIGURE 7. *Trematolobelia singularis* St. John, holotype. a, leaf, $\times 1$; b, bud, $\times 1$; c, flower, $\times 1$; d, e, f, g, fruit, $\times 1$; h, seed, $\times 40$. *T. Wimmeri* Deg. & Deg., from St. John 25,052. i, leaf, $\times 1$; j, bud, $\times 1$; k, flower, $\times 1$; l, m, fruit, $\times 1$.

rhachis glabrous; inflorescence bracts 1.5–3 cm long, linear lanceolate, green but the margins magenta; pedicels 15–25 mm long, “Mulberry Purple”; hypanthium 5–6 mm long, subglobose, “Hyacinth Violet,” (Ridgway, pl. XI); 5 calyx lobes 6–7 mm long, 4.5–5 mm wide, broadly lanceolate, obtuse, green, but the margins purplish; corollas crimson, glabrous, 5 cm long, 5–6 mm in diameter, in bud arcuate decurved; filament tube 32–35 mm long, magenta, sparsely hirsute near the tip; anther sacs “Dark Nigrosin Violet,” (Ridgway, pl. XXV), the connective tissue “Gull Gray,” (Ridgway, pl. LIII); the upper anthers 12 mm long, the lower ones 9 mm long, and penicillate with white bristles 1.5 mm long; capsules 9 mm tall, 12 mm in diameter, oblate globose, the veins of the calyx lobes and the style persistent, at maturity the exocarp and the mesocarp fall away, exposing the fenestrated endocarp.

EXPANDED DESCRIPTION: Stem 6–15 mm in diameter, brown, roughened by the elevated leaf scars, these 4–6 mm wide, lunate, pale brown; bundle scar solitary, large; pedicels 15–35 mm long.

HOLOTYPE: Hawaiian Islands, Oahu Island, Koolau Range, Konahuanui, about midway between the two peaks, 100 feet down, on open windward cliff face, with stunted *Dubautia*, *Metrosideros*, *Sadleria*, and low natives and grasses, 3,000 ft alt., Oct. 13, 1974, *John Obata* (BISH).

SPECIMENS EXAMINED: Hawaiian Islands, Oahu Island, Konahuanui, summit ridge, with *Freycinetia*, *Dubautia laxa*, *Broussaisia arguta*, *Metrosideros rugosa*, *Cladium*, in low scrubby pali vegetation, 3,100 ft alt., Oct. 2, 1966, *S. Carlquist* 2,362 (BISH); Konahuanui-Olympus Trail, semi-woody plant, single stem, 700 m alt., Dec. 21, 1926, *L. H. MacDaniels* 144 (BISH).

DISCUSSION: *T. singularis* is most closely related to *T. macrostachys* (H. & A.) Zahlbr., also of Oahu, a species with the rhachis, bracts, pedicels, and hypanthium green; calyx lobes 4–6 mm long, 3 mm wide; corolla pink, 5 cm long; flowering racemes mostly 9, and radiating. *T. singularis* has the rhachis, bracts,

pedicels, and hypanthium purple to violet; calyx lobes 6–7 mm long, 4.5–5 mm wide; corolla crimson; and the single raceme terminal and erect.

The new epithet is the Latin adjective *singularis*, alone, one at a time, and it is chosen with reference to the solitary, terminal raceme.

Trematolobelia Wimmeri Deg. & Deg., *Phytologia* 17: 370–371, 1968.

Figures 7*i–m*; 8, no. 7.

ORIGINAL DIAGNOSIS: “Lobi calycini 7 mm longi; capsula 15 mm longa et 16 mm lata.”

DESCRIPTION: Stem 1.5–2 m tall, puberulent, green; leaves 20–44 × 1.9–3.4 cm, sessile, linear oblanceolate, acute at apex, the base long cuneate, above dull green, below slightly paler, the midrib green or pinkish, the secondary veins 20–22 in each half, curved ascending and connected by an intramarginal vein, 1–2 mm from the margin; racemes several, secund; peduncles 22–35 mm long, few bracted; rhachis in flower 35–40 cm long, puberulent; bracts in flower 1.3–4 cm long, lanceolate, foliaceous, subentire; pedicels 12–23 mm long, bibracteolate below the middle, and upcurved near the flower; hypanthium 5–6 mm long, subglobose, dark green; calyx lobes 5–8 mm long, lanceolate; corollas white or slightly greenish white, glabrous, 6.5–8 cm long, 10–10.5 mm wide, 4–6 mm thick, strongly arcuate, the lobes linear lanceolate, the 2 upper lobes 5 cm long; filament tube 5–6 cm long, glabrous; anther sacs dull violet, glabrous below the apex, the 3 upper anthers 14–15 mm long; 2 lower anthers 11–12 mm long, and penicillate with white bristles 1.5–2 mm long; the green capsule with persistent calyx lobes, the body 13 mm long, 15 mm wide, 10 mm thick, when mature and dry the body 11–13 × 12–16 × 11–13 mm, the exocarp deciduous, exposing the perforated endocarp.

HOLOTYPE: Hawaiian Islands, Hawaii Island, Kilauea, near Fern Forest, rich moist sunny locality, Feb. 18, 1922, *O. Degener* 7,860 (w). Isotype (BISH). Types examined.

HAWAIIAN ISLANDS ASSEMBLED

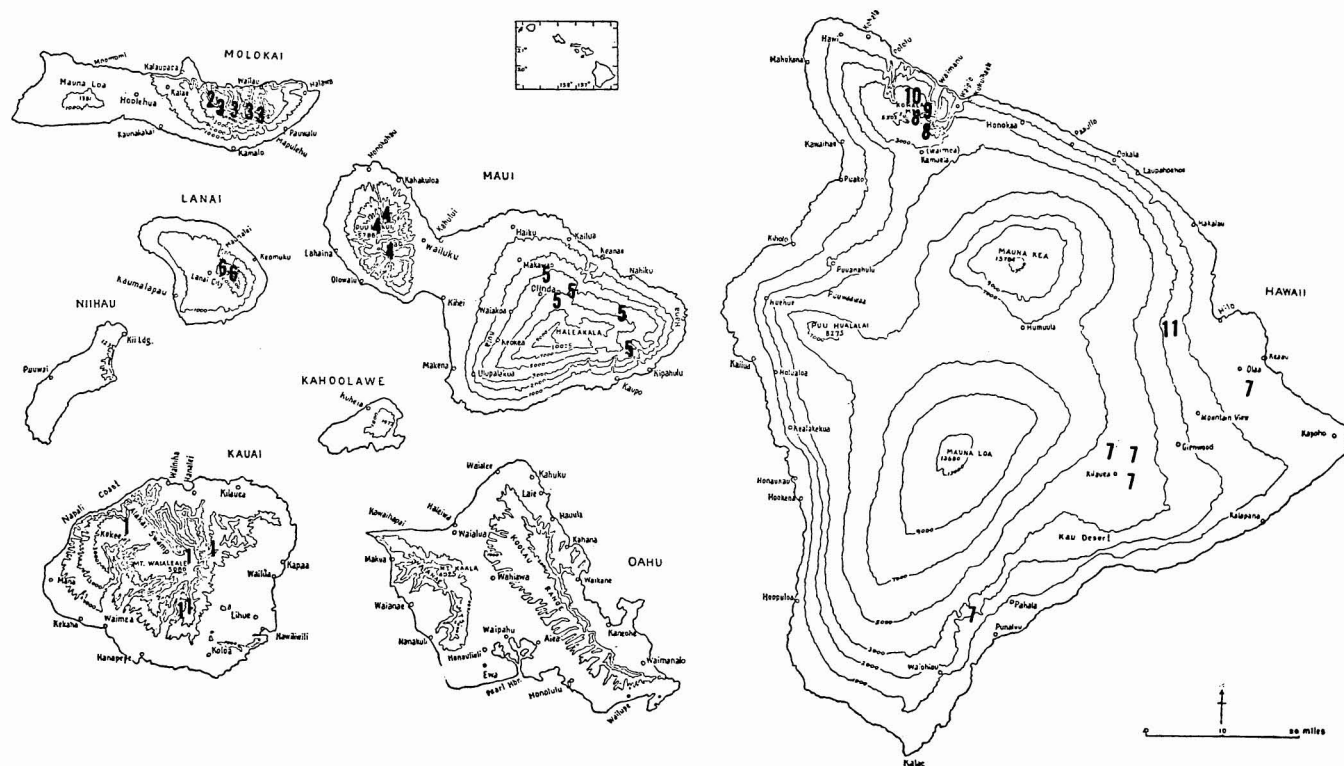


FIGURE 8. Map showing ranges of *Trematolobelia* species, except those of Oahu. 1. *T. kauaiensis* (Rock) Skottsbg; 2. *T. Rockii* St. John; 3. *T. macrostachys* (H. & A.) Zahlbr. in Rock, var. *ligulata* St. John; 4. *T. Forbesii* St. John; 5. *T. macrostachys*, var. *haleakalaensis* St. John; 6. *T. auriculata* St. John; 7. *T. Wimmeri* Deg. & Deg.; 8. *T. grandifolia* (Rock) Deg.; 9. *T. kohalaensis* St. John; 10. *T. lustrialis* St. John; 11. *T. Rockii*, var. *hawaiiensis* St. John.

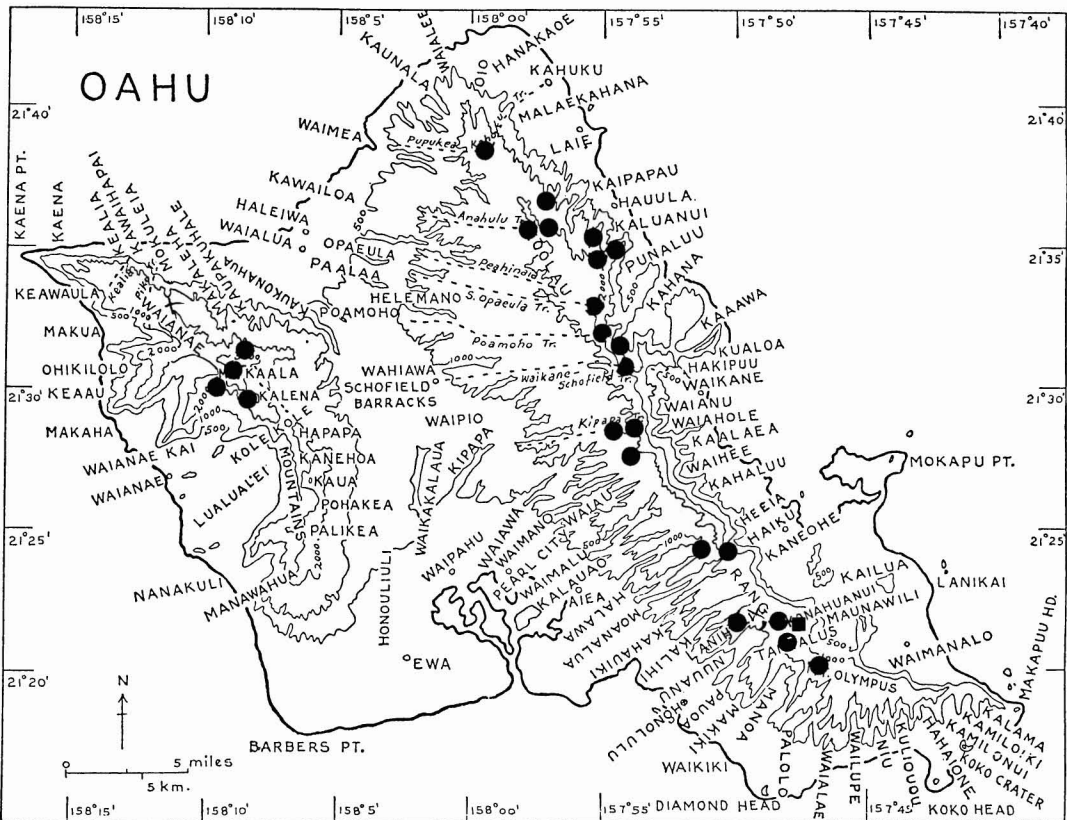


FIGURE 9. Map showing ranges of *Trematolobelia* species on Oahu. Round dot, *T. macrostachys* (H. & A.) Zahlbr. in Rock, var. *macrostachys*; square dot, *T. singularis* St. John.

SPECIMENS EXAMINED: Hawaiian Islands, Hawaii Island, end of Olaa Back Road, wet *Metrosideros* forest, 2,000 ft elev., Aug. 30, 1966, S. Carlquist 2,238; Kilauea, 1845–47, F. Didrichsen 3,418; Naalehu forest, Kau, Jan. 1913, J. F. Rock 10,360; Wright Road, Olaa Forest Reserve, Puna Dist., virgin *Cibotium glaucum* and *Metrosideros* forest, Jan. 29, 1953, H. St. John 25,052; Kilauea, Oct. 21, 1957, Ella W. Stephens (Rock no.) 26,016, and 26,017.

DISCUSSION: *T. Wimmeri* Deg. & Deg. was published in 1968 with a binomial, a 13-word diagnosis, and description, and the citation of the holotype from Kilauea, Degener 7,860 (w). The authors stated that when they visited the Natural History Museum in Vienna, this type was not available. Consequently, they sup-

plied a description based on a collection from the same region, Fagerlund & Mitchell 847, in the herbarium of the Hawaii Volcanoes National Park. The present writer has now borrowed and has before him the holotype, Degener 7,860. It is enclosed in a small pocket on the sheet. It consists of three overripe, shattered capsules, without calyx lobes, a small bracteal leaf 9 cm long, 1.3 cm wide, a 3 cm piece of a rhachis tip, a slab of bark, a 7 mm slab of a stem, and many seeds. The only significant character shown is the puberulence on the rhachis. Otherwise it is worthless. Not having the cited holotype available, Degener and Degener wrote their description from a different collection, one which also lacked good flowers. Their publication is a legal one, but the choosing of a worthless fragment as a holotype is ill-considered. Luckily, there is an

unmarked isotype in the Bishop Museum. It consists of an upper stem piece with leaves 11–14 × 1.2–1.4 cm; four fruiting racemes 25–32 cm long, and with puberulent rachises; and numerous mature capsules. This isotype is clearly of the same species as the other collections from the Kilauea region on Hawaii. Together they evidence the characteristics of the plant, which are distinctive enough to justify it as a species.

LITERATURE CITED

- CARLQUIST, SHERWIN. 1962. *Trematolobelia*; seed dispersal; anatomy of fruit and seeds. *Pac. Sci.* 16:126–134, 20 figs.
- . 1970. *Hawaii: a natural history*. American Museum of Natural History, New York. 480 pp., ill.
- DEGENER, OTTO. 1934. *Flora Hawaiiensis* fam. 339:10/15/34; 1/15/36.
- . 1968. Review of F. E. Wimmer, *Campanulaceae-Lobelioideae Supplementum et Campanulaceae-Cyphioideae*. *Das Pflanzenreich* 276c (108 heft) I–X, 816–1024; with description of *Trematolobelia Wimmeri* Deg. & Deg. *Phytologia* 17:369–371.
- HEMSLEY, W. B. 1892. *Trematocarpus*. *Ann. Bot.* 6:154.
- . 1893. The genus *Trematocarpus*. *Ann. Bot.* 7:289–290.
- HOOKE, W. J., and G. A. WALKER-ARNOTT. 1830–41. *The botany of Captain Beechey's voyage*. Treuttel & Wurz, Treuttel, Jun. & Richter, London. 485 pp., 99 pl.
- PRESL, K. B. 1836. *Prodromus monographiae Lobeliacearum*. Bömische Gesellschaft Wissenschaft, Abhandlung n. s. 4(9):1–32.
- ROCK, JOSEPH F. 1913. Descriptions of new species of Hawaiian plants. *Coll. of Hawaii Pub. Bull.* 2:39–50, 12 pl.
- . 1919. A monographic study of the Hawaiian species of the tribe Lobelioideae family Campanulaceae. B. P. Bishop Museum, *Memoirs* 7(2):xvi + 394 pp., 217 pl.
- STAPP, O. 1893. The genus *Trematocarpus*. *Ann. Bot.* 7:396–399.
- ST. JOHN, HAROLD. 1971. Endemic plants of Kipahulu Valley, Maui, Hawaiian Islands. *Hawaiian plant studies* 36. *Pac. Sci.* 25:39–79, 19 figs.
- WIMMER, F. E. 1953. In Engler and Diels, eds. *Das Pflanzenreich* IV, 276b (107 heft): 1–813. And 1968. IV, 276c (108 heft): 815–1,024, figs. 6–83.
- ZAHLEBRUCKNER, A. 1891. Ueber einige Lobeliaceen des Wiener Herbariums. *Mus. Vindob.*, *Ann.* 6:3–4, 430, fig. 1.
- . In J. F. Rock, ed. 1913. Descriptions of new species of Hawaiian plants. *College of Hawaii Publications, Bulletin* 2:39–50, 12 pl.