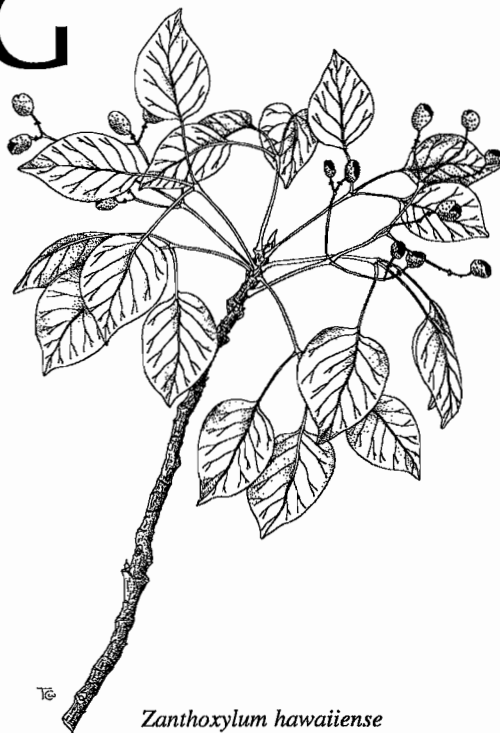


RARE PLANTS OF POHAKULOLOA TRAINING AREA

Hawaii

by Robert B. Shaw

PART II of II



Zanthoxylum hawaiiense

Center for Ecological Management of Military Lands
Department of Forest Sciences
Colorado State University
Fort Collins, Colorado 80523-1470

1997

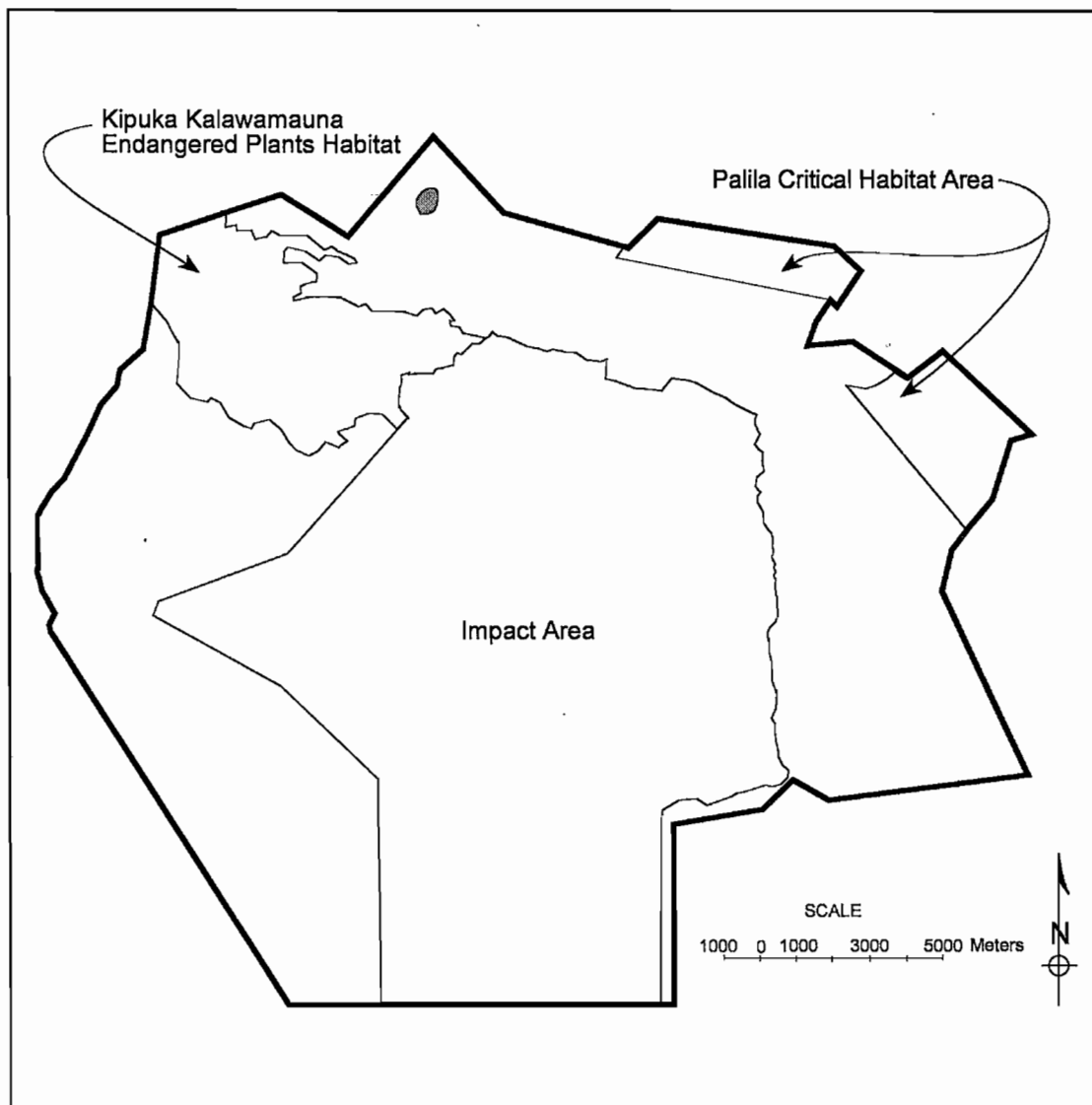


Figure 46. Distribution of *Portulaca villosa* on Pohakuloa Training Area, Hawaii.

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Figure 45. *Portulaca villosa*: (a) plant growing on barren cinder; (b) close-up of flower and leaves; (c) typical habitat in Open *Dodonaea* Shrubland on Puu Keekee; and (d) field personnel viewing the species on rocky tumulus.

Schiedea pubescens Hillebr.

Schiedea pubescens Hillebr.



Family: Caryophyllaceae (Pink Family)

Common Name: None

Federal Status: Species of Concern

Description:

Life Span: perennial. **Habit:** vine; stems from a woody base, sprawling to weakly climbing, 1–6 m or more in length. **Vegetative:** leaves and branching opposite; leaves lanceolate to ovate, short petioled, only one-nerved, purple-tinged, and chartaceous. **Fruit:** a small capsule with numerous small seeds.

Distribution:

Historical: Oahu, Molokai, Lanai, and Maui. **Current:** Reported widely scattered in mesic forests.

Habitat:

Substrate: The only known population of *Schiedea pubescens* on the installation occurs on 3000–4000 year old Mauna Loa pahoehoe lava. **Plant Communities:** Open *Metrosideros* Treeland with dense shrub understory.

Estimated Number of Individuals on PTA: < 10

Threats: Browsing by feral sheep and goats is the major threat to *S. pubescens*. Also, competition from weedy, invasive species and increased fire potential from fountain grass (*Pennisetum setaceum*) threatens the species.

Comments: This is the first report of *S. pubescens* from the island of Hawaii, according to Joel Lau. The plant was discovered growing on the installation by Trisha Tierney and Sam Gon while they were viewing a *Zanthoxylum hawaiiense* which grows nearby. A few seedlings were found growing near the larger “mother plant”. Other populations of this taxon undoubtedly occur on the installation. The plants found on the installation probably belong to the typical variety (*S.p.* var. *pubescens*) which has puberulent inflorescences and broadly lanceolate to ovate leaves.

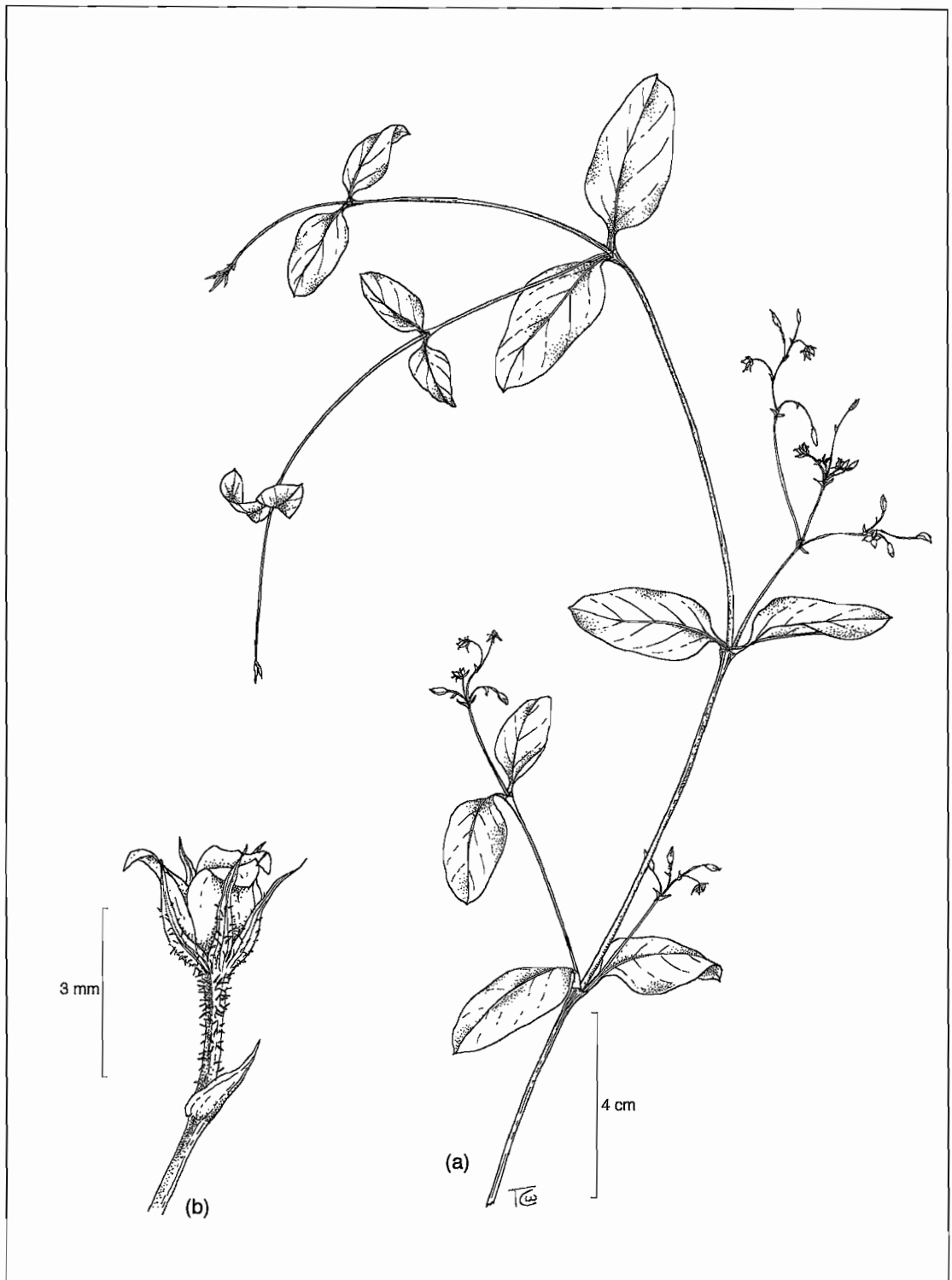


Figure 47. *Schiedea pubescens*: (a) general habit; (b) dehiscent capsule.



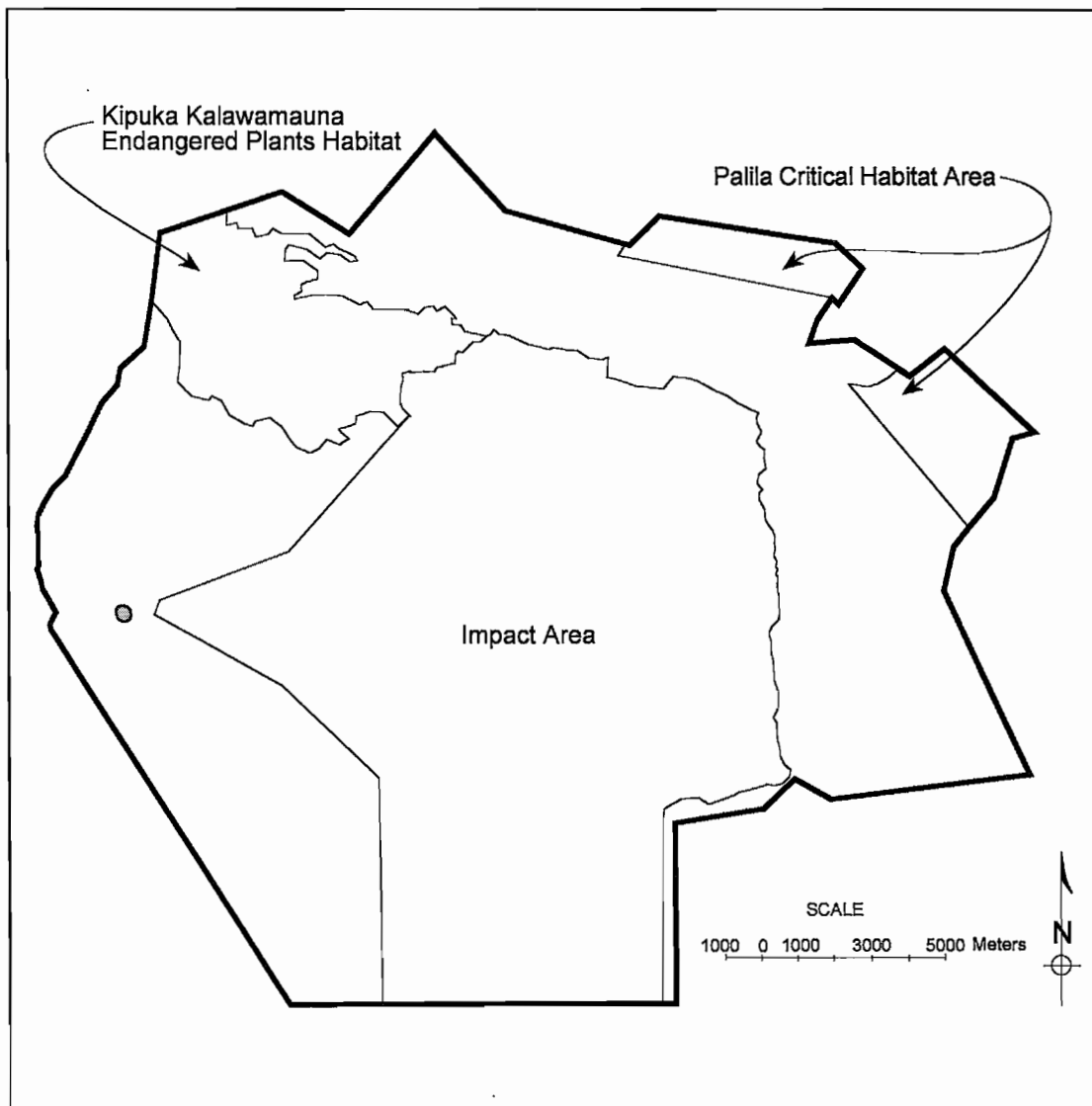


Figure 49. Distribution of *Schiedea pubescens* on Pohakuloa Training Area, Hawaii.

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Figure 48. *Schiedea pubescens*: (a) small seedling growing in pahoehoe lava crack; (b) mature individual growing at base of *Metrosideros polymorpha*; (c) stem showing vine-like nature of the plant and opposite leaf arrangement; and (d) typical habitat in Open *Metrosideros* Treeland with dense shrub understory.

Silene hawaiiensis Sherff

Silene hawaiiensis Sherff



Family: Caryophyllaceae (Pink Family)

Common Name: Hawaiian Catchfly

Federal Status: Threatened

Description:

Life Span: perennial. **Habit:** erect to sprawling shrub up to 1.5 m tall, but rarely over 0.5 m; typically has multiple stems arising from a large, tuber-shaped taproot. **Vegetative:** stems very thin, round; leaves opposite, narrow (<1 mm wide) and linear, recurved, usually hairy, and margins entire. **Floral:** flowers in a small, simple, panicle inflorescence; flowers greenish white to white above and maroon below, and completely maroon when dry; 5 petals, fused at the base, and cleft. **Fruits:** a capsule with numerous small seeds.

Distribution:

Historical: Hawaii. **Current:** Known from Kilauea Crater and Rim and Kau Desert within Hawaii Volcanoes National Park, the slopes of Mauna Kea and Mauna Loa to about 2,750 m and throughout PTA. On PTA, the species occurs from the northern boundary of the installation to the Kipuka Alala on the west side and Puu Koli on the east side. One of the largest populations is located at mid-slope on the west-southwest flank of Puu Ahi.

Habitat:

Substrate: *Silene hawaiiensis* is scattered on very old Mauna Kea flows (> 10,000 years old). It also is abundant on Mauna Loa aa and pahoehoe flows varying from 900 to over 5,000 years old. **Plant Communities:** Barren Lava, Disturbed, Sparse *Metrosideros* Treeland, Open *Metrosideros* Treeland with sparse shrub understory, Open *Metrosideros* Treeland with dense shrub understory, *Chenopodium* Shrubland, Open *Dodonaea* Shrubland, *Dodonaea* Mixed Shrubland, *Sophora-Myoporum* Shrubland with forb understory, *Styphelia-Dodonaea* Shrubland, and *Eragrostis* Grassland.

Estimated Number of Individuals on PTA: > 1,500

Threats: The above-ground portion of the plant is highly palatable to feral sheep and goats. Feral hogs root up and consume the fleshy taproot of individuals growing in areas with better soil development.

Comments: *Silene hawaiiensis* is widespread on the installation. The plant appears to be relatively hardy, perhaps due to its ability to re-sprout from the large fleshy taproot. Seeds germinate readily and seedlings are easy to establish in the greenhouse.

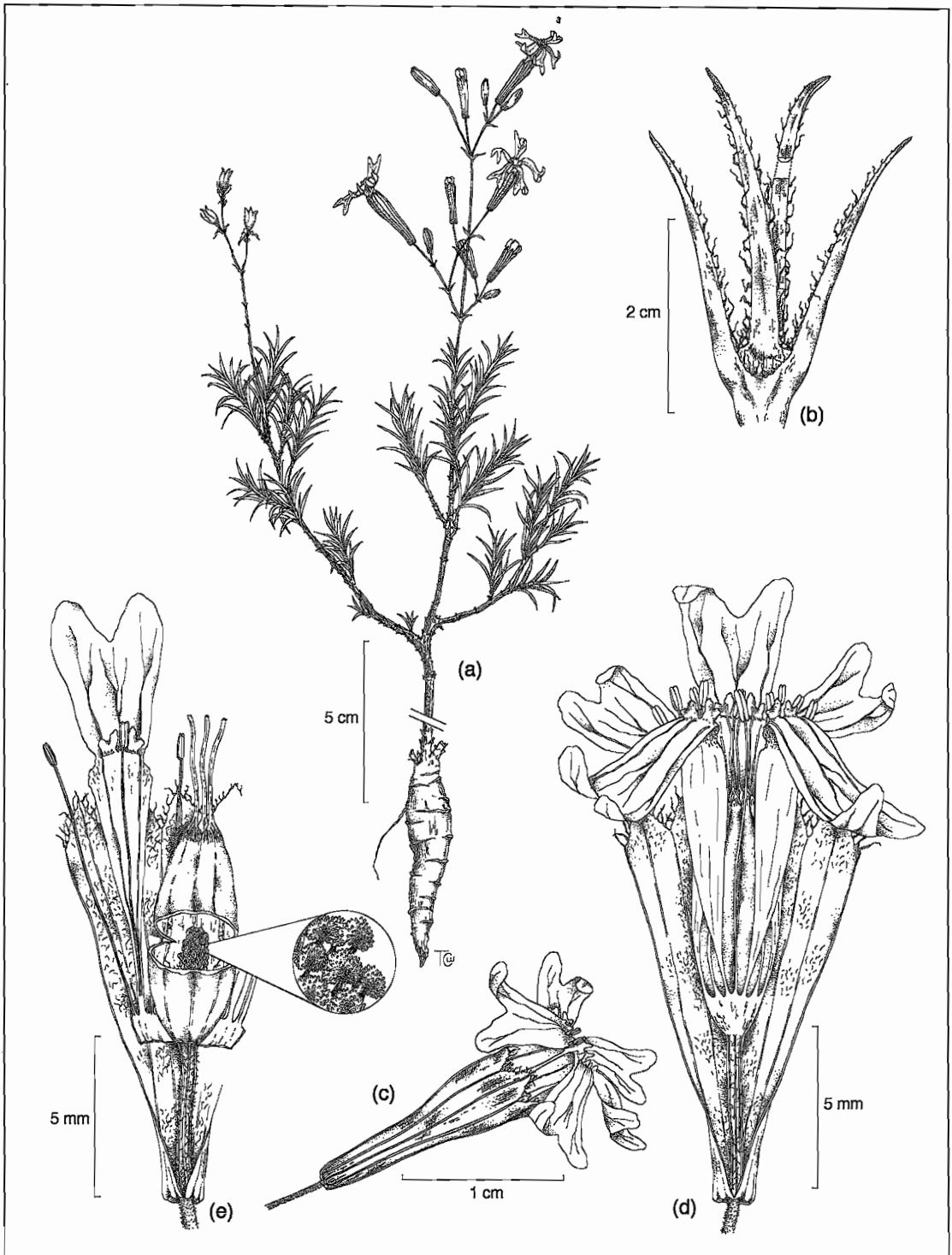
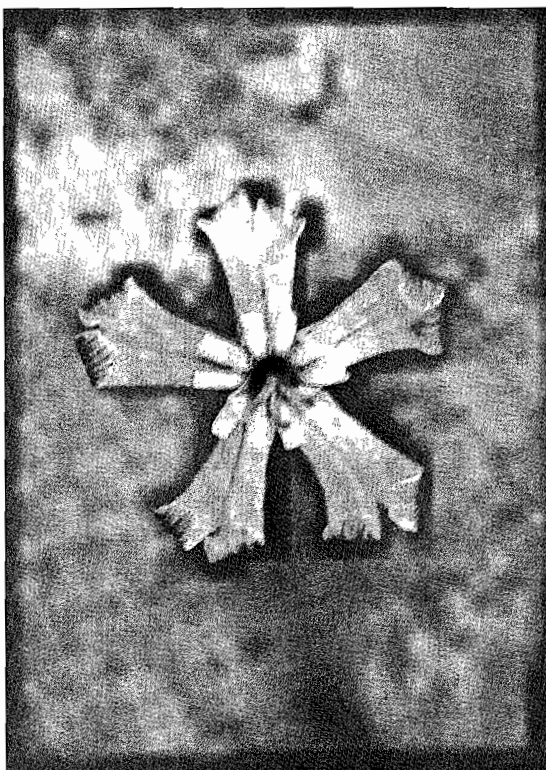
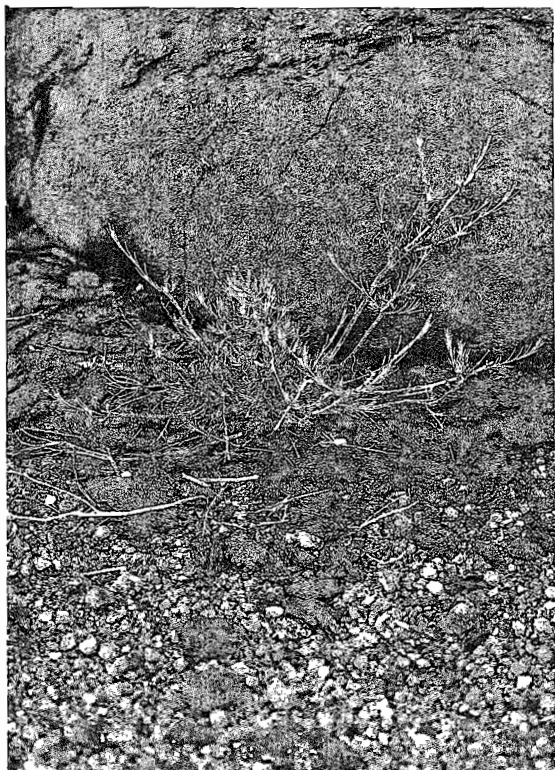


Figure 50. *Silene hawaiiensis*: (a) general habit showing the large fusiform root; (b) opposite, subulate leaves with ciliate margins; (c) single, regular-shaped flower; (d) calyx split to reveal elongated stipe (note slightly exposed stamens); and (e) capsule cross-section exposing numerous seeds.



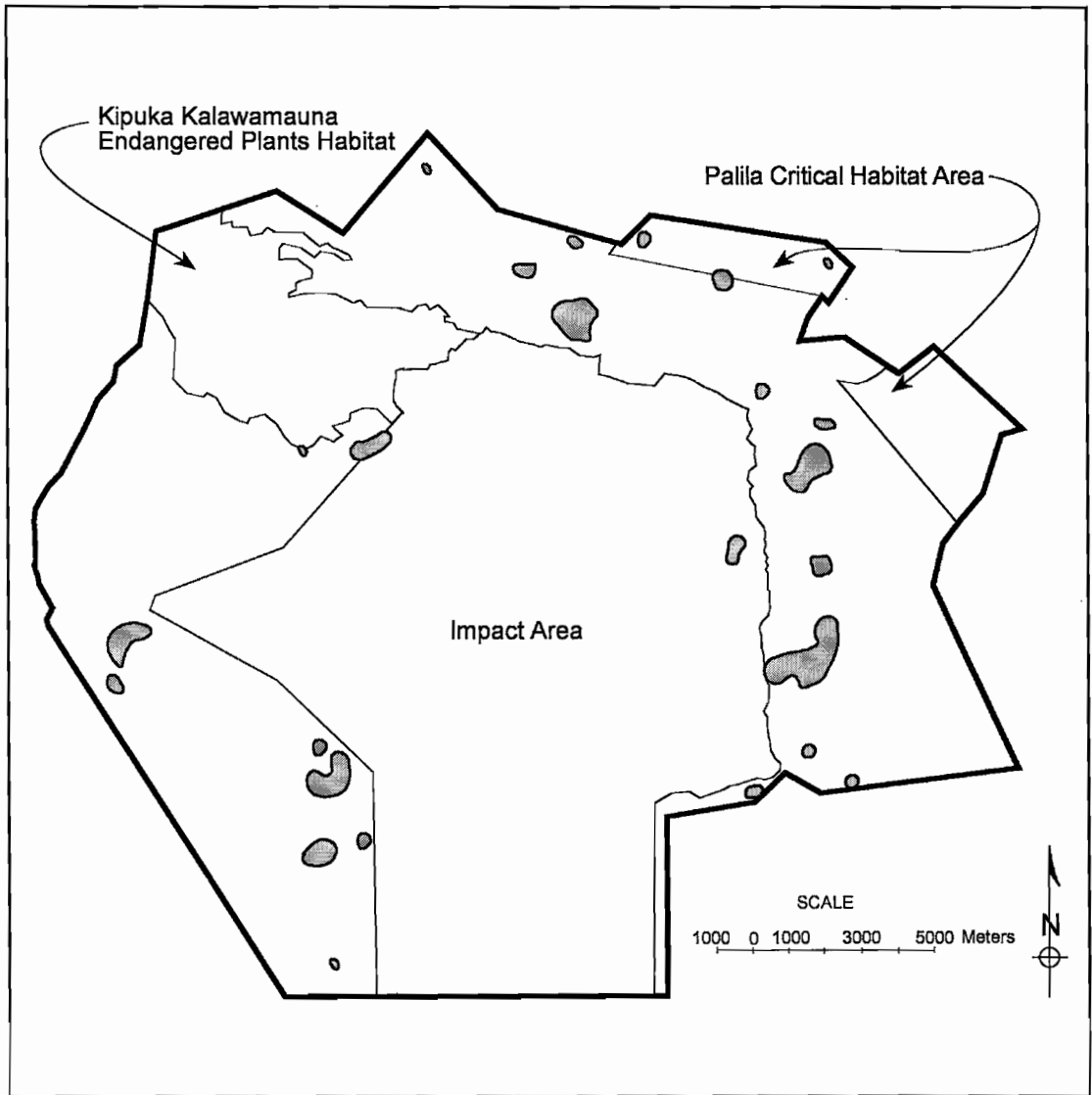


Figure 52. Distribution of *Silene hawaiiensis* on Pohakuloa Training Area, Hawaii.

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Figure 51. *Silene hawaiiensis*: (a) plant growing at edge of pahoehoe lava flow; (b) close-up of flower (note exposed stamens [yellow] and two-lobed appendages [white]); (c) typical habitat in Open *Metrosideros* Treeland with dense shrub understory; and (d) typical Open *Dodonaea* Shrubland habitat.

Silene lanceolata A. Gray

Silene lanceolata A. Gray



Family: Caryophyllaceae (Pink Family)

Common Name: Lance-leaf Catchfly

Federal Status: Endangered

Description:

Life Span: perennial. **Habit:** erect to sprawling shrub up to 1.5 m tall; single stemmed at base of plant and multiple branched above. **Vegetative:** stems round; leaves linear to lance-shaped, hairless, smooth and shiny, margins entire. **Floral:** showy flowers in an open inflorescence at the tip of most branches; flowers regular-shaped, base sticky, petals white and cleft. **Fruit:** a capsule with numerous small seeds.

Distribution:

Historical: Kauai, Lanai, Molokai, and Hawaii. **Current:** One small population is known from below Puu Kolekole on Molokai, and on PTA from Puu Keekee to the Kipuka Alala. Recently, several populations have been found on state lands west of PTA.

Habitat:

Substrate: *Silene lanceolata* is abundant on very old Mauna Kea aa and pahoehoe flows (> 10,000 years old). It also is abundant on Mauna Loa aa and pahoehoe flows varying from 900 to over 5,000 years old. **Plant Communities:** *Chamaesyce* Treeland, Open *Metrosideros* Treeland with sparse shrub understory, Open *Metrosideros* Treeland with dense shrub understory, Intermediate *Metrosideros* Mixed Treeland, Open *Dodonaea* Shrubland, Dense *Dodonaea* Shrubland, *Dodonaea* Mixed Shrubland, *Myoporum* Shrubland, *Myoporum-Dodonaea* Shrubland, *Myoporum-Sophora* and Mixed Shrubland.

Estimated Number of Individuals on PTA: > 2,500

Threats: *Silene lanceolata* is very palatable to feral sheep and/or goats, which have decimated populations of the species. Invasion of *S. lanceolata* habitat by fountain grass (*Pennisetum setaceum*) also could threaten the species. Wildfire has impacted the species negatively.

Comments: Populations of *S. lanceolata* appear to be viable and "healthy." The species is capable of establishing itself and growing successfully in a wide range of habitats. It can be found in plant communities growing on very old substrates (> 10,000 years old) or on very young aa or pahoehoe flows (900 years old). The plant is propagated easily.

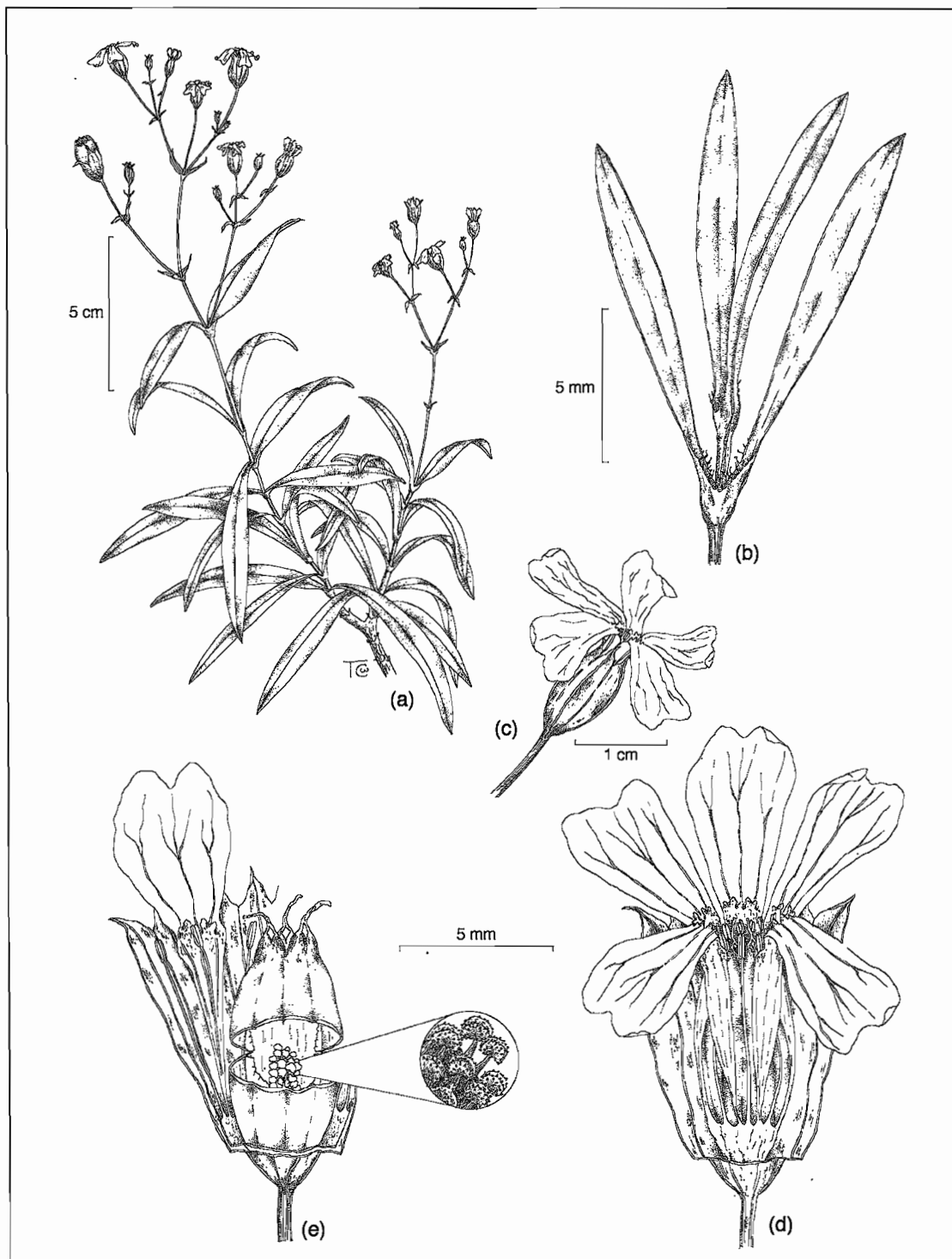
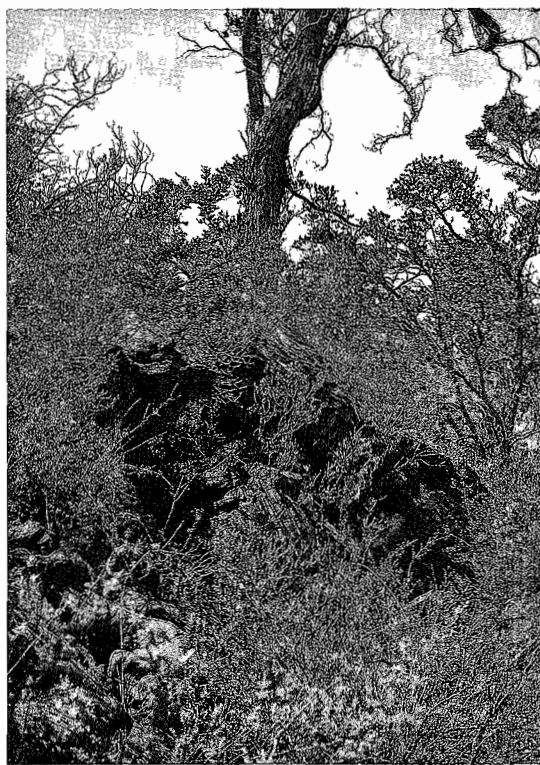
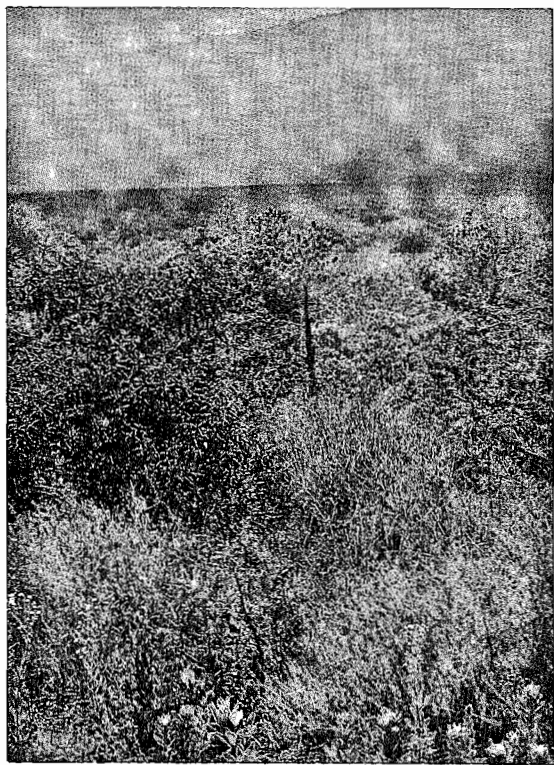
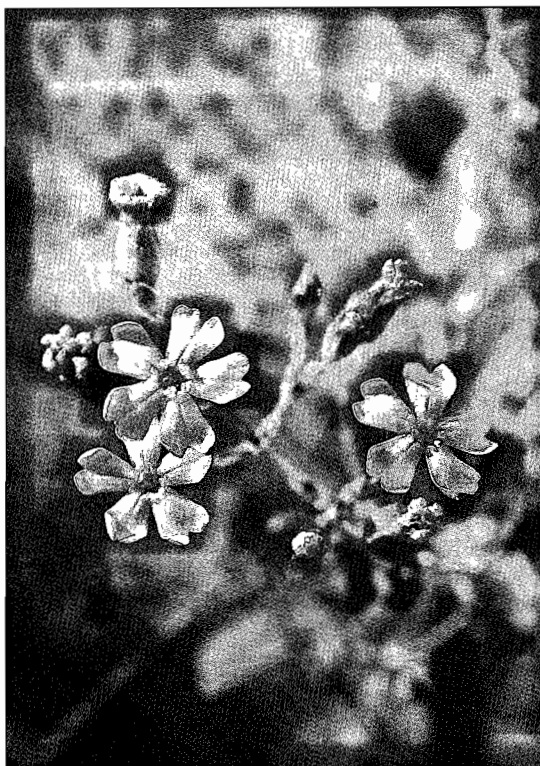
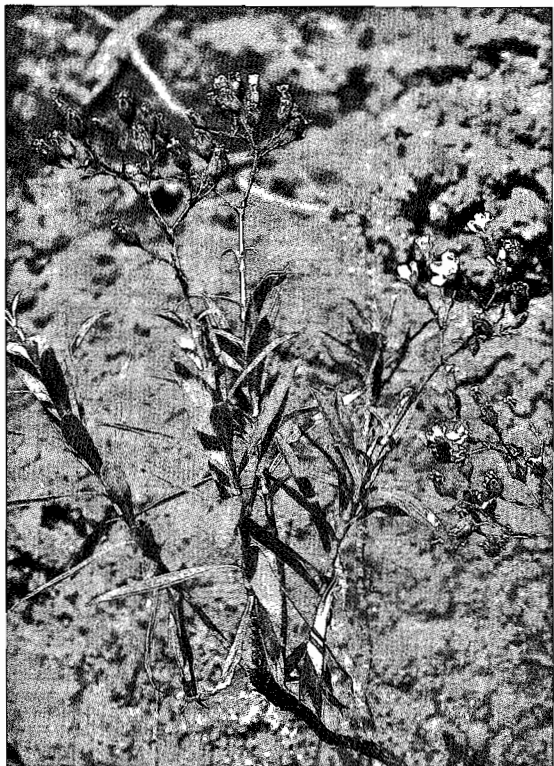


Figure 53. *Silene lanceolata*: (a) flower branch; (b) opposite leaves with entire margins; (c) single, regular-shaped flower with five petals; (d) calyx split to show stamen filament bases and fused petal bases; and (e) capsule cross-section exposing numerous kidney-shaped seeds.

Silene lanceolata



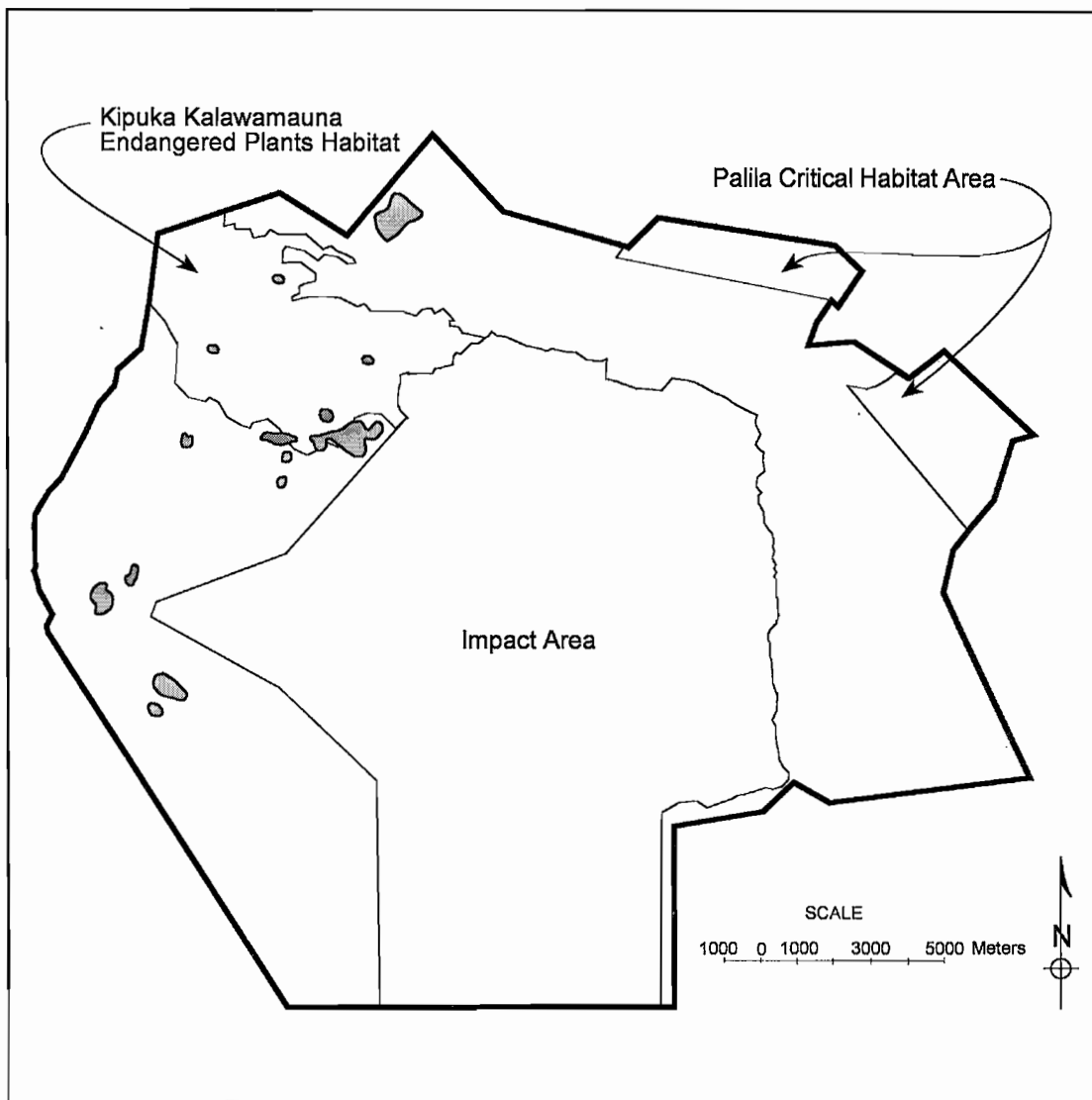


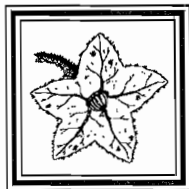
Figure 55. Distribution of *Silene lanceolata* on Pohakuloa Training Area, Hawaii.

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Figure 54. *Silene lanceolata*: (a) plant growing on barren pahoehoe lava; (b) close-up of inflorescence and flowers; (c) typical habitat in Open *Metrosideros* Treeland with dense shrub understory; and (d) *Myoporum* Shrubland habitat within Kipuka Alala.

Solanum incompletum Dunal

Solanum incompletum Dunal



Family: Solanaceae (Nightshade Family)

Common Name: Hawaiian Prickle Leaf, Popolo

Federal Status: Endangered

Description:

Life Span: perennial. **Habit:** small shrub up to 3 m tall; suckers from the base. **Vegetative:** stems and leaves armed with prominent red-orange prickles. **Floral:** flowers perfect, regular; petals white. **Fruit:** a yellow or orange berry that probably turns black when mature.

Distribution:

Historical: Kauai, Lanai, Molokai, Maui and Hawaii. **Current:** Last reported sighting was on the island of Hawaii at Puu Huluhulu in saddle region over 45 years ago.

Habitat:

Substrate: A population of this species was found growing in a 5,000-year old Mauna Loa pahoehoe flow surrounded by younger (4,200-year old) aa flows. **Plant Communities:** Sparse *Metrosideros* Treeland and *Myoporum* Shrubland.

Estimated Number of Individuals on PTA: Only 9 adults and 2 seedlings have been found on the installation.

Threats: The small number of individuals is a major concern. Also, feral sheep and/or goats have browsed most of the adult plants.

Comments: *Solanum incompletum*, *Neraudia ovata* and *Hedyotis coriacea* are the rarest and most threatened plants at PTA because of their small numbers and palatability to feral ungulates. Areas where these species occur should be fenced to protect the plants or, at the very least, individual plants should be caged.

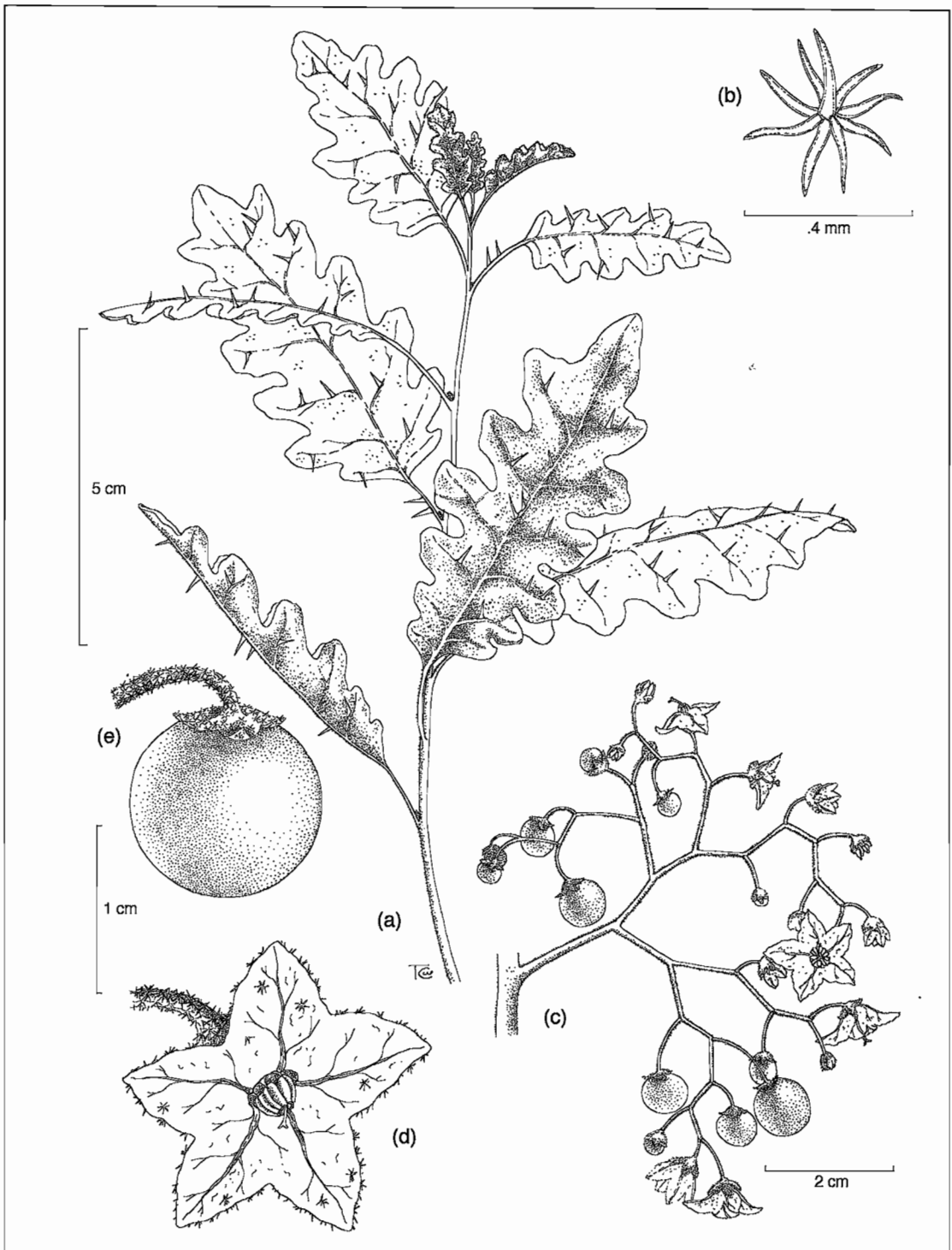
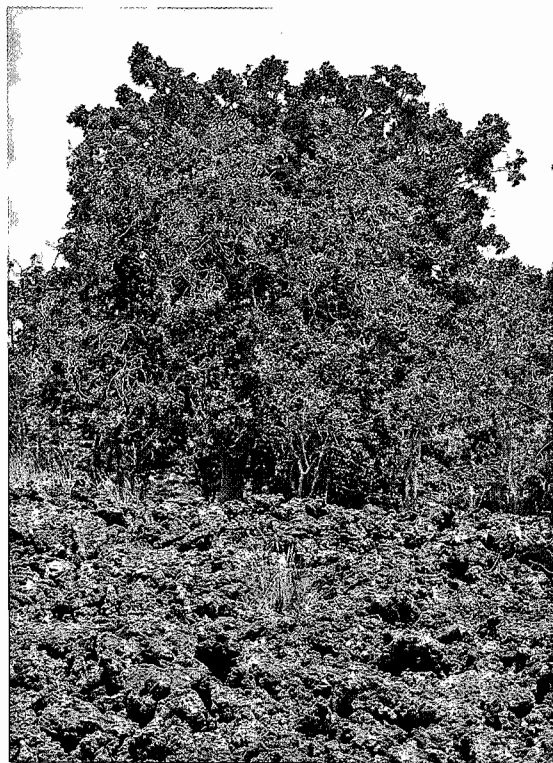
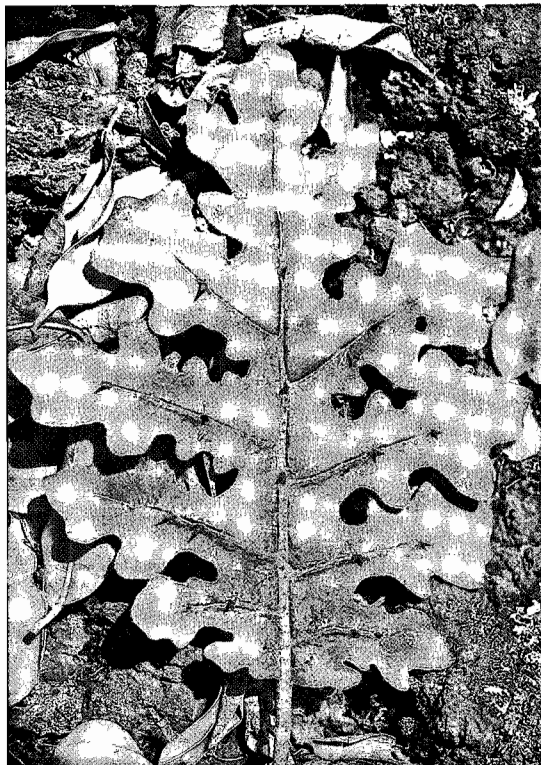
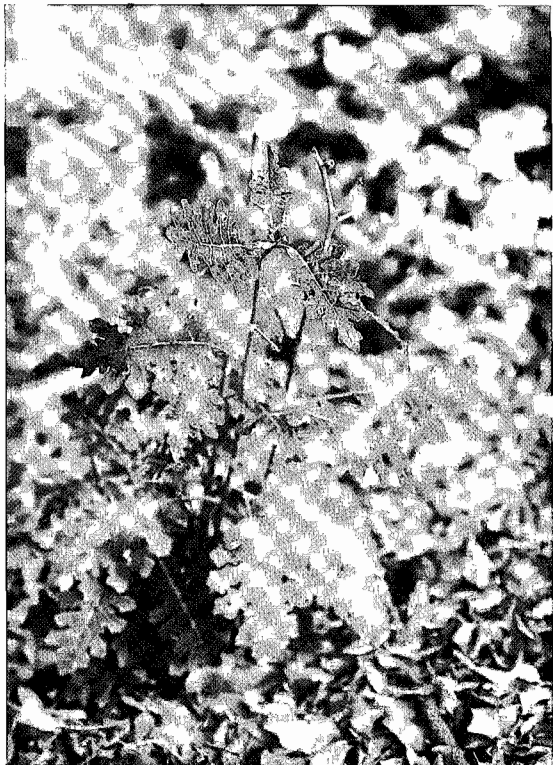


Figure 56. *Solanum incompletum*: (a) upper portion of stem illustrating alternate leaf arrangement and prominent prickles on major veins; (b) stellate hair, which covers much of the plant; (c) compound cyme inflorescence; (d) regular-shaped flower with five petals; and (e) berry-type fruit.

Solanum incompletum



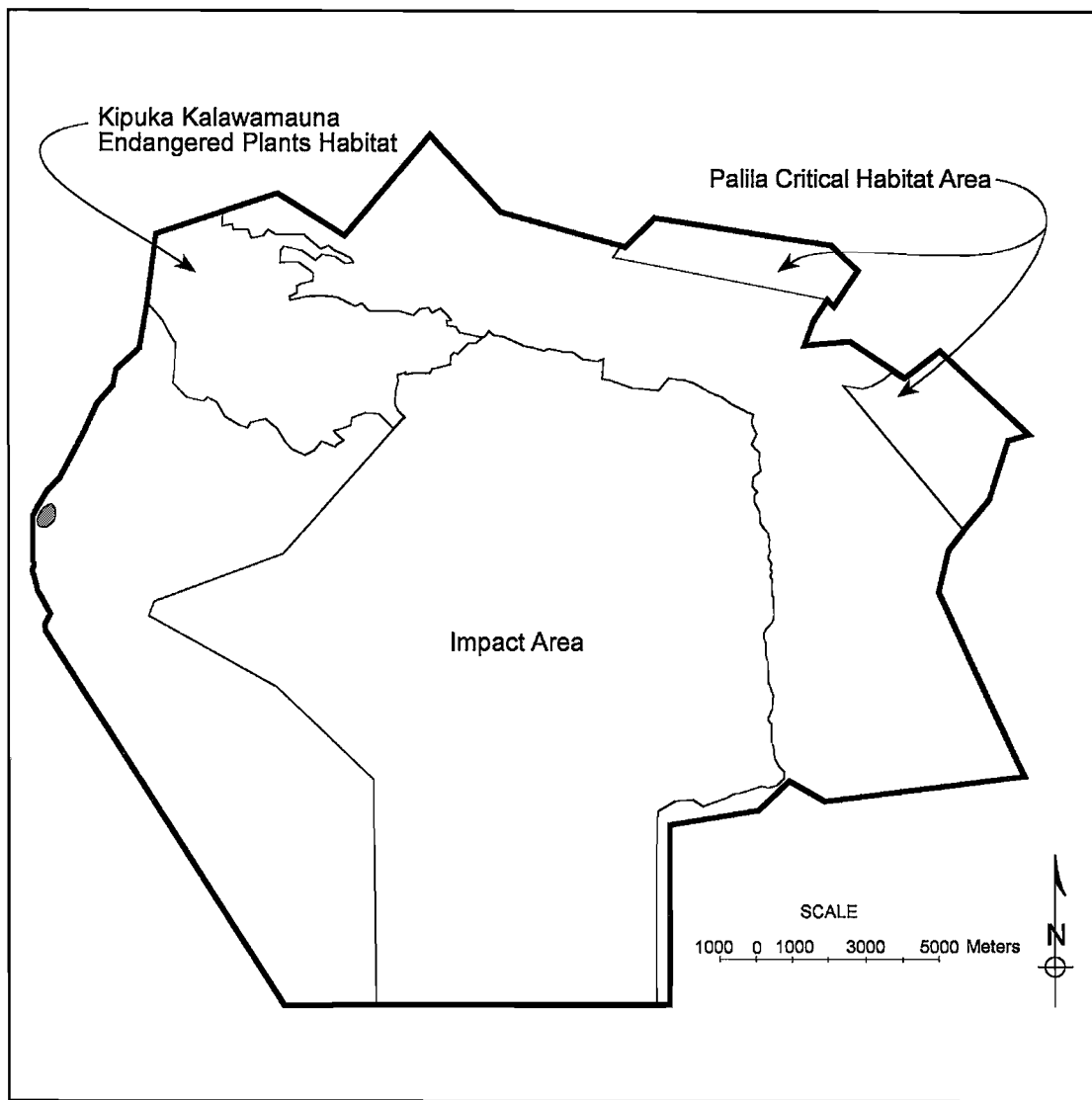


Figure 58. Distribution of *Solanum incompletum* on Pohakuloa Training Area, Hawaii.

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Figure 57. *Solanum incompletum*: (a) plant growing under *Myoporum sandwicense* shrub; (b) underside of leaf exposing golden-red prickles along midrib and major veins; (c) typical *Myoporum* Shrubland habitat; and (d) grove of *Myrsine lanaiensis* and *Neraudia ovata* in which the species was found.

Spermolepis hawaiiensis A. Gray

Spermolepis hawaiiensis Wolff



Family: Apiaceae (Umbelliferae, Parsley Family)

Common Name: Hawaiian Parsley

Federal Status: Endangered

Description:

Life Span: annual. **Habit:** an erect herb arising from a taproot. **Vegetative:** stems glabrous; leaves alternate with a sheathing petiole and compound with linear segments. **Floral:** flowers in compound umbels opposite the upper leaves and regular; petals white. **Fruit:** fruit 3–4 mm long, nearly round, ribbed, and covered with hooked spines.

Distribution:

Historical: Kauai, Oahu, Molokai, Maui and Hawaii. **Current:** Collected within the last ten years on Oahu, Maui, and Hawaii. At PTA, found in Kipuka Alala and scattered throughout the southwestern part of the installation.

Habitat:

Substrate: *Spermolepis hawaiiensis* has been found on moderately old (1,000–2,000-year old) to very old (>6,000-year old) Mauna Loa flows. It typically grows in ash and soil pockets where moisture frequently accumulates. **Plant Communities:** Open *Metrosideros* Treeland with sparse shrub understory, *Myoporum–Sophora* Mixed Shrubland, and *Myoporum–Sophora* Shrubland with forb understory. May be more widespread across the installation and, like *Hesperocnide sandwicensis*, could occur in any moist area.

Estimated Number of Individuals on PTA: > 1,000

Threats: Plants browsed by feral sheep and/or goats have been observed within the Kipuka Alala. Clearing of overstory woody plant cover and reshaping substrate for construction of roads, etc., would adversely impact the habitat needed by this species.

Comments: Joel Lau made the first discovery of this species on PTA. Since then, *S. hawaiiensis* has been found in various locations in the southwestern part of the installation. *Spermolepis hawaiiensis* can be confused with the much more common *Daucus pusillus* (American Carrot). They are easily distinguished in the field because *D. pusillus* stems are very hairy, while the stems of *S. hawaiiensis* are glabrous.

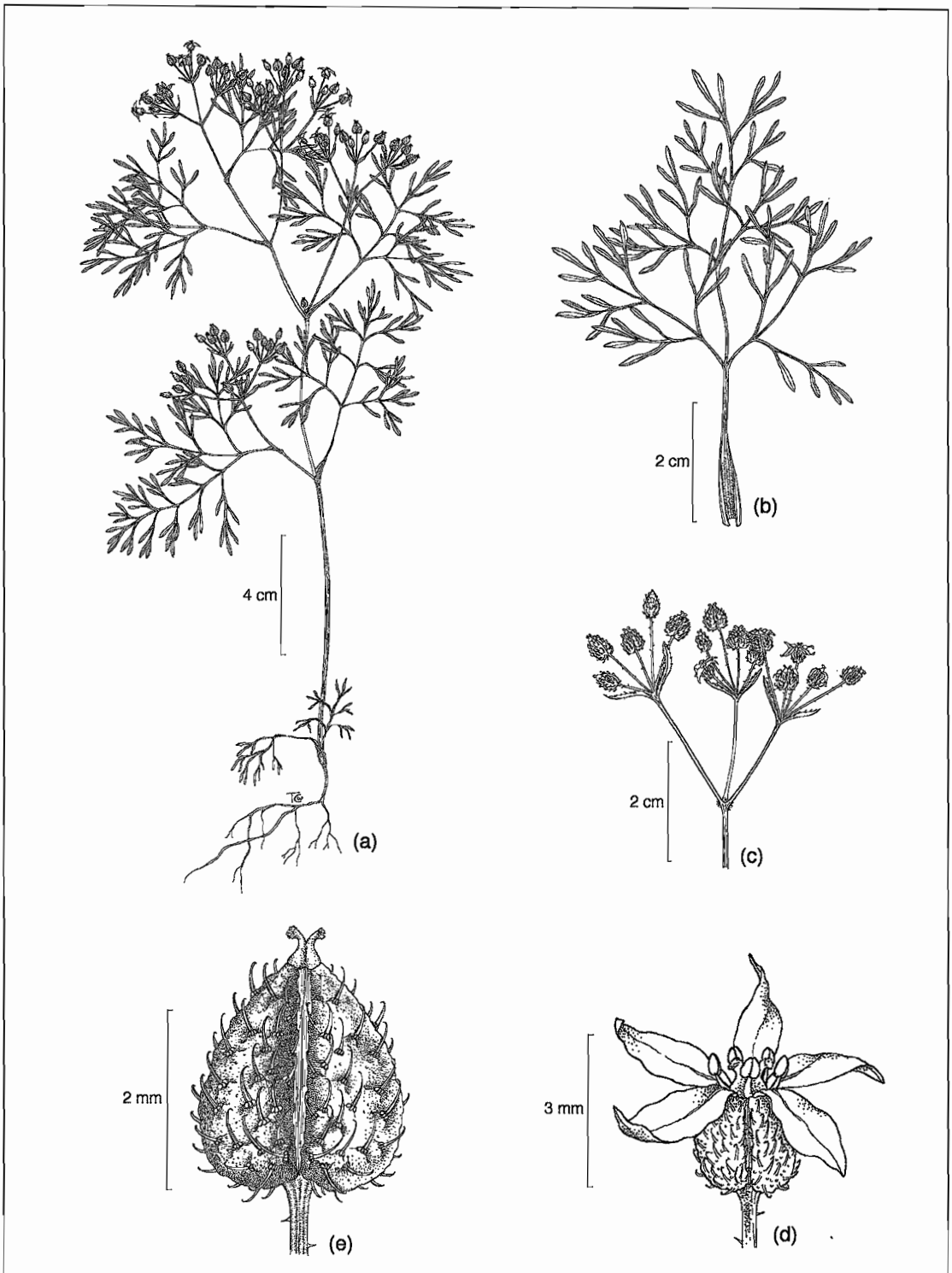
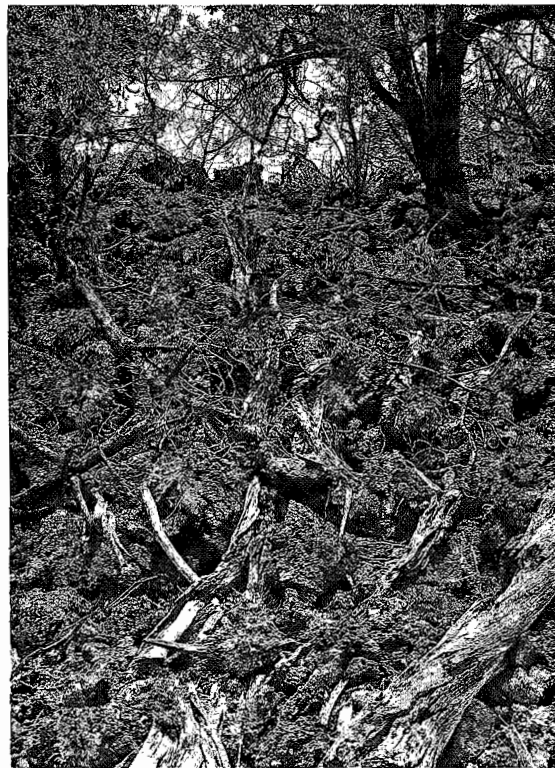
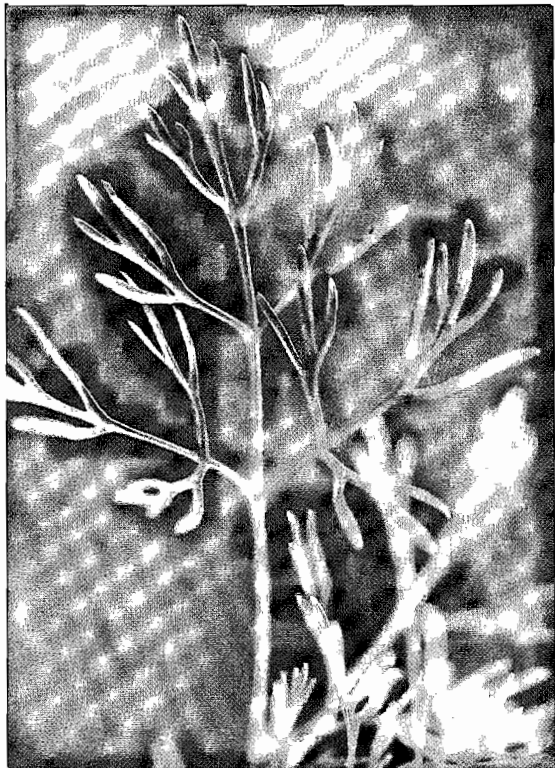


Figure 59. *Spermolepis hawaiiensis*: (a) general habit; (b) ternately compound leaf with sheathing leaf base; (c) compound umbel inflorescence; (d) single flower showing inferior ovary; and (e) fruit covered with tubercles.



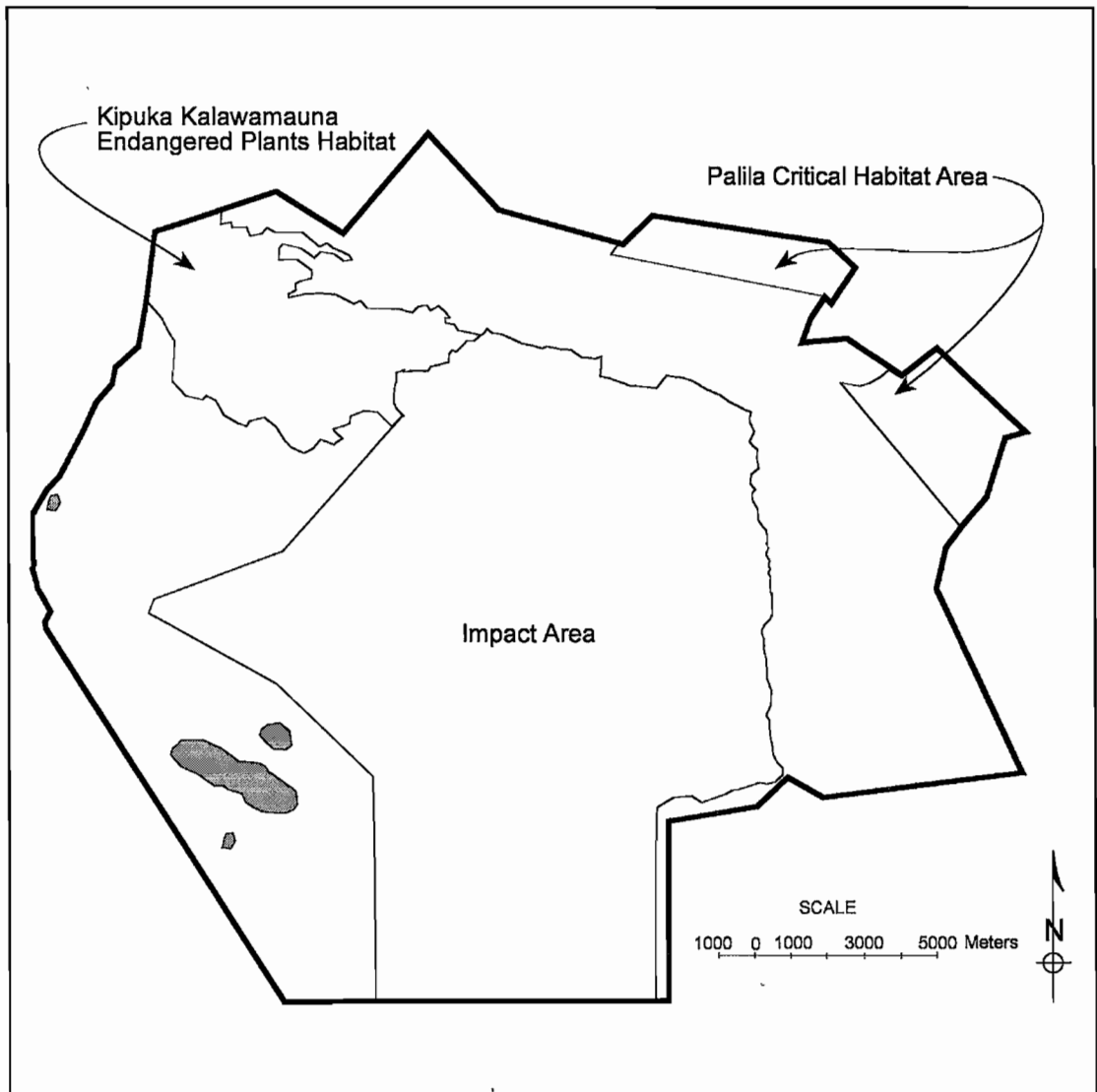


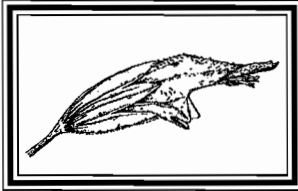
Figure 61. Distribution of *Spermolepis hawaiiensis* on Pohakuloa Training Area, Hawaii.

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Figure 60. *Spermolepis hawaiiensis*: (a) ternately compound leaf; (b) simple flowers; (c) compound umbel with developing fruit; and (d) typical *Myoporum-Sophora* Mixed Shrubland habitat within Kipuka Alala.

Stenogyne angustifolia A. Gray

Stenogyne angustifolia A. Gray



Family: Lamiaceae (Labiatae, Mint Family)

Common Name: Creeping Mint

Federal Status: Endangered

Description:

Life Span: perennial. **Habit:** low growing vine with horizontal above- and below-ground stems, becoming slightly woody at the base. **Vegetative:** stems square; leaves opposite, usually lance-shaped, margins evenly toothed. **Floral:** usually one flower at the base of each leaf; red, maroon, or (rarely) yellow, and irregularly shaped. **Fruit:** four small, black, very hard nutlets per flower.

Distribution:

Historical: Molokai, Maui, and Hawaii. **Current:** Previously reported only from PTA; however, the species has been collected recently at Waikoloa and Puu Anahulu (on Hawaii). At PTA, the species is distributed from Kipuka Kalawamauna to Kipuka Alala on the west side of PTA.

Habitat:

Substrate: *Stenogyne angustifolia* is abundant on very old Mauna Kea aa and pahoehoe flows (> 10,000 years old). The species is also abundant on Mauna Loa aa and pahoehoe flows varying from 900 to over 5,000 years old. **Plant Communities:** *Chamaesyce* Treeland, Open *Metrosideros* Treeland with sparse shrub understory, Open *Metrosideros* Treeland with dense shrub understory, Intermediate *Metrosideros* Mixed Treeland, Open *Dodonaea* Shrubland, *Dodonaea* Mixed Shrubland, *Myoporum*-*Dodonaea* Shrubland, *Myoporum*-*Sophora* Mixed Shrubland, *Myoporum* Shrubland, and *Styphelia* Mixed Shrubland.

Estimated Number of Individuals on PTA: > 100,000

Threats: Rooting activities by feral hogs could damage and kill the underground stems of this species; however, it does not appear to be highly palatable to feral sheep and goats and is only consumed during the driest periods or after fire. Invasion of *S. angustifolia* habitat by fountain grass (*Pennisetum setaceum*) also could impact the species negatively.

Comments: *Stenogyne angustifolia* hybridizes with both *S. rugosa* and *S. microphylla* on PTA. Within the Kipuka Kalawamauna Endangered Plants Habitat, individuals of *S. angustifolia* occasionally have more than two flowers at each node, which is more characteristic of *S. rugosa*. The species can be propagated rather easily from seeds or cuttings.

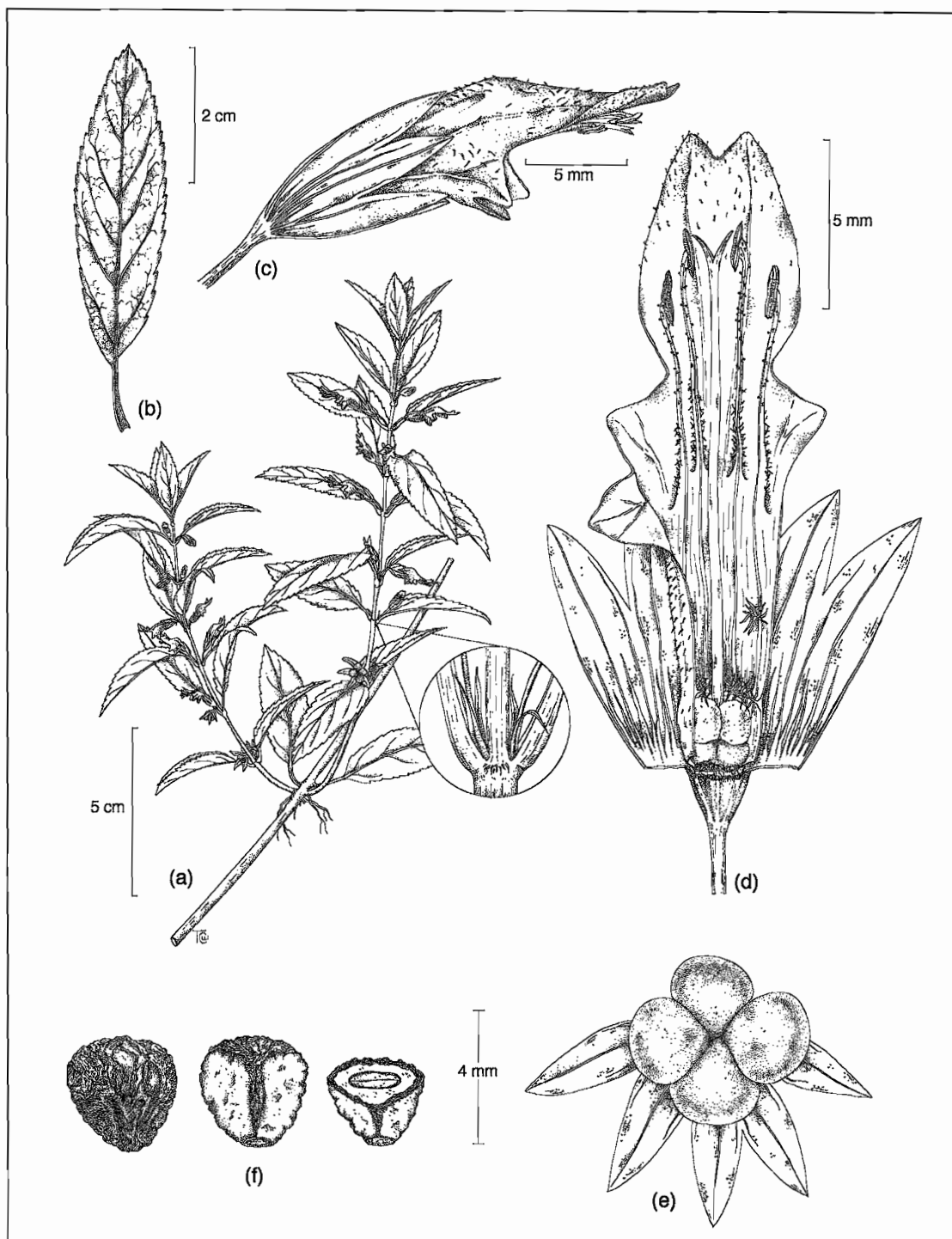
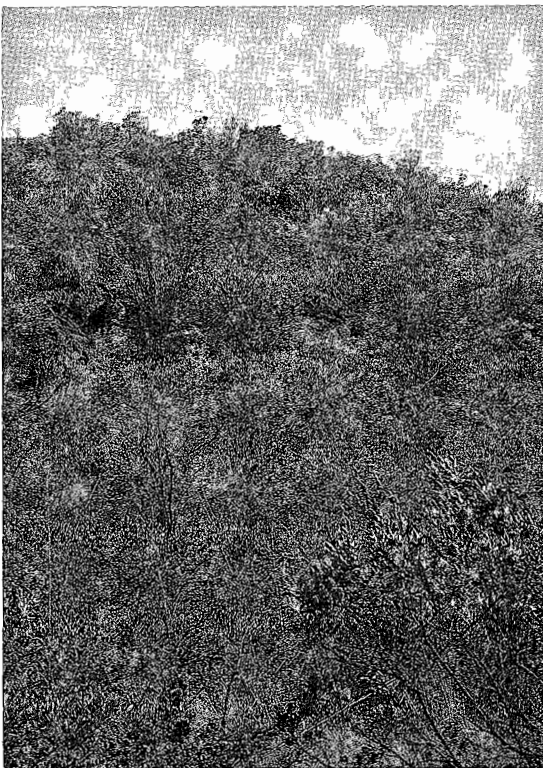
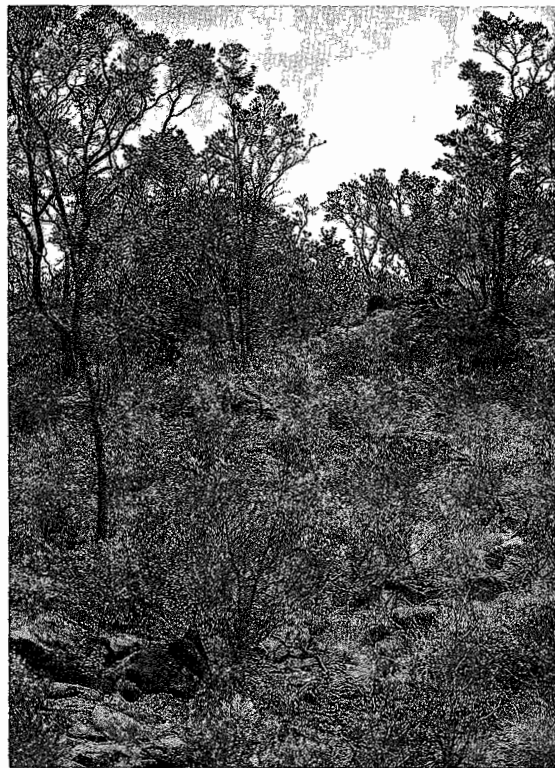
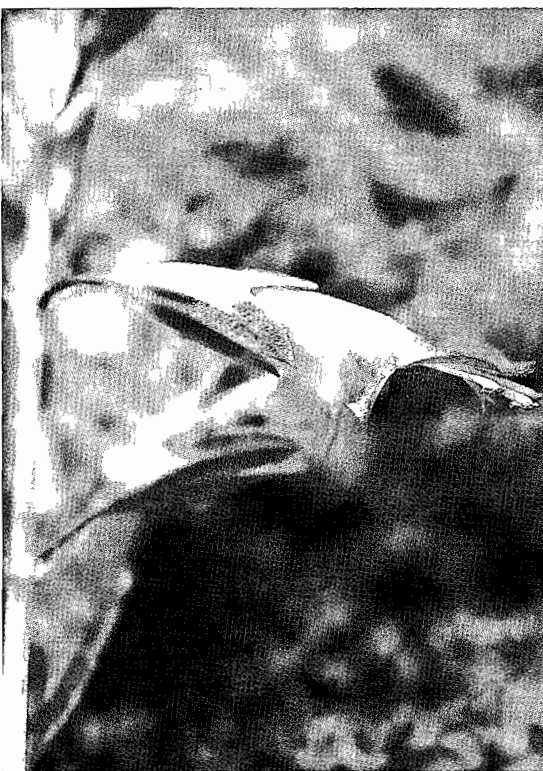


Figure 62. *Stenogyne angustifolia*: (a) horizontal, above-ground stem showing branches and roots arising from a node; (b) simple, lance-shaped leaf with evenly toothed margins; (c) a single two-lipped flower; (d) corolla tube opened to expose four stamens; stamens adnate to the corolla wall and included within the upper lip of the flower; two-lobed style; (e) top view of ovary showing four nutlets; and (f) back, front, and cross-section of nutlet.

Stenogyne angustifolia



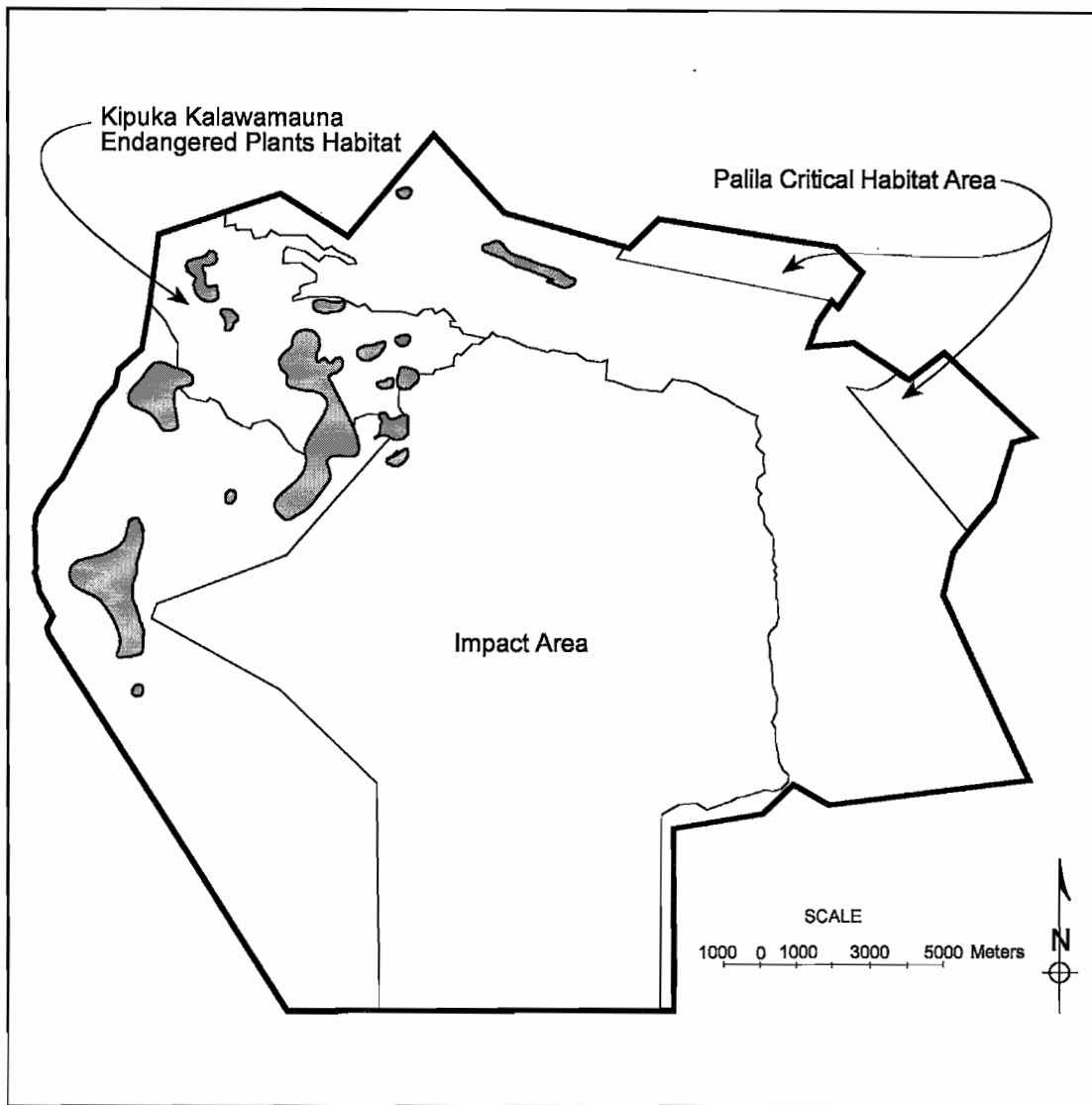


Figure 64. Distribution of *Stenogyne angustifolia* on Pohakuloa Training Area, Hawaii.

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Figure 63. *Stenogyne angustifolia*: (a) horizontal stem growing on pahoehoe lava; (b) close-up of flower; (c) *Dodonaea* Mixed Shrubland in Kipuka Kalawamauna where the species is abundant; and (d) typical habitat in Open *Metrosideros* Treeland with sparse shrub understory.

Tetramolopium arenarium (A. Gray) Hillebr.

Tetramolopium arenarium (A. Gray) Hillebr.



Family: Asteraceae (Compositae, Sunflower Family)

Common Name: Mauna Kea Pamakani

Federal Status: Endangered

Description:

Life Span: perennial. **Habit:** erect shrub to up to 2 m tall; single-stemmed at the base, branching above. **Vegetative:** stems round; leaves alternate, oblanceolate, the margins entire, usually evenly covered with short, soft hairs. **Floral:** several heads in dense clusters at the tips of branches; bracts that subtend the florets are up to 4 mm long, lance-shaped; ray florets numerous and the petal usually white and becoming recurved; disk flowers maroon or rarely yellow; pappus white and up to 4 mm long. **Fruit:** an achene with 1–4 nerves.

Distribution:

Historical: Maui and Hawaii. **Current:** Two populations are known along New Bobcat Trail and Kona Highway within the Kipuka Kalawamauna Endangered Plants Habitat on the installation.

Habitat:

Substrate: *Tetramolopium arenarium* is extremely rare on very old Mauna Kea flows (> 10,000 years old). **Plant Communities:** *Dodonaea* Mixed Shrubland

Estimated Number of Individuals on PTA: < 150

Threats: Damage from rooting and trampling by feral hogs, invasion of habitat by fountain grass (*Pennisetum setaceum*), wildfire, dust from a road that bisects the populations, and extremely small numbers are the major threats to this species. Apparently it is not palatable to feral sheep and/or goats.

Comments: Several subspecies and varieties of *T. arenarium* have been described, but recent nomenclatural debate precludes any further segregation at this time. Although the plant is extremely rare, *T. arenarium* is easy to germinate and establish in the greenhouse or field.

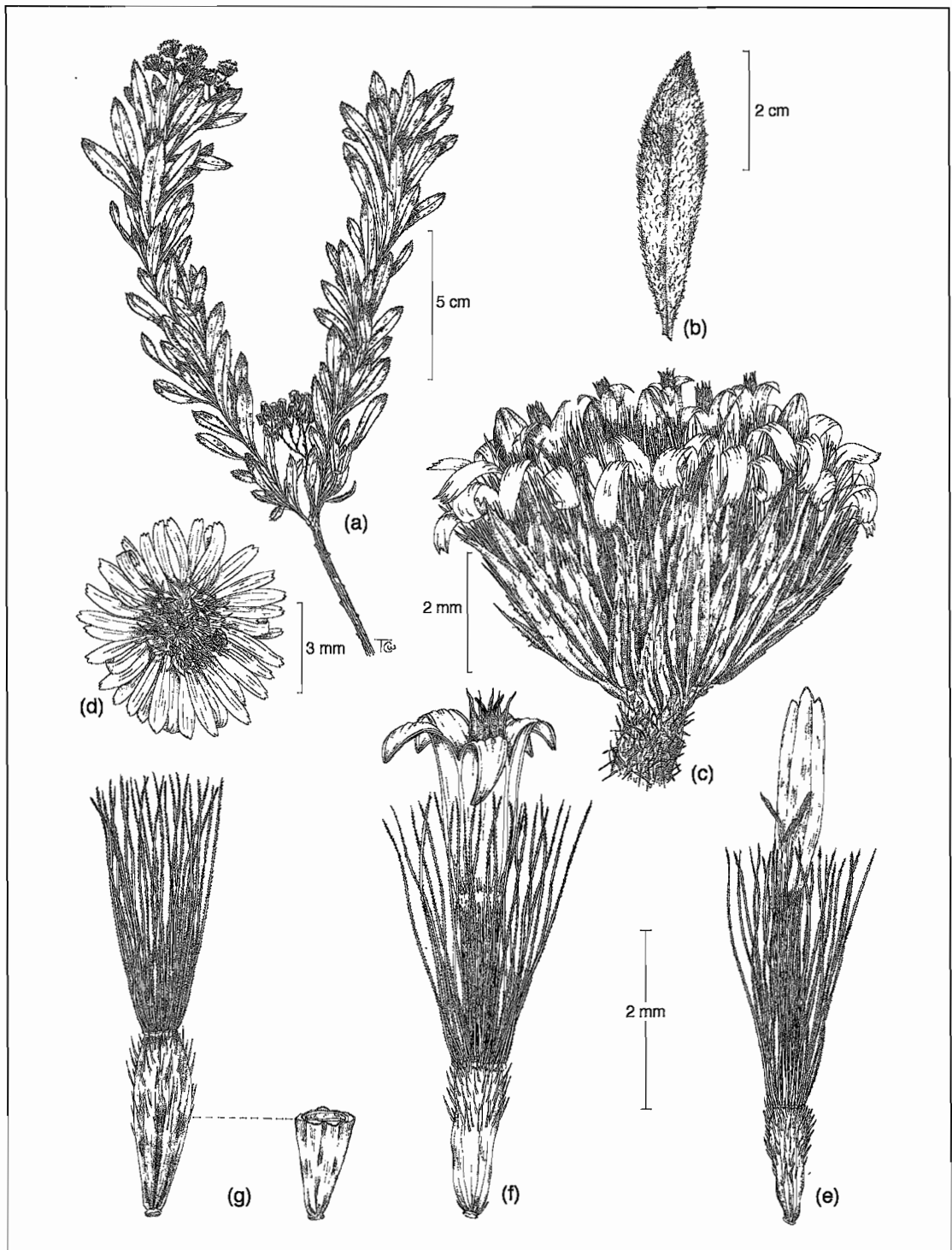
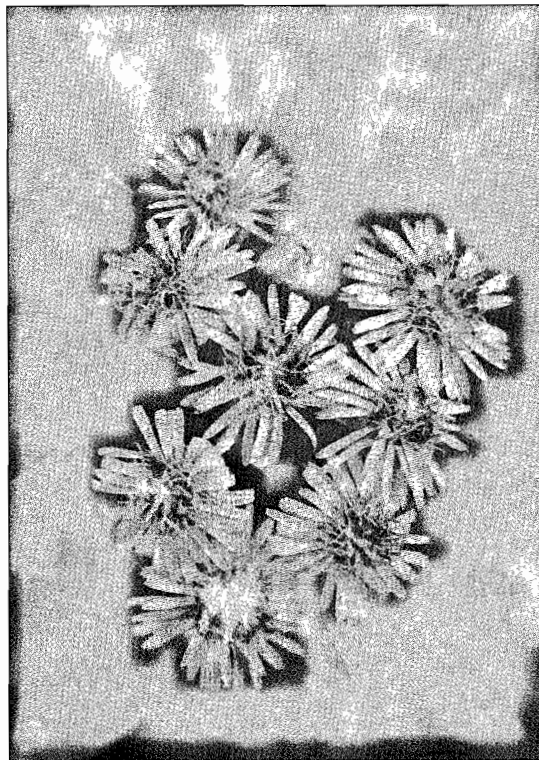
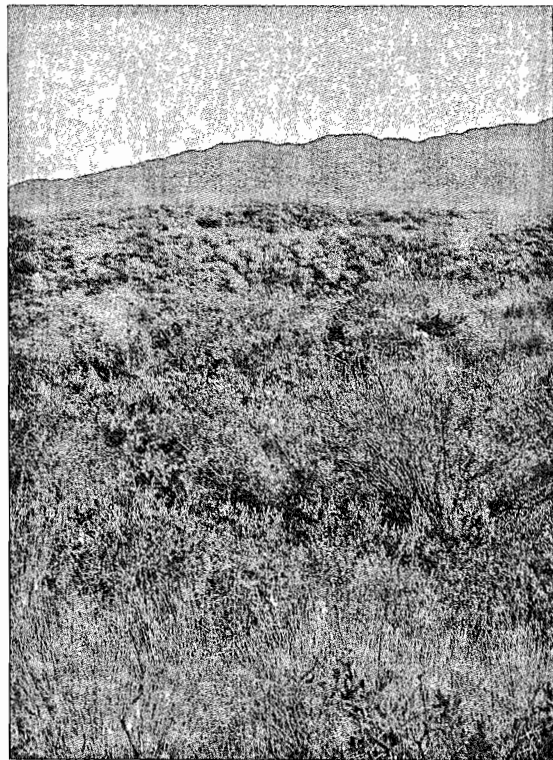


Figure 65. *Tetramolopium arenarium*: (a) typical flowering branch; (b) simple leaf with entire margin; (c) side view of single head from inflorescence; (d) top view of single head; (e) ray floret; (f) disk floret; and (g) achene with pappus and in cross-section.

Tetramolopium arenarium



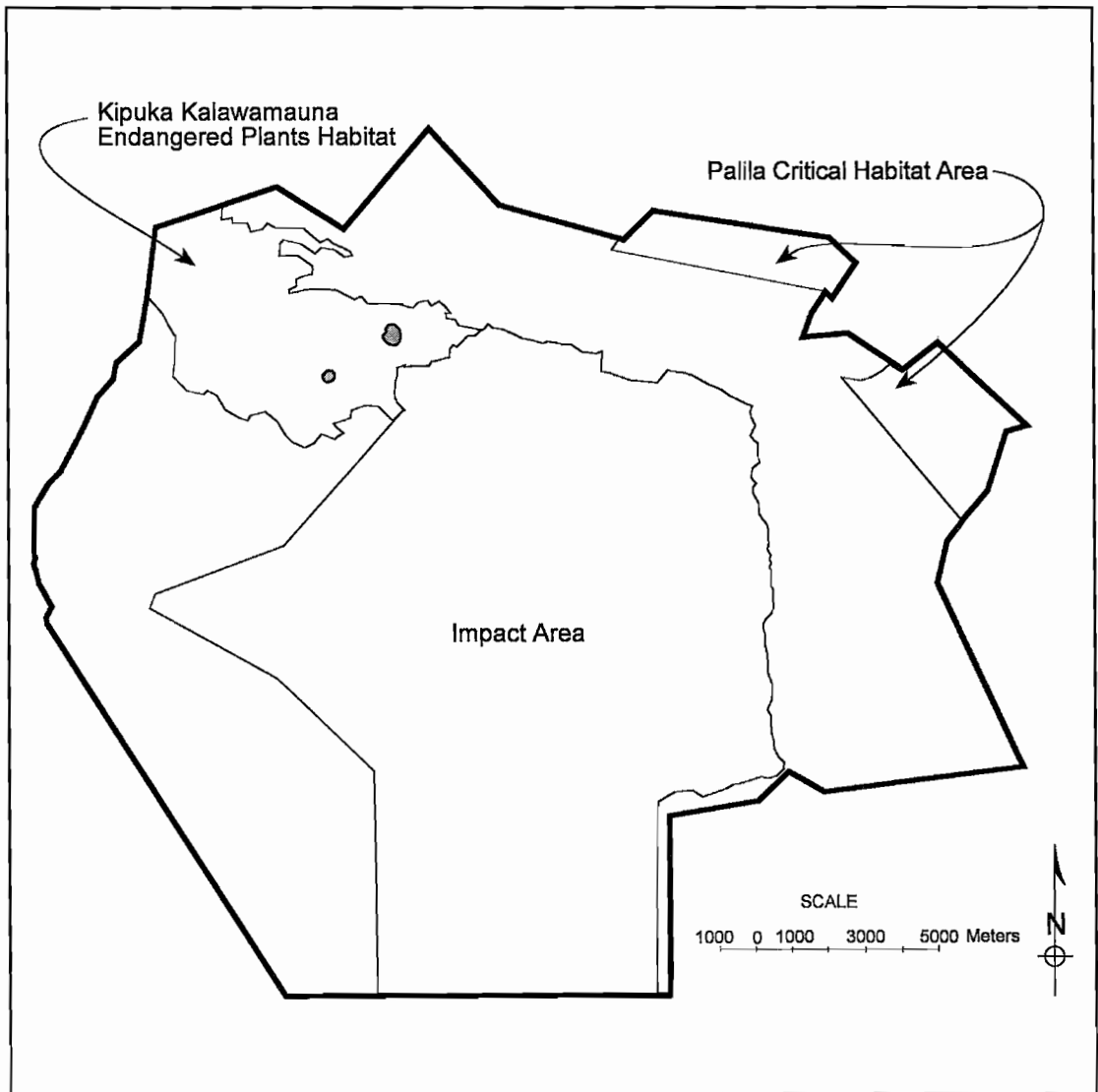


Figure 67. Distribution of *Tetramolopium arenarium* on Pohakuloa Training Area, Hawaii.

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Figure 66. *Tetramolopium arenarium*: (a) mature, erect individual showing candelabra form; (b) flowering branch with cluster of heads at the tip; (c) cluster of heads (disks florets maroon and rays florets white); and (d) typical *Dodonaea* Mixed Shrubland habitat within Kipuka Kalawamauna.

Tetramolopium consanguineum (A. Gray) Hillebr.
ssp. *leptophyllum* (Sherff) Lowrey var. *leptophyllum*

***Tetramolopium consanguineum* (A. Gray) Hillebr.
ssp. *leptophyllum* (Sherff) Lowrey var. *leptophyllum***



Family: Asteraceae (Compositae, Sunflower Family)

Common Name: Narrow-leaf Pamakani

Federal Status: Species of Concern

Description:

Life Span: perennial. **Habit:** erect shrub up to 2 m tall; single-stemmed at the base, branching above. **Vegetative:** stems round; leaves linear with stiff hairs along the midrib and margins, usually glandularly dotted, margins typically entire but occasionally with a few irregular teeth. **Floral:** numerous heads in tight clusters, which barely protrude beyond the leaves at the branch tips; bracts that subtend the flowers are up to 2.5 mm long and oblanceolate with erose margins; ray florets numerous and petals lavender or white; disk florets maroon; pappus brownish and less than 3 mm long. **Fruit:** an achene with 2–6 nerves.

Distribution:

Historical: Kauai (doubtful) and Hawaii. **Current:** The species is common from the southern boundary of Kipuka Kalawamauna Endangered Plants Habitat to the northern boundary of Kipuka Alala. A small population has been found growing within Kipuka Alala.

Habitat:

Substrate: The species is common on Mauna Loa pahoehoe and aa flows varying from 900–5000 years old. **Plant Communities:** Barren Lava, Sparse *Metrosideros* Treeland, Open *Metrosideros* Treeland with sparse shrub understory, Open *Metrosideros* Treeland with dense shrub understory, Intermediate *Metrosideros* Mixed Treeland, Open *Dodonaea* Shrubland, Dense *Dodonaea* Shrubland, *Myoporum* Shrubland, *Myoporum–Dodonaea* Shrubland, *Myoporum–Sophora* Mixed Shrubland, and *Myoporum–Sophora* Shrubland with forb understory.

Estimated Number of Individuals on PTA: > 10,000

Threats: Growing in disturbed areas along roadsides makes *Tetramolopim consanguineum* susceptible to damage from dust. Also, feral sheep and goats use the roads and frequently browse the plants near the roadside.

Comments: The species is fairly common at PTA, which represents the taxon's only known location. Another variety (*T.c.* var. *kauense*) of the species was known from the Kau District near South Point, but recent surveys into the area have failed to relocate the plants. *Tetramolopium consanguineum* is easily germinated and established in the greenhouse or field.

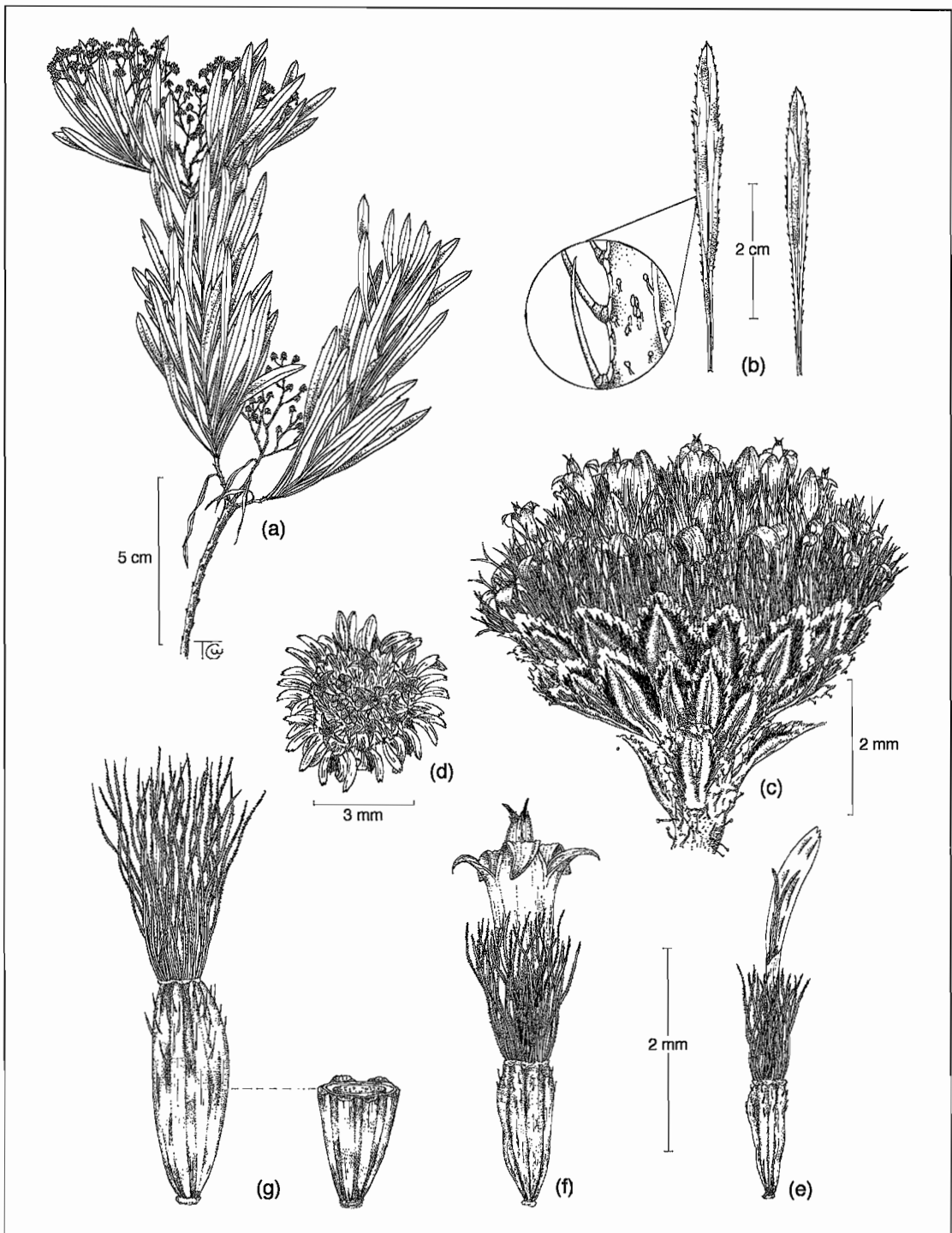
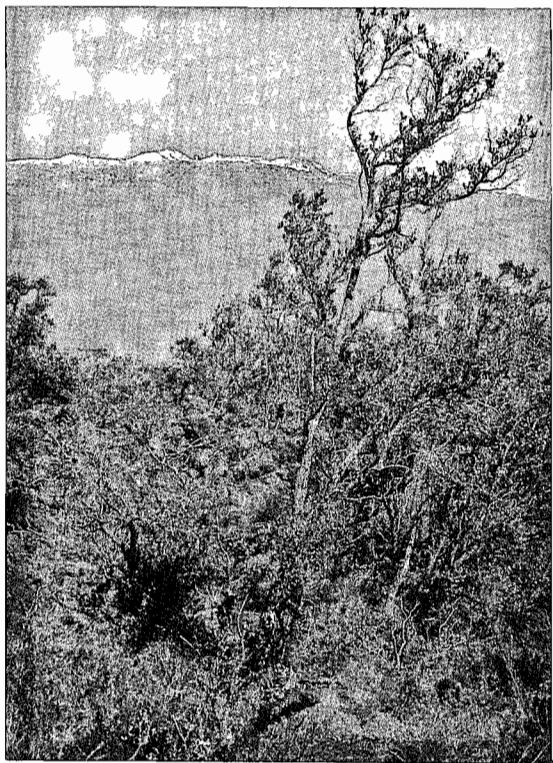
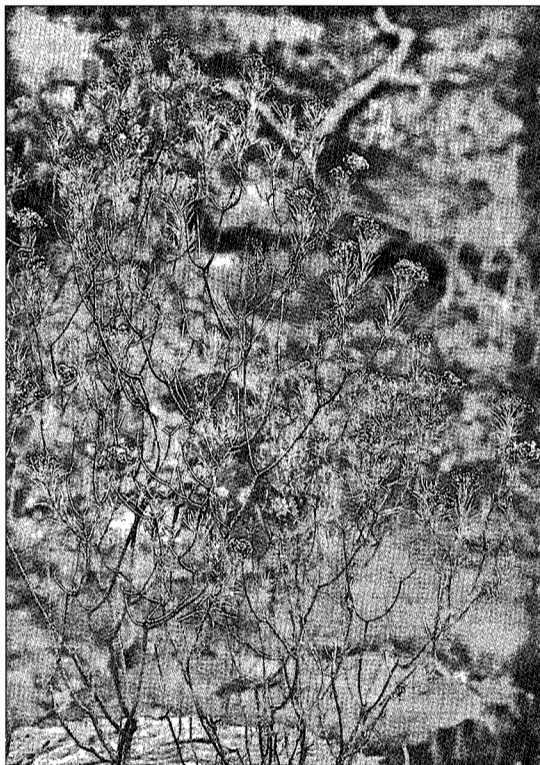
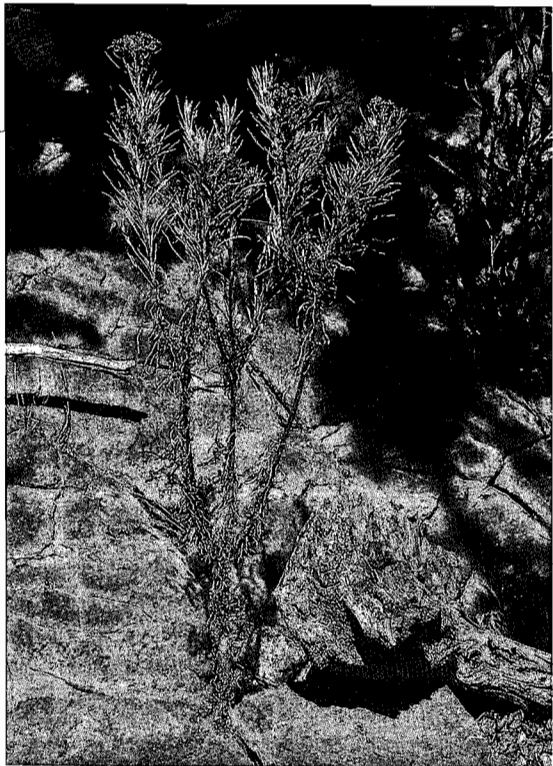


Figure 68. *Tetramolopium consanguineum* var. *leptophyllum*: (a) flowering branch; (b) simple leaves with irregularly toothed and entire margins (insert showing multicellular hairs along leaf margins); (c) side view of single head from inflorescence; (d) top view of single head; (e) ray floret; (f) disk floret; and (g) achene with pappus and cross-section showing multiple nerves per face.

Tetramolopium consanguineum var. *leptophyllum*



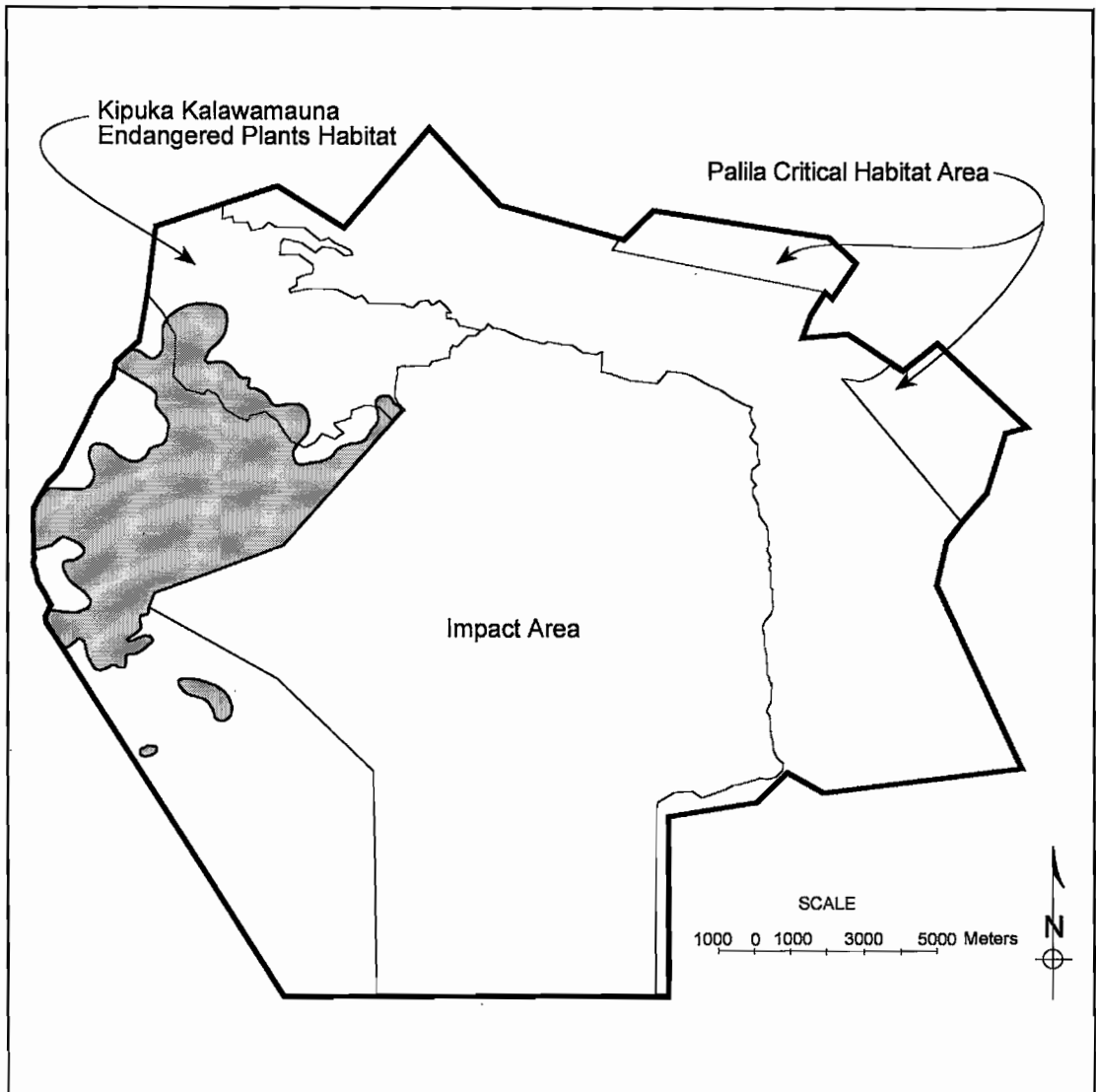


Figure 70. Distribution of *Tetramolopium consanguineum* var. *leptophyllum* on Pohakuloa Training Area, Hawaii.

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Figure 69. *Tetramolopium consanguineum* var. *leptophyllum*: (a) young plant growing in pahoehoe lava; (b) mature individual; (c) cluster of heads (disk florets maroon and ray florets white); and (d) typical habitat in Open *Metrosideros* Treeland with sparse shrub understory where the species is abundant.

Tetramolopium diersingii Shaw & Lowrey

Tetramolopium diersingii Shaw & Lowrey



Family: Asteraceae (Compositae, Sunflower Family)

Common Name: Tooth Leaf Pamakani

Federal Status: None

Description:

Life Span: perennial. **Habit:** erect shrub up to 2 m tall, single-stemmed at the base, branching above. **Vegetative:** stems round; leaves alternate, linear to oblanceolate, margins entire to variously and deeply toothed, pubescent (with long straight hairs to almost glabrous). **Floral:** numerous heads in open clusters at the tips of branches; bracts that subtend the flowers are up to 6 mm long and narrow; ray florets numerous, petals usually white and become recurved with age; disk florets yellow or (rarely) maroon; pappus white and nearly 4 mm long. **Fruit:** an achene with 1–2 nerves.

Distribution:

Historical: Hawaii. **Current:** Four populations are known from the installation.

Habitat:

Substrate: *Tetramolopium diersingii* is rare on 3,000–to 5,000-year old Mauna Loa pahoehoe lava flows. **Plant Communities:** Open *Metrosideros* Treeland with sparse shrub understory, *Dodonaea* Mixed Shrubland, and *Myoporum* Shrubland.

Estimated Number of Individuals on PTA: < 400

Threats: Extremely small numbers make this species vulnerable to catastrophic disturbance. Wildfire is probably the major threat to the species. Feral sheep and goats occasionally will consume seedlings of *T. diersingii*; however, the mature plants do not appear to be palatable to them.

Comments: This species is new to science. It is related to *T. arenarium*, *T. consanguineum*, and *T. lepidotum* and was reported as the latter species on a poster of rare plants of the installation. The plant can be readily propagated in the greenhouse.

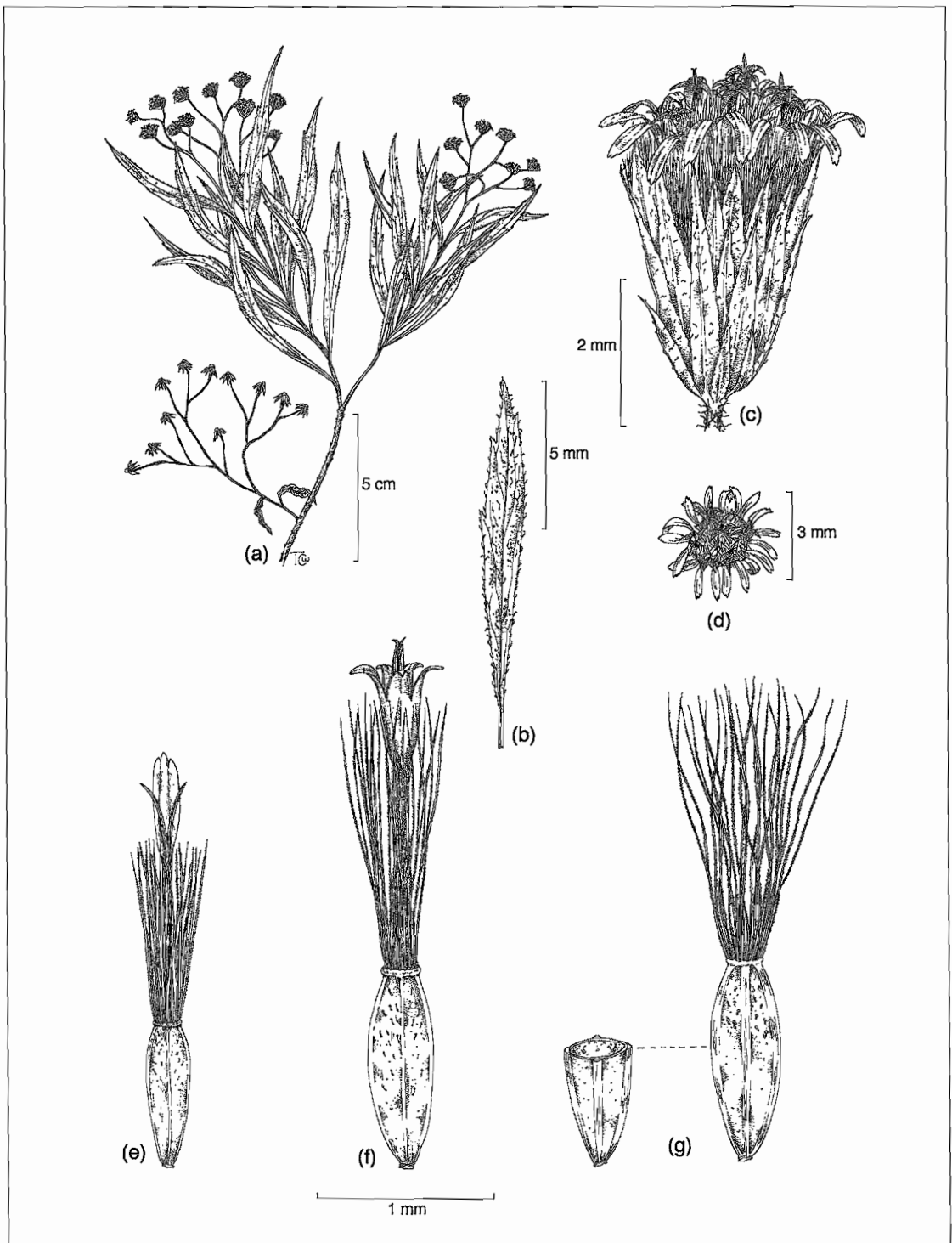
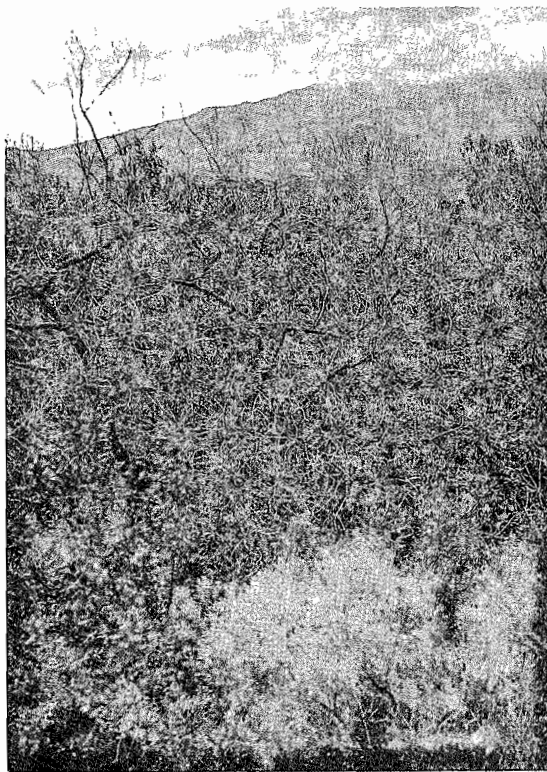
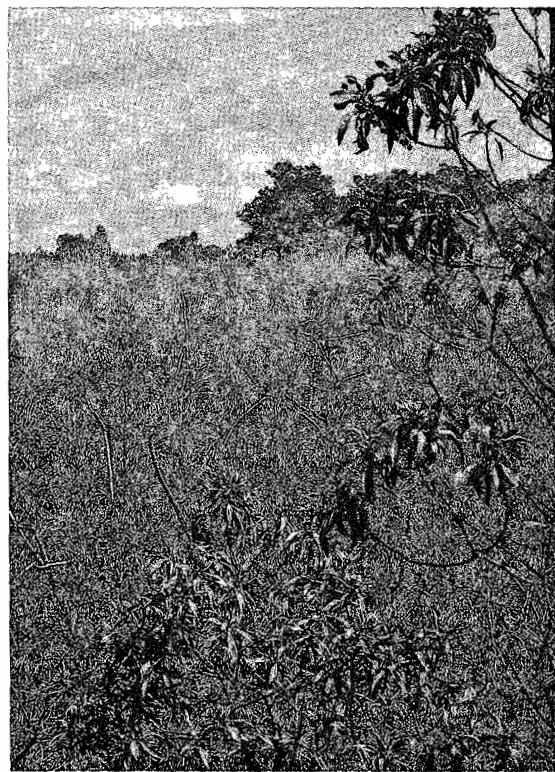
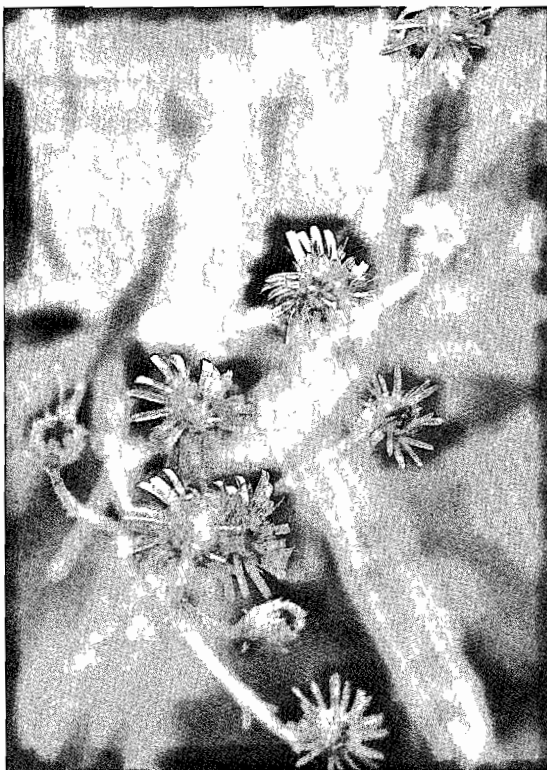


Figure 71. *Tetramolopium diersingii*: (a) typical flowering branch; (b) simple leaf with unevenly toothed margin; (c) side view of single head from inflorescence; (d) top view of single head; (e) ray floret; (f) disk floret; and (g) achene with pappus and cross-section showing a single nerve per face.

Tetramolopium diersingii



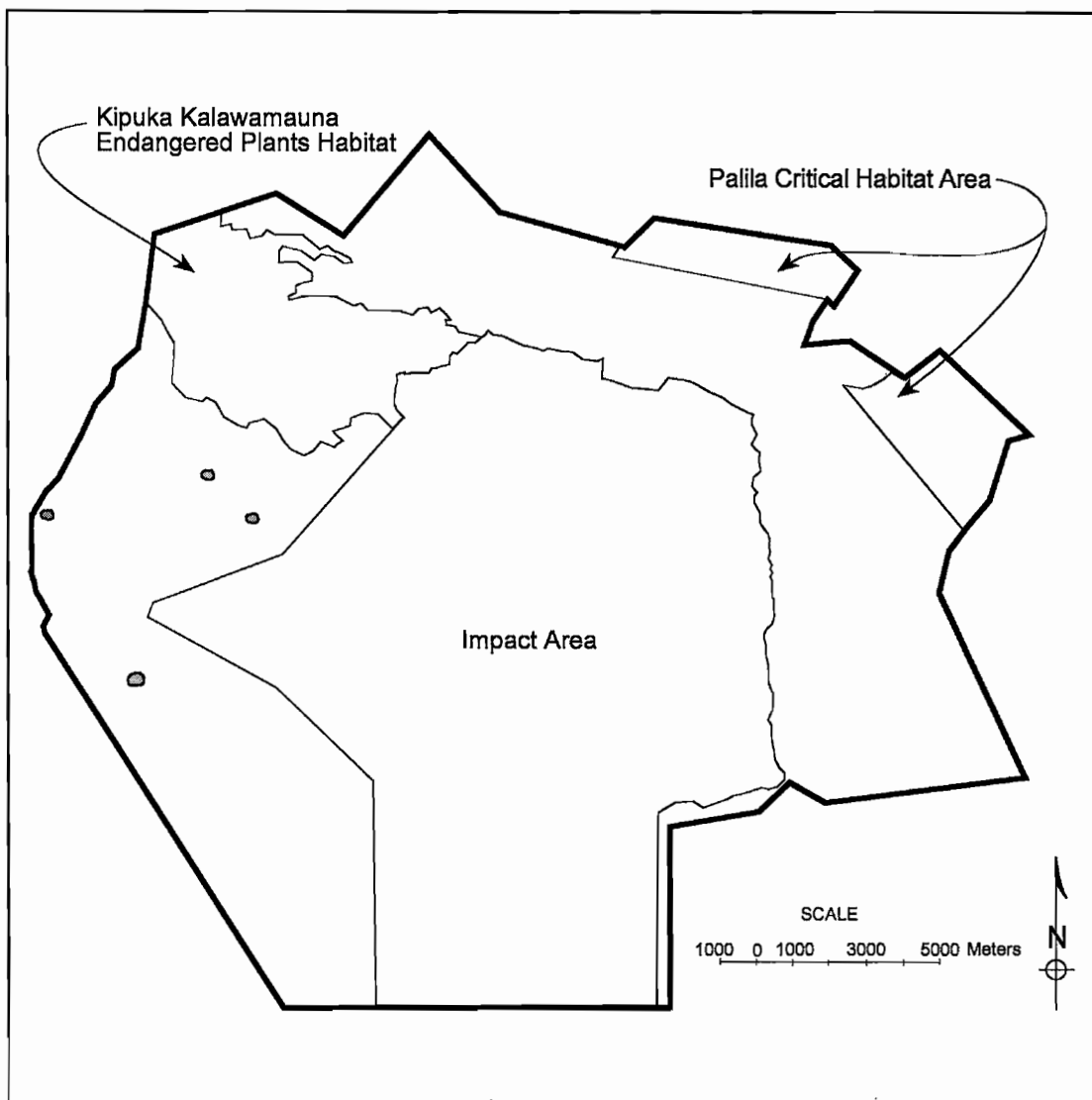


Figure 73. Distribution of *Tetramolopium diersingii* on Pohakuloa Training Area, Hawaii.

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Figure 72. *Tetramolopium diersingii*: (a) immature plant with large, irregularly-toothed leaves; (b) inflorescence with numerous heads on long and flexuous peduncles; (c) typical *Dodonaea* Mixed Shrubland habitat within Kipuka Alala; and (d) typical *Myoporum* Shrubland habitat where the species occurs near Charlie Circle.

Tetramolopium humile (A. Gray) Hillebr. ssp. *humile* var.
sublaeve Sherff

***Tetramolopium humile* (A. Gray) Hillebr. ssp. *humile* var. *sublaeve* Sherff**



Family: Asteraceae (Compositae, Sunflower Family)

Common Name: Subalpine Pamakani

Federal Status: Species of Concern

Description:

Life Span: perennial. **Habit:** small shrub up to 20 cm tall; stems branching at the base. **Vegetative:** stems densely glandular and resinous; leaves alternate, linear to spatulate, margins entire. **Floral:** heads solitary or several in dense clusters at the tips of branches; ray florets numerous, petal white or rarely purple tinged; disk florets pink to purple, or (rarely) yellow; pappus yellowish-brown, up to 8 mm long. **Fruit:** an achene 0–1 nerved.

Distribution:

Historical: Maui and Hawaii **Current:** The typical variety of the species (*Tetramolopium humile* var. *humile*) is relatively common across PTA, but it is most abundant on the southeast side of the installation along Redleg Trail, Puu Koli, and on slopes of Mauna Loa. Variety *sublaeve* is rare and has only been reported from several isolated locations.

Habitat:

Substrate: *Tetramolopium humile* var. *sublaeve* is rare on variously aged Mauna Kea pahoehoe and aa lava flows. **Plant Communities:** Sparse *Metrosideros* Treeland and *Styphelia–Dodonaea* Shrubland.

Estimated Number of Individuals on PTA: < 100

Threats: The plant is known to occur on a live-fire range, so munitions might potentially impact some individuals. The species does not appear to be palatable to feral ungulates.

Comments: There is little notable difference between *T. h.* var. *sublaeve* and the very common *T. h.* var. *humile*. The former variety has minutely glandular leaves, while the latter species has densely glandular, hispid leaves. The varieties are sympatric, and the validity of maintaining the two varieties is in question.

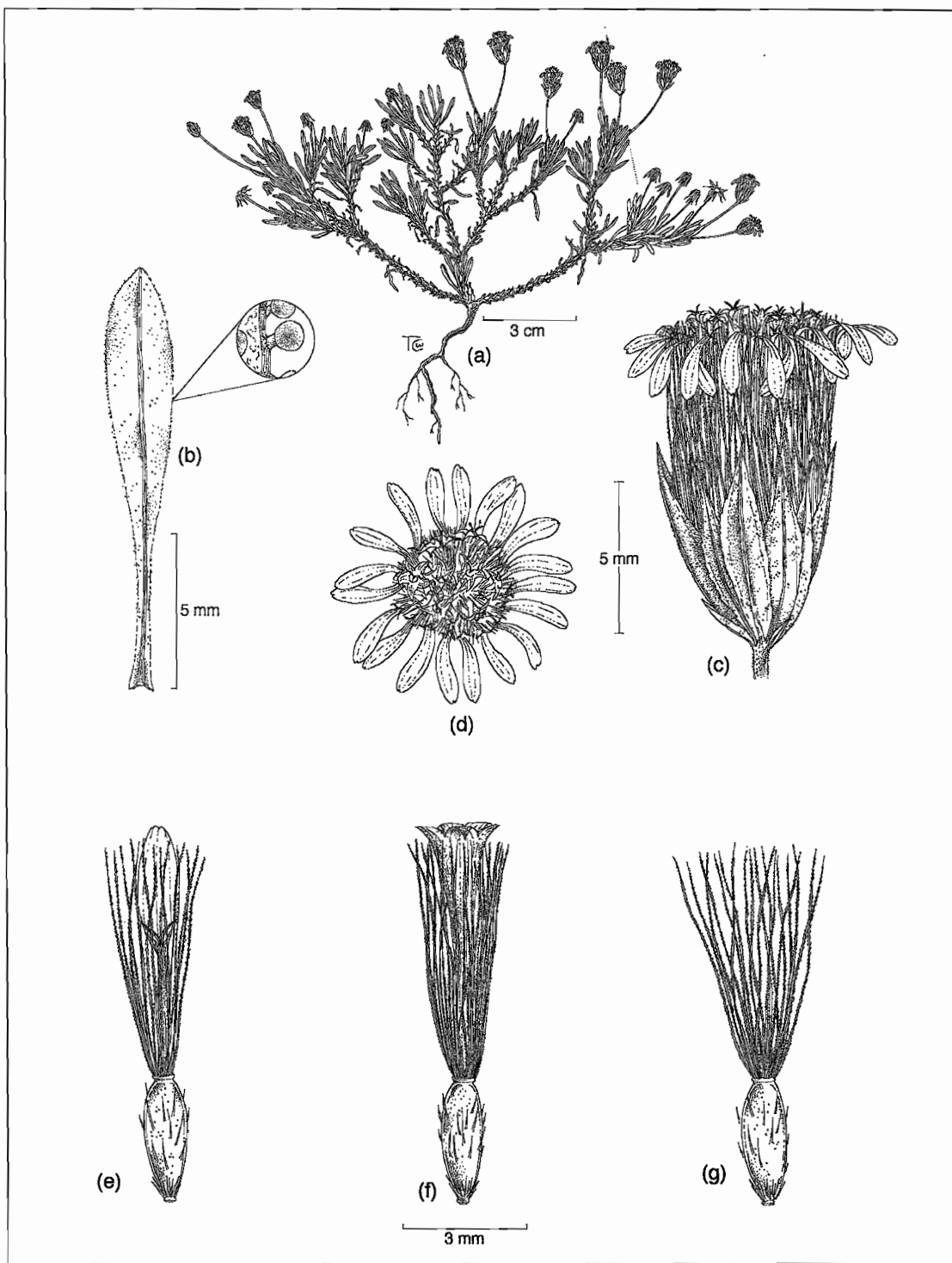
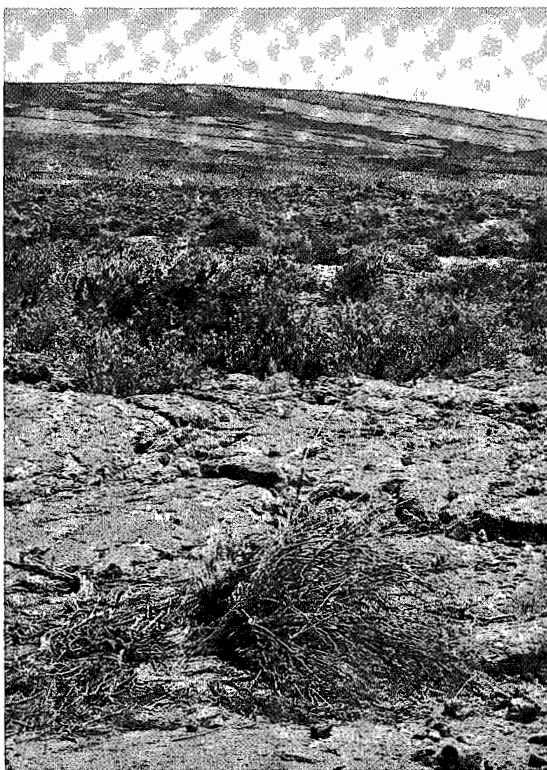
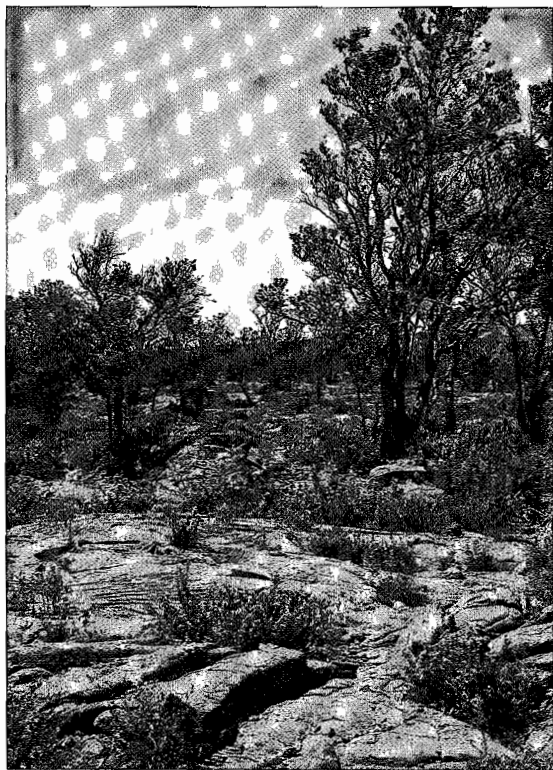


Figure 74. *Tetramolopium humile* var. *sublaeve*: (a) general caespitose habit; (b) linear-oblong leaf with entire margins (insert showing glandular hairs along margin); (c) solitary head; (d) top view of head; (e) ray floret; (f) disk floret; and (g) achene with well developed pappus.

Tetramolopium humile var. *sublaeve*



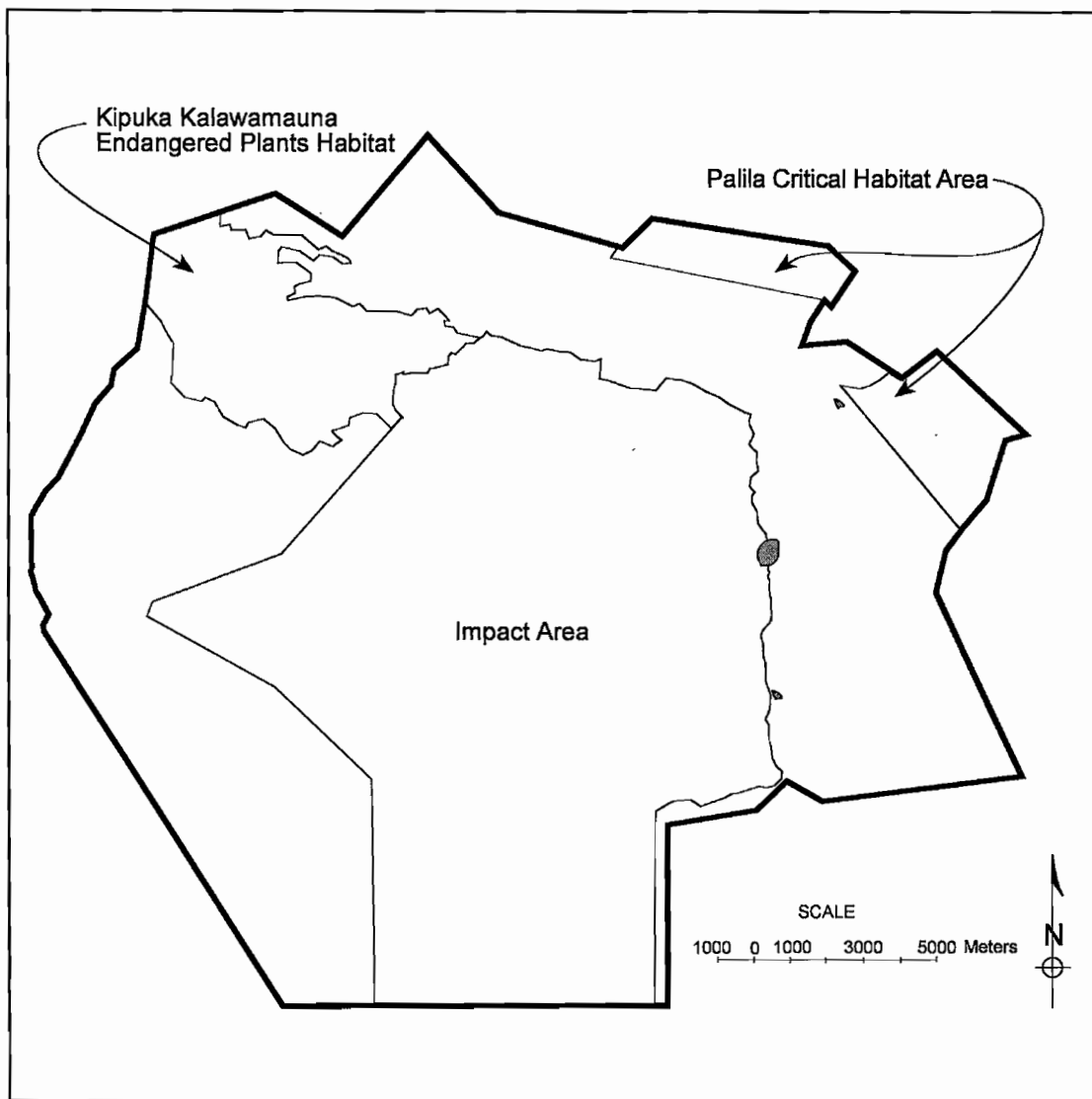


Figure 76. Distribution of *Tetramolopium humile* var. *sublaeve* on Pohakuloa Training Area, Hawaii.

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Figure 75. *Tetramolopium humile* var. *sublaeve*: (a) plant growing in young pahoehoe lava; (b) solitary heads showing white ray florets and yellow disk florets; (c) typical *Styphelia-Dodonaea* habitat near Puu Koli; and (d) typical Sparse *Metrosideros* Treeland habitat off Redleg Trail.

Zanthoxylum hawaiiense Hillebr.

Zanthoxylum hawaiiense Hillebr.



Family: Rutaceae (Citrus Family)

Common Name: Hawaiian Yellow Wood, Ae

Federal Status: Endangered

Description:

Life Span: perennial. **Habit:** a small tree up to 8 m tall. **Vegetative:** stem up to 30 cm in diameter, covered with lenticels in distinct rows. Leaves alternate, composed of three leaflets; leaflets triangular to lance-shaped; foliage lemon-scented. **Floral:** flowers unisexual and on different trees or occasionally flowers perfect. **Fruit:** a follicle with a single black, hard, glossy seed.

Distribution:

Historical: Hawaii, Lanai, Maui, Molokai. **Current:** *Zanthoxylum hawaiiense* occurs on the west side of PTA from the southern boundary of the Kipuka Kalawamauna Endangered Plants Habitat to the northern boundary of Kipuka Alala. It also has been documented in dry montane forests between PTA and Puu Waa Waa.

Habitat:

Substrate: This species is found on Mauna Kea aa flows (>10,000 years old) and on Mauna Loa aa and pahoehoe flows that vary from 900–5,000 years old. **Plant Communities:** Sparse *Metrosideros* Treeland, Open *Metrosideros* Treeland with sparse shrub understory, Open *Metrosideros* Treeland with dense shrub understory, Intermediate *Metrosideros* Mixed Treeland, *Myoporum* Shrubland, and *Myoporum–Dodonaea* Shrubland.

Estimated Number of Individuals on PTA: > 125

Threats: Feral sheep and/or goats occasionally browse on this species. A few individuals occur alongside or near roads where dust could have a negative impact on them.

Comments: Individuals of this species are widely scattered and rarely will more than a few plants be found in close proximity to one another. Leaves and leaflets have long stalks and they resemble quaking aspen (*Populus tremuloides*) when blown by the wind.

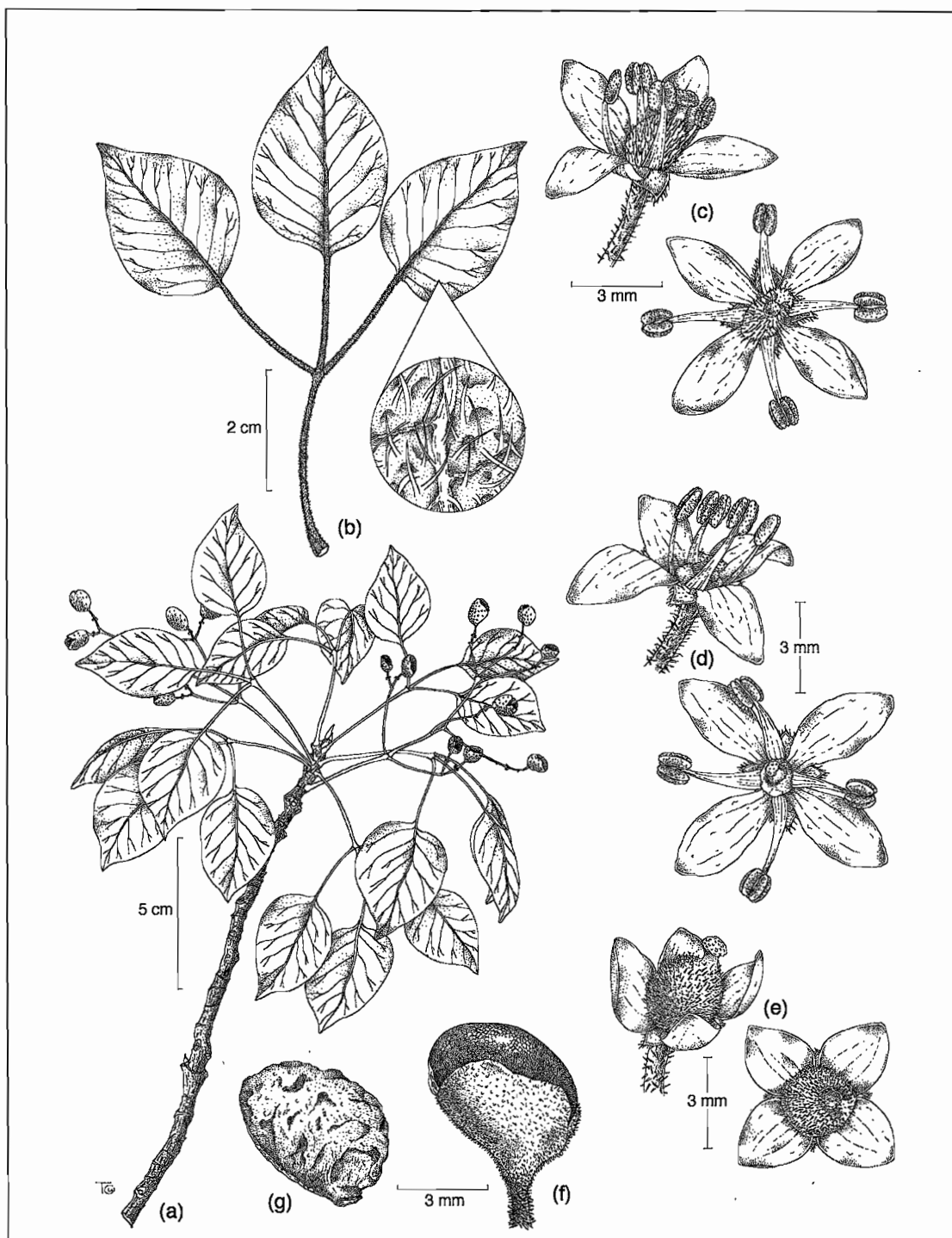
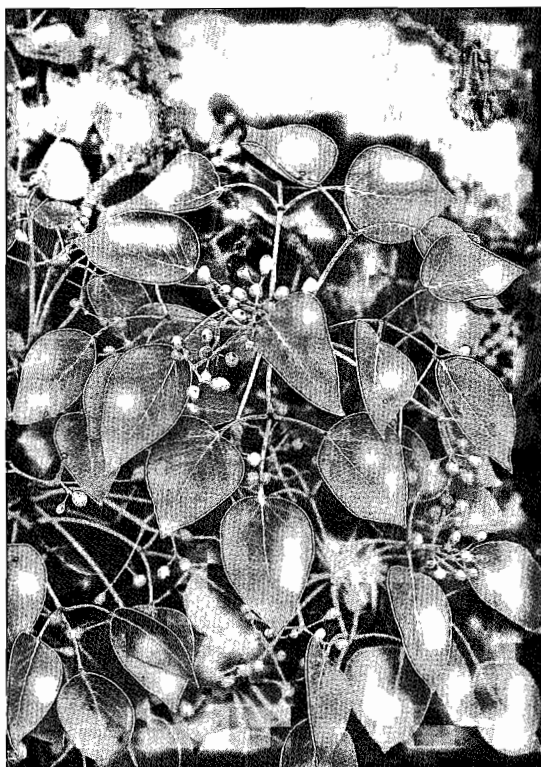


Figure 77. *Zanthoxylum hawaiiense*: (a) branch showing leaves and inflorescence; (b) single trifoliate leaf (insert showing pubescence on leaf surface); (c) side and top view of perfect flower; (d) side and top view of staminate flower with reduced and nonfunctional pistils; (e) side and top view of pistillate flower with reduced and nonfunctional stamens; (f) single follicle with pitted exocarp; and (g) seed with rugose surface after drying.



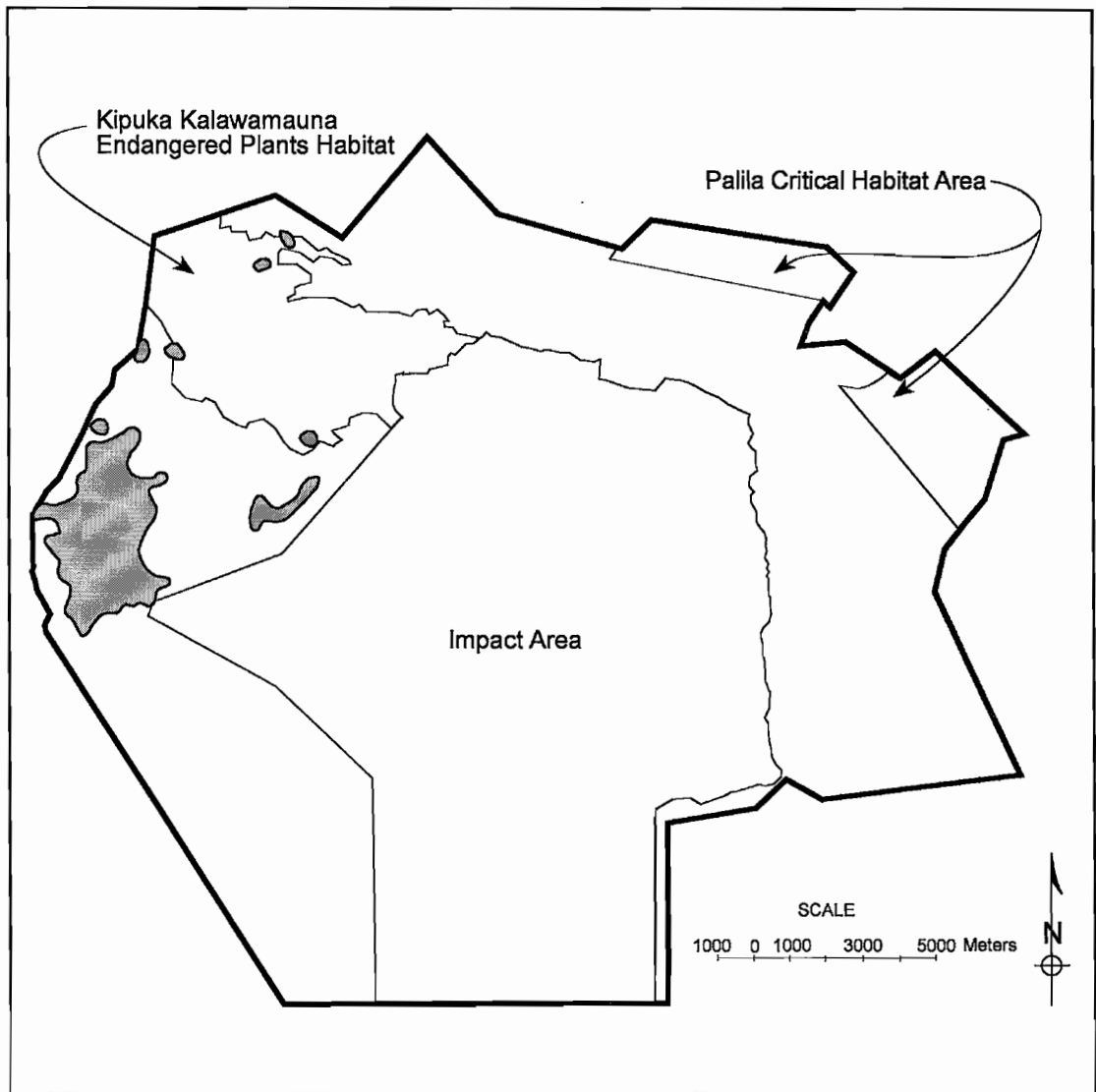


Figure 79. Distribution of *Zanthoxylum hawaiiense* on Pohakuloa Training Area, Hawaii.

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Figure 78. *Zanthoxylum hawaiiense*: (a) general habit; (b) tip of branch showing leaves and fruits; (c) trunk of tree showing bark lenticular bark; and (d) typical habitat in Intermediate *Metrosideros* Mixed Treeland on the southwest side of the installation.

As stated previously, surveys of the botanical resources at PTA have been almost continuous since November 1988. The following is a list of vascular plant species that have been collected from PTA and verified. The list is maintained and updated by the Floristics Laboratory at the Center for Ecological Management of Military Lands (CEMML), Colorado State University. Nomenclature and other information concerning the Pteridophyta (ferns) was provided by Alan R. Smith (pers. comm.). Wagner et al. (1990) was the reference for nomenclature concerning the Anthophyta (flowering plants).

The list is arranged alphabetically by family, genus, species, subspecies, and variety within each major plant category (Pteridophyta, Coniferophyta, Anthophyta, Liliopsida [monocot] and Magnoliopsida [dicot]).

The scientific name and following information is given for each taxa:

- L** = Life span or longevity: annual (A), perennial (P).
- A** = Affinity: endemic (E)—species that occur naturally only in the Hawaiian Archipelago; indigenous (I)—species that occur naturally within the Archipelago but which have a wider distribution; naturalized (N)—species introduced by humans; uncertain (?)—species with uncertain origin.
- H** = Habit: fern and fern allies (F), grass (G), herb (H), parasite (P), shrub (S), tree (T), and vine (V).
- S** = Status under the Endangered Species Act: endangered (E), threatened (T), species of concern (S), or none (-) (U.S. Fish and Wildlife Service 1997).

Scientific name	L	A	H	S
PTERIDOPHYTA				
ASPLENIACEAE				
<i>Asplenium adiantum-nigrum</i> L.	P	I	F	-
<i>Asplenium fragile</i> K. Presl var. <i>insulare</i> C. Morton (SYN= <i>A. rhomboideum</i> Brack.)	P	E	F	E
<i>Asplenium praemorsum</i> Sw. (SYN= <i>A. rhipidoneuron</i> B. L. Robins.)	P	I	F	-
<i>Asplenium trichomanes</i> L.	P	I	F	-

Species List

Scientific name	L	A	H	S
ASPLENIACEAE cont.				
<i>Cheilanthes decora</i> (Brack.) R. M. & A. F. Tryon (SYN= <i>Dryopteris decora</i> Brack.)	P	E	F	-
BLECHNACEAE				
<i>Sadleria cyatheoides</i> Kaulf.	P	E	F	-
DENNSTAEDTIACEAE				
<i>Lindsaea repens</i> (Bory) Thwaites var. <i>macaranea</i> (Hook. & Arnott) Mett. ex Kuhn	P	E	F	-
<i>Pteridium aquilinum</i> (L.) Kuhn var. <i>decompositum</i> (Gaud.) R. Tryon	P	E	F	-
DRYOPTERIDACEAE				
<i>Cyrtomium falcatum</i> (L. f.) K. Presl	P	N	F	-
<i>Cystopteris douglasii</i> Hook.	P	E	F	-
<i>Dryopteris wallichiana</i> (Spreng.) Hyl.	P	I	F	-
<i>Nephrolepis exaltata</i> (L.) Schott ssp. <i>hawaiiensis</i> W. H. Wagner, ined.	P	E	F	-
POLYPODIACEAE				
<i>Lepisorus thunbergianus</i> (Kaulf.) Ching (SYN= <i>Pleopeltis thunbergiana</i> Kaulf.)	P	I	F	-
<i>Polypodium pellucidum</i> Kaulf. var. <i>vulcanicum</i> Skottsb.	P	E	F	-
PSILOTACEAE				
<i>Psilotum nudum</i> (L.) P. Beauv.	P	I	F	-
PTERIDACEAE				
<i>Adiantum raddianum</i> K. Presl	P	N	F	-
<i>Pellaea ternifolia</i> (Cav.) Link	P	I	F	-
<i>Pteris cretica</i> L.	P	N	F	-

Scientific name	L	A	H	S
THELYPTERIDACEAE				
<i>Christella parasitica</i> (L.) H. Lév.	P	N	F	-
CONIFEROPHYTA				
PINACEAE				
<i>Pinus coulteri</i> D. Don	P	N	T	-
<i>Pinus radiata</i> D. Don	P	N	T	-
ANTHOPHYTA				
LILIOPSIDA				
AGAVACEAE				
<i>Cordyline fruticosa</i> (L.) A. Chev.	P	N	S	-
CYPERACEAE				
<i>Bulbostylis capillaris</i> (L.) C. B. Clarke	A	N	H	-
<i>Carex inversa</i> R. Br.	P	N	H	-
<i>Carex wahuensis</i> C. A. Mey. ssp. <i>rubiginosa</i> (R. Krauss) T. Koyama	P	E	H	-
<i>Carex wahuensis</i> C. A. Mey. ssp. <i>wahuensis</i>	P	E	H	-
<i>Gahnia gahniiformis</i> (Gaud.) A. Heller	P	I	H	-
<i>Mariscus hillebrandii</i> (Boeck.) T. Koyama ssp. <i>hillebrandii</i>	P	E	H	-
JUNCACEAE				
<i>Luzula hawaiiensis</i> Buchenau var. <i>hawaiiensis</i>	P	E	H	-
LILIACEAE				
<i>Dianella sandwicensis</i> Hook. & Arnott	P	I	H	-

Species List

Scientific name	L	A	H	S
POACEAE				
<i>Agrostis avenacea</i> J. G. Gmelin	P	I	G	-
<i>Agrostis sandwicensis</i> Hillebr.	P	E	G	-
<i>Anthoxanthum odoratum</i> L.	P	N	G	-
<i>Avena fatua</i> L.	A	N	G	-
<i>Briza minor</i> L.	A	N	G	-
<i>Bromus rigidus</i> Roth (SYN= <i>Bromus diandrus</i> Roth)	A	N	G	-
<i>Bromus willdenowii</i> Kunth (SYN= <i>Bromus catharticus</i> Vahl)	A/P	N	G	-
<i>Chloris gayana</i> Kunth	A	N	G	-
<i>Cynodon dactylon</i> (L.) Pers.	P	N	G	-
<i>Dactylis glomerata</i> L.	P	N	G	-
<i>Danthonia pilosa</i> R. Br.	P	N	G	-
<i>Deschampsia nubigena</i> Hillebr.	P	E	G	-
<i>Ehrharta calycina</i> Smith	P	N	G	-
<i>Ehrharta stipoides</i> Labill. [SYN= <i>Microlaena stipoides</i> (Labill.) R. Br.]	P	N	G	-
<i>Eragrostis atropioides</i> Hillebr.	P	E	G	-
<i>Eragrostis brownei</i> (Kunth) Nees ex Steud.	P	N	G	-
<i>Eragrostis deflexa</i> Hitchc.	P	E	G	S
<i>Eragrostis leptophylla</i> Hitchc.	P	E	G	-
<i>Festuca hawaiiensis</i> Hitchc.	P	E	G	S
<i>Gastridium ventricosum</i> (Gouan) Schinz & Thell.	A	N	G	-

Scientific name	L	A	H	S
POACEAE cont.				
<i>Holcus lanatus</i> L.	P	N	G	-
<i>Hordeum leporinum</i> Link [SYN= <i>Hordeum murinum</i> L. ssp. <i>leporinum</i> (Link) Arcang.]	A	N	G	-
<i>Koeleria nitida</i> Nutt. [SYN= <i>Koeleria macrantha</i> (Ledeb.) Schutes]	P	N	G	-
<i>Lolium perenne</i> L.	P	N	G	-
<i>Melinis minutiflora</i> P. Beauv.	P	N	G	-
<i>Panicum konaense</i> Whitney & Hosaka	A	E	G	-
<i>Panicum pellitum</i> Trin.	A	E	G	-
<i>Panicum tenuifolium</i> Hook. & Arnott	P	E	G	-
<i>Paspalum dilatatum</i> Poir.	P	N	G	-
<i>Paspalum notatum</i> Flugge	P	N	G	-
<i>Pennisetum clandestinum</i> Chiov.	P	N	G	-
<i>Pennisetum setaceum</i> (Forssk.) Chiov.	P	N	G	-
<i>Poa annua</i> L.	A	N	G	-
<i>Poa pratensis</i> L.	P	N	G	-
<i>Polypogon interruptus</i> Kunth	P	N	G	-
<i>Polypogon monspeliensis</i> (L.) Desf.	A	N	G	-
<i>Rhynchelytrum repens</i> (Willd.) Hubb.	A/P	N	G	-
<i>Sporobolus africanus</i> (Poir.) Robyns & Tourney	P	N	G	-
<i>Sporobolus indicus</i> (L.) R. Br.	P	N	G	-
<i>Stipa cernua</i> Stebb. & A. Love [SYN= <i>Nassella cernua</i> (Stebb. & A. Love) Barkworth]	P	N	G	-

Species List

Scientific name	L	A	H	S
POACEAE cont.				
<i>Trisetum glomeratum</i> (Kunth) Trin.	P	E	G	-
<i>Vulpia bromoides</i> (L.) S. F. Gray	A	N	G	-
<i>Vulpia myuros</i> (L.) C. C. Gmelin	A	N	G	-
SMILACACEAE				
<i>Smilax melastomifolia</i> Sm.	P	E	V	-
MAGNOLIOPSIDA				
AIZOACEAE				
<i>Lampranthus glomerata</i> (L.) N. E. Br.	P	N	S	-
AMARANTHACEAE				
<i>Nototrichium sandwicense</i> (A. Gray) Hillebr.	P	E	S/T	-
APIACEAE				
<i>Ciclospermum leptophyllum</i> (Pers.) Sprague	A	N	H	-
<i>Daucus pusillus</i> Michx.	A	N	H	-
<i>Foeniculum vulgare</i> Mill.	P	N	H	-
<i>Petroselinum crispum</i> (Mill.) A. W. Hill	P	N	H	-
<i>Spermolepis hawaiiensis</i> Wolff	A	E	H	E
APOCYNACEAE				
<i>Alyxia oliviformis</i> Gaud.	P	E	S/V	-
ASCLEPIADACEAE				
<i>Asclepias curassavica</i> L.	P	N	H	-
<i>Asclepias physocarpa</i> (E. Mey.) Schlecter	P	N	H	-

Scientific name	L	A	H	S
ASTERACEAE				
<i>Achillea millefolium</i> L.	P	N	H	-
<i>Ageratina riparia</i> (Regel) R. King & H. Robinson	P	N	S	-
<i>Ageratum conyzoides</i> L.	A/P	N	H	-
<i>Ambrosia pumila</i> (Nutt.) A. Gray	P	N	H	-
<i>Anthemis cotula</i> L.	A	N	H	-
<i>Bidens alba</i> (L.) DC var. <i>radiata</i> (Schultz-Bip.) Ballard ex Melchert	A/P	N	H	-
<i>Bidens menziesii</i> (A. Gray) Sherff ssp. <i>filiformis</i> (Sherff) Ganders & Nagata	P	E	S	-
<i>Bidens pilosa</i> L.	A	N	H	-
<i>Centaurea melitensis</i> L.	A	N	H	-
<i>Cirsium vulgare</i> (Savi) Ten.	P	N	H	-
<i>Conyza bonariensis</i> (L.) Cronq.	A	N	H	-
<i>Conyza canadensis</i> (L.) Cronq. var. <i>canadensis</i>	A	N	H	-
<i>Conyza canadensis</i> (L.) Cronq. var. <i>pusilla</i> (Nutt.) Cronq.	A	N	H	-
<i>Crassocephalum crepidioides</i> (Benth.) S. Moore	A	N	H	-
<i>Crepis capillaris</i> (L.) Wallr.	A/P	N	H	-
<i>Dubautia ciliolata</i> (DC) D. Keck ssp. <i>ciliolata</i>	P	E	S	-
<i>Dubautia linearis</i> (Gaud.) D. Keck ssp. <i>hillebrandii</i> (H. Mann) G. Carr	P	E	S	-
<i>Dubautia scabra</i> (DC) D. Keck	P	E	S	-
<i>Emilia fosbergii</i> Nicolson	A	N	H	-

Species List

Scientific name	L	A	H	S
ASTERACEAE cont.				
<i>Galinsoga parviflora</i> Cav.	A	N	H	-
<i>Galinsoga quadriradiata</i> Ruiz & Pav.	A	N	H	-
<i>Gnaphalium japonicum</i> Thunb.	A	N	H	-
<i>Gnaphalium purpureum</i> L. [SYN= <i>Gamochoaeta purpurea</i> (L.) Cabrera]	A/P	N	H	-
<i>Gnaphalium sandwicense</i> Gaud. var. <i>hawaiiense</i> (Degener & Sherff) W. L. Wagner, Herbst & Sohmer	P	E	H	-
<i>Gnaphalium sandwicense</i> Gaud. var. <i>kilaueanum</i> Degener & Sherff	P	E	H	-
<i>Gnaphalium sandwicense</i> Gaud. var. <i>sandwicense</i>	P	E	H	-
<i>Helichrysum foetidum</i> (L.) Cass.	P	N	H	-
<i>Heterotheca grandiflora</i> Nutt.	A/P	N	H	-
<i>Hypochoeris radicata</i> L.	P	N	H	-
<i>Lactuca serriola</i> L.	P	N	H	-
<i>Lipochaeta subcordata</i> A. Gray	P	E	H	-
<i>Picris hieracioides</i> L.	P	N	H	-
<i>Pluchea symphytifolia</i> (Mill.) Gillis	P	N	S	-
<i>Reichardia tingitana</i> (L.) Roth	A/P	N	H	-
<i>Senecio mikanioides</i> Otto ex Walp.	P	N	V	-
<i>Senecio sylvaticus</i> L.	A	N	H	-
<i>Senecio vulgaris</i> L.	A	N	H	-
<i>Sigesbeckia orientalis</i> L.	A	N	H	-

Scientific name	L	A	H	S
ASTERACEAE cont.				
<i>Sonchus asper</i> (L.) J. Hill	A	N	H	-
<i>Sonchus oleraceus</i> L.	A	N	H	-
<i>Tagetes minuta</i> L.	A	N	H	-
<i>Tetramolopium arenarium</i> (A. Gray) Hillebr.	P	E	S	E
<i>Tetramolopium consanguineum</i> (A. Gray) Hillebr. ssp. <i>leptophyllum</i> (Sherff) Lowrey var. <i>leptophyllum</i>	P	E	S	S
<i>Tetramolopium diersingii</i> Shaw & Lowrey ¹	P	E	S	-
<i>Tetramolopium humile</i> (A. Gray) Hillebr. ssp. <i>humile</i> var. <i>humile</i>	P	E	S	-
<i>Tetramolopium humile</i> (A. Gray) Hillebr. ssp. <i>humile</i> var. <i>sublaeve</i> Sherff	P	E	S	S
<i>Verbesina encelioides</i> (Cav.) Benth. & Hook.	A	N	H	-
<i>Xanthium strumarium</i> L. var. <i>candense</i> (Mill.) Torr. & A. Gray	A	N	H	-
<i>Youngia japonica</i> (L.) DC	A	N	H	-
<i>Zinnia peruviana</i> (L.) L.	A	N	H	-
BRASSICACEAE				
<i>Brassica juncea</i> (L.) Czernj.	A	N	H	-
<i>Brassica nigra</i> (L.) W. Koch	A	N	H	-
<i>Capsella rubella</i> Reut.	A	N	H	-
<i>Cardamine flexuosa</i> With.	A/P	N	H	-
<i>Coronopus didymus</i> (L.) Sm.	A	N	H	-
<i>Lepidium africanum</i> (Burm. f.) DC	P	N	H	-
<i>Lepidium hyssopifolium</i> Desv.	P	N	H	-

Species List

Scientific name	L	A	H	S
BRASSICACEAE cont.				
<i>Lepidium virginicum</i> L.	A/P	N	H	-
<i>Sisymbrium altissimum</i> L.	A	N	H	-
<i>Sisymbrium irio</i> L.	A	N	H	-
<i>Sisymbrium officinale</i> (L.) Scop.	A	N	H	-
CACTACEA				
<i>Opuntia ficus-indica</i> (L.) Mill.	P	N	T	-
CAMPANULACEAE				
<i>Triodanis biflora</i> (Ruiz & Pav.) Greene [SYN= <i>Triodanis perfoliata</i> (C.) Nieuwl. var. <i>biflora</i> (Ruiz & Pav.) Bradley]	A	N	H	-
<i>Wahlenbergia gracilis</i> (G. Forster) A. DC [SYN= <i>Wahlenbergia marginata</i> (Thunb.) A. DC]	P	N	H	-
CAPRIFOLIACEAE				
<i>Sambucus mexicana</i> K. Presl. ex A. DC	P	N	S/T	-
CARYOPHYLLACEAE				
<i>Arenaria serpyllifolia</i> L.	A	N	H	-
<i>Cerastium fontanum</i> Baumg. ssp. <i>triviale</i> (Link) Jalas [SYN= <i>Cerastium fontanum</i> Baumg. ssp. <i>vulgare</i> (Hartman) Greuter & Burdet]	P	N	H	-
<i>Petrorhagia velutina</i> (Guss.) P. Ball & Heyw. [SYN= <i>Petrorhagia dubia</i> (Raf.) G. Lopez & Romo]	A	N	H	-
<i>Polycarpon tetraphyllum</i> (L.) L.	A	N	H	-
<i>Schiedea pubescens</i> Hillbr.	P	E	V	S
<i>Silene gallica</i> L.	A/P	N	H	-
<i>Silene hawaiiensis</i> Sherff	P	E	S	T

Scientific name	L	A	H	S
CARYOPHYLLACEAE cont.				
<i>Silene lanceolata</i> A. Gray	P	E	S	E
<i>Stellaria media</i> (L.) Vill.	A/P	N	H	-
CHENOPODIACEAE				
<i>Atriplex semibaccata</i> R. Br.	P	N	H	-
<i>Atriplex suberecta</i> Verd.	A	N	H	-
<i>Chenopodium album</i> L.	A	N	H	-
<i>Chenopodium ambrosioides</i> L.	A/P	N	H	-
<i>Chenopodium carinatum</i> R. Br.	A	N	H	-
<i>Chenopodium murale</i> L.	A	N	H	-
<i>Chenopodium oahuense</i> (Meyen) Aellen	P	E	S	-
<i>Salsola kali</i> L.	A	N	H	-
CONVOLVULACEAE				
<i>Ipomoea tuboides</i> Degener & Ooststr.	P	E	V	-
<i>Ipomoea violacea</i> L.	P	N	V	-
CRASSULACEAE				
<i>Crassula sieberiana</i> (Schult.) Druce	A	N	H	-
<i>Kalanchoe tubiflora</i> (Harv.) Raym.- Hamet	P	N	H	-
CUCURBITACEAE				
<i>Sicyos anunu</i> (St. John) Telford	A	E	V	-
<i>Sicyos lasiocephalus</i> Skottsb.	A	E	V	-
EPACRIDACEAE				
<i>Styphelia tameiameia</i> (Cham. & Schlechtend.) F. v. Muell.	P	I	S	-

Species List

Scientific name	L	A	H	S
ERICACEAE				
<i>Vaccinium reticulatum</i> Sm.	P	E	S	-
EUPHORBIACEAE				
<i>Chamaesyce albomarginata</i> (Torr. & A. Gray) Small	P	N	H	-
<i>Chamaesyce multiformis</i> (Hook. & Arnott) Croizat & Degener var. <i>microphylla</i> (Boiss.) Degener & I. Degener	P	E	S	-
<i>Chamaesyce olowaluana</i> (Sherff) Croizat & Degener	P	E	T	S
<i>Euphorbia peplus</i> L.	A	N	H	-
<i>Ricinus communis</i> L.	P	N	S	-
FABACEAE				
<i>Indigofera suffruticosa</i> Mill.	P	N	S	-
<i>Lupinus arboreus</i> Sims.	P	N	S	-
<i>Medicago lupulina</i> L.	A/P	N	H	-
<i>Medicago polymorpha</i> L.	A	N	H	-
<i>Melilotus indica</i> (L.) All.	A	N	H	-
<i>Sophora chrysophylla</i> (Salisb.) Seem.	P	E	S/T	-
<i>Trifolium arvense</i> L. var. <i>arvense</i>	A	N	H	-
<i>Trifolium hybridum</i> L. var. <i>hybridum</i>	P	N	H	-
<i>Trifolium pratense</i> L. var. <i>sativum</i> Schreb.	P	N	H	-
<i>Trifolium repens</i> L. var. <i>repens</i>	P	N	H	-
<i>Vicia sativa</i> L. ssp. <i>nigra</i> (L.) Ehrh.	A	N	H	-
<i>Vicia villosa</i> Roth	A/P	N	H	-

Scientific name	L	A	H	S
FAGACEAE				
<i>Quercus suber</i> L.	P	N	T	-
GENTIANACEAE				
<i>Centaurium erythraea</i> Raf. ssp. <i>erythraea</i>	P	N	H	-
GERANIACEAE				
<i>Erodium cicutarium</i> (L.) L'Hér.	A	N	H	-
<i>Geranium cuneatum</i> Hook. ssp. <i>hololeucum</i> (A. Gray) Carlq. & Bissing	P	E	S	-
<i>Geranium homeanum</i> Turcz.	P	N	H	-
<i>Geranium retrorsum</i> L'Hér. ex DC	P	N	H	-
LAMIACEAE				
<i>Haplostachys haplostachya</i> (A. Gray) St. John	P	E	H	E
<i>Marrubium vulgare</i> L.	P	N	H	-
<i>Plectranthus parviflorus</i> Willd.	P	I	H	-
<i>Stenogyne angustifolia</i> A. Gray	P	E	V	E
<i>Stenogyne microphylla</i> Benth.	P	E	V	-
<i>Stenogyne rugosa</i> Benth.	P	E	V	-
LYTHRACEAE				
<i>Lythrum maritimum</i> Kunth	P	I?	S	-
MALVACEAE				
<i>Malva parviflora</i> L.	A/P	N	H	-
<i>Sida fallax</i> Walp.	P	I	S	-
MENISPERMACEAE				
<i>Cocculus trilobus</i> (Thunb.) DC	P	I	V	-

Species List

Scientific name	L	A	H	S
MYOPORACEAE				
<i>Myoporum sandwicense</i> A. Gray	P	I	S/T	-
MYRSINACEAE				
<i>Myrsine lanaiensis</i> Hillebr.	P	E	T	-
MYRTACEAE				
<i>Eucalyptus citriodora</i> Hook.	P	N	T	-
<i>Metrosideros polymorpha</i> Gaud. var. <i>glaberrima</i> (H. Lév.) St. John	P	E	S/T	-
<i>Metrosideros polymorpha</i> Gaud. var. <i>polymorpha</i>	P	E	S/T	-
OLEACEAE				
<i>Ligustrum lucidum</i> Ait.	P	N	S/T	-
<i>Olea europaea</i> L. ssp. <i>europaea</i>	P	N	T	-
ONAGRACEAE				
<i>Epilobium billardierianum</i> Ser. ssp. <i>cinereum</i> (A. Rich.) Raven & Engelhorn	P	N	H	-
<i>Oenothera stricta</i> Ledeb. ex Link ssp. <i>stricta</i>	A/P	N	H	-
OXALIDACEAE				
<i>Oxalis corniculata</i> L.	P	N	H	-
PAPAVERACEAE				
<i>Argemone glauca</i> (Nutt. ex Prain) Pope var. <i>decipiens</i> Ownbey	P	E	H	-
PASSIFLORACEAE				
<i>Passiflora mollissima</i> (Kunth) L. H. Bailey	P	N	V	-

Scientific name	L	A	H	S
PIPERACEAE				
<i>Peperomia tetraphylla</i> (G. Forster) Hook. & Arnott	P	I	H	-
PITTOSPORACEAE				
<i>Pittosporum confertiflorum</i> A. Gray	P	E	S/T	-
<i>Pittosporum terminalioides</i> Planch. ex A. Gray	P	E	T	-
PLANTAGINACEAE				
<i>Plantago lanceolata</i> L.	P	N	H	-
POLYGONACEAE				
<i>Emex spinosa</i> (L.) Campd.	A	N	H	-
<i>Polygonum capitatum</i> F. Ham.	P	N	H	-
<i>Rumex acetosella</i> L.	P	N	H	-
<i>Rumex brownei</i> Campd.	P	N	H	-
<i>Rumex giganteus</i> W. T. Aiton	P	E	S/V	-
<i>Rumex skottsbergii</i> Degener & I. Degener	P	E	S	-
PORTULACACEAE				
<i>Portulaca oleracea</i> L.	A	N	H	-
<i>Portulaca sclerocarpa</i> A. Gray	P	E	H	E
<i>Portulaca villosa</i> Cham.	P	E	H	-
PRIMULACEAE				
<i>Anagallis arvensis</i> L.	A/P	N	H	-
PROTEACEAE				
<i>Grevillea robusta</i> A. Cunn. ex R. Br.	P	N	T	-

Species List

Scientific name	L	A	H	S
RHAMNACEAE				
<i>Alphitonia ponderosa</i> Hillebr. ²	P	E	T	-
<i>Rhamnus californica</i> Eschsch. var. <i>californica</i>	P	N	S	-
ROSACEAE				
<i>Heteromeles arbutifolia</i> Roem.	P	N	S	-
<i>Osteomeles anthyllidifolia</i> (Sm.) Lindl.	P	I	S	-
<i>Rubus rosifolius</i> Sm.	P	N	S	-
RUBIACEAE				
<i>Coprosma ernodeoides</i> A. Gray	P	E	S	-
<i>Coprosma montana</i> Hillebr.	P	E	S/T	-
<i>Hedyotis coriacea</i> Sm.	P	E	S	E
RUTACEAE				
<i>Melicope hawaiiensis</i> (Wawra) T. G. Hartley & B. C. Stone (SYN= <i>Pelea hawaiiensis</i> Wawra)	P	E	S/T	S
<i>Zanthoxylum hawaiiense</i> Hillebr.	P	E	T	E
SANTALACEAE				
<i>Exocarpos gaudichaudii</i> A. DC	P	E	S/T	S
<i>Exocarpos menziesii</i> Stauffer	P	E	S	-
<i>Santalum ellipticum</i> Gaud.	P	E	S/T	-
<i>Santalum paniculatum</i> Hook. & Arnott var. <i>paniculatum</i>	P	E	S/T	-
<i>Santalum paniculatum</i> Hook. & Arnott var. <i>pilgeri</i> (Rock) Stemmermann	P	E	S/T	-

Scientific name	L	A	H	S
SAPINDACEAE				
<i>Dodonaea viscosa</i> Jacq.	P	I	S/T	-
SCROPHULARIACEAE				
<i>Lophospermum erubescens</i> D. Don	P	N	V	-
<i>Verbascum thapsus</i> L.	P	N	H	-
<i>Verbascum virgatum</i> Stokes	P	N	H	-
<i>Veronica plebeia</i> R. Br.	A/P	N	H	-
<i>Veronica serpyllifolia</i> L.	P	N	H	-
SOLANACEAE				
<i>Datura stramonium</i> L.	A	N	H	-
<i>Nicotiana tabacum</i> L.	P	N	H	-
<i>Physalis peruviana</i> L.	P	N	S	-
<i>Solanum americanum</i> Mill.	A/P	I?	H/S	-
<i>Solanum incompletum</i> Dunal	P	E	S	E
<i>Solanum nigrescens</i> Mart. & Galeotti	P	N	H/S	-
<i>Solanum pseudocapsicum</i> L.	P	N	S	-
THYMELAEACEAE				
<i>Wikstroemia phillyreifolia</i> A. Gray	P	E	S/T	-
URTICACEAE				
<i>Hesperocnide sandwicensis</i> (Wedd.) Wedd.	A	E	H	-
<i>Neraudia ovata</i> Gaud.	P	E	S	E
<i>Urtica urens</i> L.	A	N	H	-

Species List

Scientific name	L	A	H	S
<hr/>				
VERBENACEAE				
<i>Verbena litoralis</i> Kunth	P	N	H	-
VISCACEAE				
<i>Korthalsella complanata</i> (Tiegh.) Engl.	P	I	P	-
<i>Korthalsella latissima</i> (Tiegh.) Danser	P	E	P	-
ZYGOPHYLLACEAE				
<i>Tribulus terrestris</i> L.	A	N	H	-

¹ Unpublished

² Personal communication, Joel Lau 1996.

LITERATURE CITED

- Brueggemann, M. M. 1995. Endangered and threatened wildlife and plants; proposed endangered status for thirteen plants from the Island of Hawaii, State of Hawaii. Fed. Reg. 60: 49377-49392.
- Brueggemann, M. M., J. E. Canfield and D. R. Herbst. 1994. Endangered and threatened wildlife and plants; endangered status for four ferns from the Hawaiian Islands. Fed. Reg. 59: 49025-49032.
- Canfield, J. E., D. R. Herbst and A. Asquith. 1994. Endangered and threatened wildlife and plants; endangered status for 12 plants from the Hawaiian Islands. Fed. Reg. 59:56333-56351.
- Castillo, J. M., T. Tierney, and R. B. Shaw. 1997. Plant Community Types of Pohakuloa Training Area, Hawaii. Center for Ecological Management of Military Lands, Colorado State University, Fort Collins, CO. Map.
- Herbst, D. R., J. E. Canfield, J. M. Yoshioka, and Z. E. Ellshoff. 1992a. Endangered and threatened wildlife and plants; determination of endangered and threatened status for 15 plants from the island of Maui. Fed. Reg. 57:20772-20878.
- Herbst, D. R., J. E. Canfield, J. M. Yoshioka, and Z. E. Ellshoff. 1992b. Endangered and threatened wildlife and plants; determination of endangered and threatened status for 16 plants from the island of Molokai. Fed. Reg. 57:46325-46340.
- Herbst, D. R. and J. J. Fay 1979. Endangered and threatened wildlife and plants; determination that three Hawaiian plants are endangered species. Fed. Reg. 44:62468-62469.
- Langeheim, V. A. and D. A. Clauge. 1987. The Hawaiian Emperor Volcanic Chain. Part II. Stratigraphic framework of volcanic rocks of the Hawaiian Islands. IN: R. W. Decker, T. L. Wright and P. H. Stauffer (eds.). Vol. 1. U. S. Geological Survey Professional Paper 1350.
- Loope, L. L. and P. G. Scowcroft. 1985. Vegetation response within exclosures in Hawaii: A review. IN: C. P. Stone and J. M. Scott (eds.). Hawaii's Terrestrial Ecosystems: preservation and management. University of Hawaii Press, Honolulu, HI.
- MacDonald, G. A. 1949. Petrography of the Island of Hawaii. U.S. Geological Survey Professional Paper 214D. Map.
- Mehrhoff, L. A. 1994. Endangered and threatened wildlife and plants; determination of endangered or threatened status for 21 plants from the Island of Hawaii, State of Hawaii. Fed. Reg. 59: 10305-10325.
- Sato, H. H., W. Ikeda, R. Paeth, R. Smyth and M. Takehiro. 1973. Soil survey of the island of Hawaii. USDA Soil Conservation Service in cooperation with the University of Hawaii.
- Shaw, R. B., C. M. Bern, K. A. Schulz, V. E. Diersing, and D. J. Tazik. 1990. U. S. Army Land Condition/Trend Analysis of the Pohakuloa Training Area, Hawaii. Proceedings of the International Symposium on Tropical Hydrology and Caribbean Islands Water Resources Congress. American Water Resources Association. San Juan, PR.
- Stearns, H. T. and G. A. MacDonald. 1946. Geology and ground-water resources of the Island of Hawaii. Hawaii Division of Hydrology Bulletin 7.
- U.S. Fish and Wildlife Service. 1997. Species List for the State of Hawaii, May. U.S.D.I. Fish and Wildlife Service, Pacific Islands Ecoregion, Honolulu, Hawaii.
- Wagner, W. L., D. R. Herbst and S. H. Sohmer. 1990. Manual of the Flowering Plants of Hawaii. University of Hawaii Press and Bishop Museum Press, Honolulu, Hawaii.
- Wolfe, E. W. and J. Morris. 1996. Geologic Map of the Island of Hawaii. U.S. Geologic Survey. Miscellaneous Investigations Series. Map 1-2524-A.



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