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Hawaiian Ti

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Ti (kī in Hawaiian) is the common name for *Cordyline fruticosa*, which is found throughout tropical Asia, Australia, and the Pacific islands. There are approximately 20 species of *Cordyline*. Several other *Cordyline* species are grown in Hawai'i, but they are less common and not usually referred to as ti. Ti commonly grows in moist, semi-shaded areas in wet valleys and forests on all the major Hawaiian islands except Kaho'olawe. It is the most popular *Cordyline* species as an indoor potted plant and is used extensively by florists as cut green foliage for flower arrangements and decorative displays. It is also used as a food wrapping.

Characteristics

Description

Ti is an upright evergreen shrub with slender single or branched stems, growing up to 10 feet high. Its spread is 3–4 feet. The growth rate is moderate to moderately fast. The taproot is long, thick, white, and sweet and becomes large in older plants.

Leaves

Leaf clusters are arranged in close spirals at the branch tips. The large, narrow-oblong leaves (1–2 feet long and

Ti plant
Cordyline fruticosa (L.) Chevalier
Laxmanniaceae family
Synonyms: *Cordyline terminalis*, *Convallaria fruticosa*, *Dracaena terminalis*, *Terminalis fruticosa*, *Taetsia fruticosa*
Native of Eastern Asia
Common names: ti plant; ti; green ti; Hawaiian good-luck plant; ti tree; good-luck plant; tree of kings; common dracaena; dracaena; dracaena palm; lily palm; miracle plant; kī, lau kī, lā'ī (Hawaiian)

Red ti decorates an urban entryway.

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about 4 inches wide) are smooth, flexible, and glossy, with deeply channeled petioles 2–6 inches long. Some varieties have very small leaves, only 8 inches long and 2 inches wide. Leaf blades are lanceolate to broadly elliptic with a prominent midrib on the underside. Foliage may be green or variegated with various combinations of red, pink, purple, maroon, rose, yellow, and orange. Seedlings and propagated cuttings show their true color when they begin to produce mature leaves. Older basal leaves turn yellow and drop from the stems, leaving rings of leaf scars.

Flowers

Many sessile (stalkless) or shortly stalked flowers ⅓–½ inch long are borne on a panicle (drooping branched stem) about 1 foot long that grows from the tip of the plant in the spring. The flowers come in several colorsæwhite, pink, lavender, or yellow. As the six petals open, they expose six yellow stamens and one white pistil. Florets are star-shaped.

Fruits

The fruits, which are not uncommon, are round berries less than ½ inch in diameter containing many seeds. The fruit cover is fleshy and may be green, yellow, red, or scarlet. Some cultivars have red flowers and large scarlet berries.

Outdoor production

Soil

Ti plants grow best in deep, fertile, moist, acidic, well-drained soils that are high in organic matter. Soil pH should be 5.5 to 6.5.

Light

Ti can be grown outdoors in full sun or under shadecloth. It is best grown in light to moderate shade (3000–4500 foot-candles). As a point of reference, the amount of light at noon on a clear summer day is approximately 10,000 foot-candles. Leaf coloration is more striking in sunnier locations, although the foliage of brightly colored cultivars and those with white-striped leaves is easily burned when grown in full sunlight. When grown in heavy shade, red cultivars such as ‘Peter Buck’ tend to produce leaves with more green color.

Rainfall

Ti grows well in open forests of valleys where there is plenty of rain. Irrigation is required in dry areas. Unless heavily irrigated, growth is reduced, and many leaves turn yellow and fall off. Insufficient amounts of water also cause stunting.

Temperature

Ti does well between 65 and 95˚F and is hardy to about 30˚F. Leaf color is more intense during the cooler weather in the winter and spring.

Elevation

Ti is common at elevations from sea level to 2000 feet. On the Kona side of the Big Island, ti can grow well above 2000 feet.

Tolerances

Possessing moderate drought tolerance, ti can tolerate only brief periods of drought. It has poor to fair salt tolerance; it does not tolerate salt spray on its foliage. Being only fairly wind-tolerant, it requires windbreaks in windy areas to prevent shedding of the leaves. Ti is tolerant of considerable shade and extreme temperatures (with medium heat tolerance), but growth is reduced.

Watering

Ti grows well in areas with high rainfall. In dry locations, irrigation is required. Otherwise, growth is reduced, and many leaves turn yellow and fall off. Supplement natural rainfall with enough irrigation to supply at least 1 inch of water per week.

Fertilizer

Ti needs occasional applications of a general garden fertilizer at 3–4-month intervals. The fertilizer ratio of the major elements should be 3:1:2 for N, P, and K, respectively. Apply 35 pounds N-P_2O_5-K_2O per 1000 square feet per year. Increase the application in heavy rainfall areas or if frequent irrigation is applied. An N-P-K ratio of 1:1:1 is recommended for soil-based media, whereas a ratio of 3:1:2 is suggested for soilless media.

Another common nutritional program is liquid feed with 24-8-16 or 20-10-20 N-P-K formulation, following the product directions. Liquid fertilizer should be rinsed off the foliage with water to help remove fertil-

izer salts from the terminal whorl and avoid damage to or death of the emerging leaf.

Pruning

As leaves are harvested and plants become tall, cut the stem 1 foot above the soil to encourage branching or 6 inches above the soil to rejuvenate the plant. Leave three new shoots to grow, and remove all smaller shoots.

Landscape uses

The ease with which ti is propagated, its rapid growth, and its colorful leaf variation make it a popular garden and landscape plant. It is used in outdoor landscapes as an accent, hedge, screen, mass planting, and foundation or background planting. Plant it on 2–3-foot centers for massing in the landscape. Small leafed varieties can be planted closer. Ti can also be planted singly as a specimen plant in a small garden.

In a container or aboveground planter, ti is suitable for growing outdoors or indoors, as it requires only ordinary care and tolerates low light intensities. It makes an excellent container plant for a deck or lanai.

Indoor culture

Light

Ti is adaptable to interior conditions, tolerating light levels as low as 75–150 foot-candles. However, at those levels new growth becomes stretched and poor in color, and foliage variegation is reduced. Foliage color and quality retention improve as light increases to around 800 foot-candles.

As a point of reference, the amount of light at noon on a clear summer day is approximately 10,000 foot-candles. On an overcast winter day, it may be as low as 500 foot-candles. Indoors, on a clear summer afternoon the direct sun entering a window may be 4000–8000 foot-candles, but the level will be only about 600 foot-candles in the shade to the sides of the window. The natural light indoors on the shady side of a house may be 150–250 foot-candles, depending on the amount of window area and the presence of window blinds or curtains.

Ti develops its best leaf color in bright light and is less suitable for locations where it receives only artificial light. Plants require 4 hours of direct sunlight or bright, indirect light. Locate plants in well-lighted areas within 4–8 feet of large south-facing, east-facing, or west-facing windows. Low light, low humidity, and hot, dry air can cause leaf loss.

Temperature

Maintain temperatures between 65 and 85˚F. Ti prefers humidity levels between 40 and 60%. Avoid cold, drafty areas.

Potting media

Plant newly rooted stem cuttings in a well-drained potting media containing high-quality peat at no more than 50–60%. Choose a medium with excellent aeration, good water-holding capacity, and good drainage characteristics. Amendments should include a low to moderate level of micronutrients, such as 1 pound of MicromaxÒ per cubic yard of medium and sufficient dolomite to adjust the medium's pH to 5.5–6.5. Use a 4-inch pot for a small plant or a 6-inch pot for a larger plant. Plants may be repotted into larger containers as they grow.

Watering

Ti plants respond well to plenty of water. Keep the well-drained growth medium moist but not wet, avoiding extremes in wetness and dryness. Excessive drying between waterings causes tipburn and necrosis of the leaf margins.

Fertilizer

Slow-release fertilizers work best; they can be top-dressed or incorporated into the potting medium. Apply a 20-10-20 fertilizer at a rate of 1 teaspoon in a 6-inch pot every 2 months. A liquid fertilizer may be used, applying a 20-10-20 fertilizer to provide 200 ppm N with every watering (or as recommended on the fertilizer container).

Pruning

As the plant grows and produces new leaves at the tip, cut or pull off the lower leaves if they turn yellow or brown or become diseased with leaf spots. Prune to control plant size. Plants may be rejuvenated by cutting the stems back to 6 inches above the level of the soil or medium in the pot, so that new shoots will arise at a lower location on the stem.

Propagation

The relative ease with which ti is propagated help make it a popular garden plant. Ti is propagated from stem sections, terminal stem cuttings, seeds, and by air-layering.

Cuttings

Cut stem sections in pieces 1 inch or more long. Cuttings from young stems are easier to root than those from old, woody stems. Cuttings root quickly, and a rooting hormone is not necessary. Plant cuttings vertically or horizontally into a rooting medium (perlite, vermiculite, or peat moss-sand mixture) so that three-fourths of the length of the vertical section is buried or ¼ inch of the diameter of the horizontal section is covered. Cuttings inserted in a vertical position will grow into single plants. Cuttings inserted in a horizontal position may grow into several plants, depending on their length. Keep cuttings moist and in a partially shaded location. Mist can be applied manually, typically two or three times per day. Rooting time is 2–4 weeks. A terminal cluster of leaves with 6 inches of stem will root quickly and make a well-shaped plant in 4–6 months.

Cuttings may also be rooted in plain water and should be at least 6 inches long. The end of the cutting should be immersed in about 1 inch of water. Water in the container should be changed occasionally to prevent the growth of plant pathogens or rot organisms. A water-soluble fertilizer such as 20-10-20 may be added to the water to provide some nutrients (follow the directions on the fertilizer package). After a strong root system has developed, the cutting may be transplanted. The cuttings should be planted before the rootlets get very long; otherwise, they may break off in the planting process.

Air-layering

It takes a couple of months for an air-layered branch to root. After removal of two or three basal leaves, air-layers are transplanted into a pot or container with care to avoid injuring the roots.

Seeds

Before being gathered the berries should be allowed to mature to be sure that the seeds are ripe. Up to 16 seeds are enclosed in the berries. Seeds that are sown when fresh germinate rapidly (2–6 weeks). Propagating from seed usually results in seedlings having wide variation in plant size and leaf color and shape.

Use a fine medium such as sand, a commercial potting mixture, or peat moss. Sow seeds ¼ inch deep in the medium and cover them. Keep the seeded medium moist and in a warm location. The berries may be planted whole or, to hasten germination, mashed to release the seeds before planting. When the seedlings are several inches high and have a strong root system, be transfer them to individual pots or containers.

Commercial production

Most commercial production is of the common green ti, although there is some production of other types of cut tis. According to the Hawai‘i Department of Agriculture, in 2004, 41 farms produced 7.2 million cut ti leaves with a farm-gate value of $669,000. Out-of-state sales of cut ti leaves (including wholesale and retail sales) generated $750,000. Although commercial growing of ti is primarily for cut foliage, cane (stem pieces) and potted plants are also marketed.

Planting

Ti plants generally are propagated from cuttings. For cut foliage production, the plants must be vigorous enough to produce four leaves per terminal per month. Other desirable characteristics include good leaf color, resistance to disease, and leaves that can withstand shredding from strong winds, resist discoloration from sunlight, and have a long postharvest shelf life.

In commercial plantings, ti plants are spaced at 1½–2 feet in rows and between rows. There may be two or more rows per bed with 3-foot spacing between the beds. A greater distance between plants is not considered desirable for green ti because the leaves may become too large. Remove inflorescences as they emerge to direct energy toward new leaves.

Fertilizer

Appropriate fertilizers include urea and formulations such as 16-16-16, 10-10-10, 8-12.5-6, or 10-30-10, depending on the soil’s P status. Apply two ounces per plant of one of these balanced fertilizers every second month to improve the growth of new leaves. Soil can be tested for levels of nutrients. Nutrient deficient ti leaves are more susceptible to *Cercospora* leaf spot and other diseases. Magnesium (Mg) deficiency results in broad

Red ti in a nursery.

yellowing in older leaves and potassium (K) deficiency in dull color in older leaves, sometimes with necrotic spots. If Mg is low, add magnesium sulfate.

Irrigation

Supplementary irrigation is used wherever necessary to maintain leaf production during dry periods. Drier climates with the use of irrigation help avoid fungus and bacterial leaf spots.

Pest management

Diseased leaves should be removed from plants weekly and plants kept well fertilized and watered. The use of fungicides may be necessary in extremely wet environments. Weed control is very important for the establishment of new fields.

Harvest

Leaves are harvested as soon as the plant produces leaves that are 12 inches long, usually 10 months from the time terminal cuttings are planted. When the plants grow too tall, the stems are cut back to 1–3 feet above the soil level. Harvesting of leaves can begin again from these topped plants in 8–9 months.

The best time to harvest is early morning. Harvesting is done by cutting or pulling the lower leaves off the cane. Only the top three or four leaves are left to support plant growth. Harvesting may also be done by breaking off the terminal completely. The period between harvests of leaves from each terminal may be as long as a month.

Pot production

Although ti plants represent only a small portion of the potted foliage plant product mix, they are among the most colorful foliage plants. Small-leaved selections of ti plants are finished as small and medium pots and for use in combination planters. Larger multi-branched plants in 6–17-inch pots are produced for large-scale interior planting projects. Larger plants are stepped up to larger pot sizes. Many of the highly colored cultivars are propagated by terminal stem cuttings (tips) which are directly stuck in pots, then eventually sold. If the propagative cane diameter is too small, there could be a problem with cane rot. Colored tis have a higher light requirement (medium to higher light intensity).

Postharvest handling

When properly applied, a combination of insecticidal soap and a pyrethroid in a postharvest dip is more effective than either one used alone. A promising postharvest treatment of ti leaves for insect control is a hot water dip at 120°F for 10 minutes. The leaves are graded according to small, medium, and large (12, 18, and 24 inches long, respectively). They are tied into bundles and packed for shipment in corrugated boxes.

Pests and diseases

Problems affecting ti are listed on pages 8–11. Pesticides may be applied to ti plants for landscape use and in containerized production nurseries, but they should not be applied to ti plants or ti leaves intended for culinary or adornment uses.

Special notes

Leaves of both green ti and cultivars of other colors used in arrangements by florists and exported as cut foliage. They are frequently packed with mixed tropical flowers.

Early Polynesians believed the ti plant had divine power. To dispel evil, fresh leaves were worn around the neck, waist, and ankles and hung around dwellings. Masses of plants were planted around homes to ward off evil and bring good fortune. The kāhili (feathered standard), a sign of royalty, was fashioned in the form of a tall ti plant. The ti stalk was used as a sign of surrender.

Hawaiians steamed ti root in imu (ovens in the ground) to be eaten as a sweet. The root was also fermented to make a beer, fermented and distilled to make a brandy called ʻōkolehao, or boiled and used as a laxative.

Many ancient Hawaiian uses of ti continue today. Fresh leaves are used as a wrapper for foods such as taro, pork, and fish before they are steamed or roasted in an imu. Ti leaf skirts are worn for the hula. Leaves have been used as thatch for houses, rain capes, sandals, plates, food for horses and cattle, fishnets for hukilau, whistles, and as sleds to slide down slopes. Dry leaves were fastened to fishing nets to drive fish into shallow water in hukilau fishing.

Many kinds of decorations are made from ti. Stems are cut into 6–8-inch sections and rooted in water to produce new leaves for table decorations. Cut leaves are used to garnish food or to cover floats in a parade, a stage, or a table at a luau. Large numbers of leaves, green as a basic foliage and other colored types, are used by florists to complement all kinds of tropical flowers. Attractive designs are fashioned by florists by cutting, trimming, rolling, and folding ti leaves.

Common cultivars (horticultural varieties)

Plants grown from seed have provided hundreds of cultivars, displaying a wide range of plant size, leaf size, shape, and color including purple, crimson, scarlet, rust, pink and green; or striped with pink, red, and white. These cultivars are then propagated vegetatively. Various growing conditions often alter leaf color. There is no one authority that names ti plants, and varietal names vary from place to place, even island to island. Some of the many ti cultivars are listed on pages 12–14.

In addition to those listed in the table, other cultivars include Amazing Grace, Apple Juno, Auntie Lou, Baby Spoon, Ballerina, Bangkok Gold, Bolero, Burgundy, Calypso Orange, Cameroon, Carmen Mehealani, Cascade, China Boy, Chong Giant, Compacta, Curly Green, Diamond Sunrise, Dr. Brown, Emerald Green, Exotica, Haole Boy, Hawaiian Bonsai, Hawaiian Boy, Hawaiian Compacta, Hawaiian Green, Honokulani, Iaukea, Indian Blanket, Kahaluu Beauty, Kahaluu Rainbow, Kalakaua II, Kamehameha, Kauai Beauty, Kawauchi, Kiaki, Kilauea Red, Kilauea Iki, King Arthur, Koolau, Lilinoe (Lilinoi), Magic, Maize, Mauna Kea, Melvin C, Merry Christmas (Mele Kalikimaka), Mini Orange, Miniature Green, Miss Andrea, Miss Hawaii, Moonlight Rose, Narrow Onomea, Negri/Black, New Guinea Black, Noe Noe, Nuuanu Juno, Oahu Rainbow, Orange Glow, Orange Julius, Orange Splash, Orange Tulip, Painter's Pallette, Picotee, Pineapple, Pink Lady, Pink Sensation, Powder Puff, Purple Haze, Red Cameroon (Tempest), Red Sister, Red Spoon, Ricky, Rooster Tail, Ruby, Satsuki, Satsuki Pink, Sharkskin, Sherbert, Sousa, Sunset, Tachibana, Tango, Tiger Stripe, Valery Sophia, Volcano, Wahine, Wailua Purple, and Will I's Gold).

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References and further reading

Blessington, T.M., and P.C. Collins. 1993. Foliage plants: Prolonging quality: Postproduction care & handling. Ball Publishing, Batavia, Illinois.

Brennan, B.M., S.F. Swift, and C.M. Nagamine. 2002. Turf and ornamental pest control: A guide for commercial pesticide applicators. Cooperative Extension Service, College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa. Pesticide Risk Reduction Education PRRE-3.

Brown, B.F. 1994. The Cordyline: King of tropical foliage. Valkaria Tropical Gardens, Valkaria, Florida.

Chase, A.R. 1997. Foliage plant diseases: Diagnosis and control. APS Press, St. Paul, Minnesota.

Ebesu, R. 2003. Integrated pest management for home gardens: Insect identification and control. Cooperative Extension Service, College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa. Insect Pests IP-13.

Gilman, E.F. 1999. *Cordyline terminalis*. Cooperative Extension Service, University of Florida. Fact Sheet FPS-141.

Griffith, Jr., L.P. 2002. Tropical foliage disorders: A Ball guide. Ball Publishing, Batavia, Illinois.

Griffith, Jr., L.P. 1998. Tropical foliage plants: A grower's guide. Ball Publishing, Batavia, Illinois.

Growing plants for Hawaiian lei: 85 **plants** for gardens, conservation, and business. 2002. College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa. p. 46-47.

Hara, A.R., R.Y. Niino-DuPonte, and C.M. Jacobsen. 2001. Root mealybugs of quarantine significance in Hawaii. Cooperative Extension Service, College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa. Insect Pests IP-6.

Hara, A.H. and R.F.L. Mau. 1987. 1987 Guide to chemical control of insect and mite pests of ti plant. Cooperative Extension Service, College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa. HITAHR Brief 066.

Henley, R.W., L.S. Osborne, and A.R. Chase. 1991. Cordyline—Ti plant. CFREC-A Foliage Plant Research Note RH-91-34, Central Florida Research and Education Center–Apopka, Florida.

Kawabata, A.F., A. Hara, B. Bushe, and C. Jacobsen. 2005. Mite control chart for ornamental crops. Cooperative Extension Service, College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa. Miscellaneous Pest Publication MP-4.

Kawabata, A., A. Hara, and C. Jacobsen. 2004. Insect control chart for ornamental crops. Cooperative Extension Service, College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa. Insect Pest Publication IP-19.

Mersino, E.F. 2002. Mites on ornamentals. Cooperative Extension Service, College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa. Miscellaneous Pests MP-2.

Moorman, G. 2005. Cordyline (ti plant) diseases. Cooperative Extension Service, Pennsylvania State University.

Rauch, F.D. and P.R. Weissich. 2000. Plants for tropical landscapes: A gardener's guide. University of Hawai'i Press, Honolulu, HI.

Rauch, F.D. 1996. Tropical landscape plants. 3rd edition. Hawaii Floriculture. Battle Ground, WA.

Schmitt, D.P. and B.S. Sipes. 1998. Plant-parasitic nematodes and their management. Cooperative Extension Service, College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa. Plant Disease PD-15.

Teho, F. 1992. Plants of Hawaii: How to grow them. Petroglyph Press, Ltd., Hilo, Hawaii.

Watson, D.P. and W. W.J. Yee. 1973. Hawaiian ti. Cooperative Extension Service, College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa. Circular 481.

Problem	Description	Symptoms	Control
Aphids	Small, rounded, or pear-shaped, soft bodied insects clustered on stems, leaves, buds, and flowers; usually found on new growth. Most aphids have a pair of tube-like cornicles on the posterior of the abdomen.	Aphids suck the sap causing speckles on the foliage, reduced color, stunting, wilting, and deformed leaves. In severe cases, leaf loss occurs.	Insecticidal soap is the safest and most effective control strategy.
Broad mites (*Polyphagotarsonemus latus*)	These small pests feed on young, new growth. Most mites are very small and difficult to see even with a hand lens.	Feeding causes curling, puckering, deformity, distortion, and bronzing. Wilting may occur.	Minimize the possibility of introducing mites into the growing area on infested plant material. Eliminate weeds that are alternate hosts. Ultra fine oil, insecticidal soap, or neem may also be used. Wash foliage with a strong spray of cold water. Wash the plants with soapy water and a soft brush or cloth to remove insects.
Carmine spider mites, *Tetranychus cinnabarinus*; false spider mites	Feed primarily on the underside of the foliage, on stems, and leaf petioles. Heavy infestations of carmine spider mites have large amounts of silk webbing and appear bleached due to feeding punctures. False spider mites do not spin webs; they are reddish in color with black patterns.	Spider mites suck plant juices from leaves causing graying and discoloration of leaves, especially on the undersides. Injured foliage begins to turn yellow or become speckled. In severe cases, webbing, loss of foliage, and plant death can occur. When false spider mites feed, the leaves become silvery, followed by a tanning, then a blackening.	Eliminate weeds that are alternate hosts. Make sure incoming plants are free of mites before placing them near other crops. Directing a forceful spray of water at the plants to remove dust will help keep mite populations down.
Fungus gnats	Small, black flies (1/8 inch long) found buzzing around the soil surface or on leaves. Primarily, a problem in wet conditions and when large amounts of algae are present.	Damage is caused by larvae feeding on roots, root hairs, leaves in contact with the soil, and lower stem tissues. The larvae spin webs on the soil surface, which resemble spider webs.	Avoid algal growth where possible. Reduce the amount of water applied to each pot whenever possible.
Chinese rose beetles, *Adoretus sinicus*	Dark brown beetles feed on foliage at night. Attracted to weakened plants	Holes in leaves. Heavy infestations cause lace-like appearance of leaves.	Spray plants or soil drench with an insecticide registered for ti plants.
Grasshoppers and katydids		These insects occasionally consume large quantities of foliage. Their feeding leaves an irregular appearance.	Spray plants with an insecticide registered for ti plants.
Green garden loopers, *Chrysodexis eriosoma*	Caterpillars feed on leaves. Newly hatched caterpillars often feed only on the lower surfaces of leaves.	Loopers chew leaves.	Biological insecticide, *Bacillus thuringiensis*, is effective. Hand removal if only a small number of plants.

Problem	Description	Symptoms	Control
Mealybugs, *Dysicoccus neobrevipes*; longtailed mealybug, *Pseudococcus longispinus*	White cottony masses found in the leaf axils, underside of leaves, on roots, and other protected areas.	Mealybugs suck plant juices. Infested plants become stunted, and plant parts may die. Honeydew and sooty mold are often present.	Systemic insecticides are preferred. Mealybugs can be removed with an alcohol-saturated cotton swab. Wash the plants with soapy water and a soft brush or cloth to remove insects. Remove mealybugs with tweezers or a toothpick.
Nematodes	Microscopic, parasitic roundworms that live in and feed on roots. Damage roots and prevent normal uptake of water and nutrients.	Poor growth, stunted, chlorotic (yellow) foliage; premature wilting, low vigor, thin canopy, and leaf loss under relatively mild stress; swollen, knotted, gnarled areas on the roots.	The goal is to manage their population, reducing their numbers below damaging levels. Incorporate good compost or organic materials, such as manure or wood shavings, into the soil as a preplant amendment to encourage microbial activity to depress nematode populations. Grow French variety marigolds, tilling it in as green mulch. Solarization, the heating of soil by using clear plastic tarps to increase and trap the sun's heat, can be an effective means of controlling nematodes in the soil.
Scales, primarily armored scale; ti scale, *Pinnaspis buxi*	Scales are sedentary insects that are covered by a hard protective covering (shell) or waxy secretion. Appear on leaves, petioles, or stems.	Scales suck plant juices. They appear as raised or brown bumps (scale) which give stems or leaves a lumpy appearance. Feeding causes a characteristic yellow or chlorotic streak that radiates from point of attachment.	Volck Supreme horticultural oil. A systemic insecticide may have to be used against the armored scales. Wash the plants with soapy water and a soft brush or cloth to remove insects. Thoroughly wash undersides of leaves where pests may also reside. Removal with alcohol-saturated cotton swab.
Thrips, *Parthenolthrips dracaena*; banana rust thrips, *Chaetanaphothrips signipennis*	Thrips are tiny, slender insects with mouthparts modified into a short beak used to suck the plant sap. They feed on leaf undersides and the whorls of immature leaves. Generally, thrip populations increase during the summer and decrease during the winter.	Their feeding often causes a stippling of leaf tissue accompanied by silver to gray leaf scars, bronzing, or silvering (characterized by long white streaks). Infested leaves become curled or distorted with calloused areas where feeding occurred. When severe, russeting, graying of leaves, stunting of leaves occur. Immature leaves may fail to unfurl and thus appear as deformed leaf whorls.	Remove infested foliage and flowers from the field or shadehouse to eliminate sources of thrips. Discard old stock plants that may harbor thrips and obtain thrips-free propagative material for restocking. Cut down unwanted clumps of banana plants near commercial farms.

Problem	Description	Symptoms	Control
Whiteflies	Sap-feeding insects that feed on underside of leaves. Whiteflies are tiny; the adults resemble white moths. The immature stages look like scale insects.	Infested leaves often have small yellow spots where adults or immature whiteflies have fed. When populations become dense, the leaves become yellowed and lower leaves are covered with black sooty mold.	Many insecticides are registered for and effective at controlling whiteflies. Undersides of leaves must be covered thoroughly to achieve satisfactory control. Successive sprays of insecticidal soaps, oils, or synthetic pyrethrum.
Snails and slugs	Feed mostly at night. Slugs hide during the day under boards, rocks, potted plants, and in the soil.	Can feed on bark and girdle stems; chew leaves.	Snails and slugs can be controlled with baits containing metaldehyde or similar baits. Use only those snails and slug killers approved for gardens. Try trapping them or using various organic baits. An effective way to prevent snails from entering the garden is by use of sharp sand or erecting a copper strip around the perimeter of the garden. Search for these pests, handpick, and destroy them. Destroy their hiding places.
Cercospora leaf spot	Fungus attacks during prolonged wet periods without drying winds.	Initially, rust-colored specks form. Many specks merge to form rectangular areas between leaf veins. Rectangular yellow to brown spots between veins on both surfaces of leaves. Affected leaves yellow and fall.	Best grown in drier climates with irrigation. To avoid wet foliage, water early in the day and increase plant spacing. Avoid overhead watering. Discard infected plants. Keep plants well-fertilized. Remove diseased leaves regularly. Spray plants with a fungicide registered for ti plants.
Fusarium stem and root rot	Fungus attacks the growing tips. Common in areas of high rainfall.	Causes die-back to the cane. Bark becomes loose, and lesions observed near the base of the stem. Internal bark tissue is generally dry. Roots are mushy and brown and easily disintegrate when handled. Soft, mushy rot at base of cuttings or rooted plants. Rotten area frequently has purplish or reddish margin.	Best to grow in drier climates with irrigation. Remove and destroy symptomatic plants as soon as they are found. Avoid overhead watering. Avoid wounding plants. Minimize water applications, and grow pathogen-free plants in pathogen-free potting media. Discard infected plants.
Pseudomonas bacterial stripe	Can be severe during prolonged wet periods without wind.	Water-soaked, slender, long stripes between veins, becoming darker as disease progresses until tissue falls out.	Best to grow in drier climates with irrigation.

Problem	Description	Symptoms	Control
Chlorosis	A lack of normal green pigmentation in foliage, generally due to deficiency of one or more micronutrients (usually iron), root rot, or root-knot nematodes. Some leaf yellowing on older leaves is normal.	Yellow or pale leaves.	Increase water supply, light applications of 10-30-10 fertilizer monthly, and remove old leaves.
Fluoride toxicity	Ti plants are highly sensitive to fluoride exposure by air, water, media, or fertilizer. Cause is excess fluoride.	Tipburn and marginal necrosis followed by mottling within the center of the leaf and death of entire leaf in severe cases.	Use potting media, irrigation water, and fertilizers low in fluoride content. Propagation and potting media should have a pH of 6.0 to 6.5. Irrigation water should contain less than 0.25 ppm of fluoride. Avoid high calcium water.

Note

The pesticides mentioned are provided as suggestions for selecting suitable controls and should not be considered to be recommendations. The pesticide label is the law. Read it before purchasing a pesticide to ensure that it is registered for your intended use. Carefully read the label entirely before use and follow its instructions.

Reference to a company or product name does not imply approval or recommendation of the products to the exclusion of others that may also be suitable. Because pesticide registrations may change, consult a chemical sales representative, pesticide company representative, the Hawaii Department of Agriculture, or the CTAHR Cooperative Extension Service for information on insecticides currently approved. On the Web, consult the CTAHR-CES Hawaii Pesticide Information Retrieval System (HPIRS) at http://pesticides.hawaii.edu.

Pesticides may be applied to ti plants for landscape use and in containerized production nurseries. Do not use pesticides on ti plants or ti leaves intended for culinary or adornment uses.

Cultivar	Leaves	Leaf color	Comments
Baby Doll	6 x 1¼ inches; margins flat, leaf width uniform to pointed tip. Small-leaved.	Green with red to black highlights. Maroon trimmed with a pink edge.	Plant is small to intermediate in size with small narrow leaves. Typically grown for small containers and dish gardens. Will begin to produce leaves with wider pink margins as the light intensity is reduced. Susceptible to fluoride toxicity.
Bob Alonzo	12 inches long.	Orange yellow.	
Floozie	18 inches long.	Neon red.	
Graveyard Red	Intermediate.	Burgundy to black.	Standard size plant. Widely plant around cemeteries in parts of Hawaii to add color.
Haole Girl	Shorter, broader than *Lau Kea*.	Pale yellow.	
Hawaiian Beauty		Green, heavily streaked with white, pink, and red.	Medium size plant.
Hawaiian Flag	10½ x 3 inches; margins undulating and conspicuously incurving. Narrow foliage.	Centers yellow with green or maroon stripes; margins green or yellow striped. Heaviest streaks toward apical end.	Medium height plant. Relatively slow growing and color best in partial shade.
Hawaiian Stiff	Large, narrow.	Striped with purple.	Stiff, upright growth habit.
Hilo Boy	Medium to broad.	Apple green with streaks of cream and lime; pink margins.	Standard size plant.
Hilo Rainbow (Imperialis)	16–20 x 4 inches, spaced far apart. Mature leaves strongly recurved or folded backward.	Few brown streaks between mid-rib and narrow, red margins.	Tall plant.
Iwao Shimizu	6 inches long.	Small, green edged with orange.	Dwarf plant.
John Cummis	11 x 3½ inches; thick with undulating edges.	Burnt orange first appears on leaf margins and later spreads toward midrib.	Medium height plant. Slow grower.
Johnny Noble	26 x 5½ inches; rippled, tending to be firm and curved. Cupped margins.	Entire blade rich ruby red. Maroon.	Large plant.
Juno	9½ x 5 inches; edges undulating with tip curved down.	Pale yellow in center of blade; dark pink at apex, lower half may remain green.	Medium size plant. Leaves may burn in full sunlight after coloring has appeared. Vigorous grower.
Kahuna	10 x 2½ inches; undulating.	Pale to dark green.	

Cultivar	Leaves	Leaf color	Comments
Kauai Rose	8 x 4 inches; thick in texture, arranged in compact whorl around the stem.	Pink to rose extending from leaf margin inward. Area around midrib may be green.	Medium height plant.
Kauai Rosebud	8½ x 5 inches; thick texture, closely spaced, arranged like a rose.	Rich, rose red to purple. Section near midrib may be black.	Intermediate height plant.
Kalakaua	9½ x 4½ inches; thick, spaced closely together. Apical end recurving.	Pink margins with mid-section purplish black.	Medium size plant. Growth is like a kahili.
Kilauea	18 x 5 inches; flat and thin.	Dusky brown with red midrib and margins.	Large plant.
Kiwi	Medium, narrow.	Olive green heavily striped with yellow. Leaves are margined with red that sometimes spreads into red streaks.	Intermediate height plant.
La'i (common green ti)	30 x 4½ inches; pliable but firm.	Clear glossy green.	Large plant. Used as garnish for food and by florists as cut foliage.
Lau Kea	10 inches long; slender.	Pale yellow.	
Lovely Hula Hands	15 x 3 inches; lanceolate.	Light green to pale yellow. Midrib may be green.	Medium height plant.
Makaleka	Unique longish broad leaf.	Green with white margin. Center leaves occasionally show a flash of white, streaked with red.	Large growing plant.
Manoa Beauty	9 x 3¾ inches; leaf margins strongly undulating and incurving.	Pink to rose.	Medium height plant. Leaves arranged compactly at the terminal.
Maui Beauty	8½ x 3½ inches; medium texture, undulating to slightly incurving.	Rose-red to purple. Color may change to ruby red.	Intermediate height plant. Vigorous grower producing many lateral branches. Some lateral branches may die due to over-crowding.
Mauna Kea Snow (Snow of Maunakea)	9⅓ x 3½ inches; margins slightly undulating and incurving.	Pale, yellow with green sections, especially around the midrib.	Medium height plant. Leaves are compactly arranged.
Menehune	6 x 1 inches; lightly arrange in Kahili fashion at tip of stem.	Pale green, pink, and red blends.	

Cultivar	Leaves	Leaf color	Comments
Oahu Rainbow (Rainbow)	18 x 5 inches.	Narrow streaks of light green; different shades of red run through entire leaf.	Large cultivar. Slow grower.
Onomea (Ono Mea)	15 x 4 inches; large under ideal conditions. Thick texture, flat.	Immature leaves pink. At maturity, maroon stripes on green background, rose-colored border and rose-colored stripes toward tip.	Tall plant. Vigorous growing. Leaves used for export cut foliage.
Pele	14 x 1½ inches; lanceolate.	Leaf margins and midrib generally purple while the rest of the leaf is brown.	Intermediate height plant.
Pele's Flame	15 x 4½ inches; thick texture, margins undulating and incurving.	Crimson with center black. May have some streaks of crimson running through the black.	Medium height plant.
Pele's Smoke (Pele's Hair, Chocolate Baby)	21 x 4½ inches; mature leaves are strongly recurved or folded backward.	Olive black or dusky, purplish-gray medium size streaks run through a green leaf.	Medium size plant.
Peter Buck (Kauka Wilder; Sir Peter Buck)	21 x 6 inches; larger under ideal conditions.	Light to dark red; orange red.	Grows tall. Good strong grower. Tends to produce leaves with more green color when grown in heavy shade. In full sun, some bleaching may take place. Strong grower in full sunlight.
Purple Prince	8½ x 2¾ inches; flat.	Violet at first; mature green with pansy violet margins.	Intermediate height plant. Very slow grower. Fully colored leaves will burn easily if not properly protected from sunlight.
Red (Wine Red, Wahine ʻo Hawaiʻi)	14½ x 3 inches.	Ruby red.	Medium height plant. Plants are of moderate vigor.
Rosebud	8½ x 5 inches; thick.	Ruby red, pink to rose green near midrib.	Leaves arranged in compact whorl.
Schubertti (Kaupo Beauty)	28 x 6 inches; flat, thin texture, widely spaced.	Green with red to broad, brown streaks near margins.	Tall plant.
Tricolor (Venustus)	14 x 5½ inches; incurving.	Purple brown stripes about center of leaf extending to margins. Leaf margins are generally yellow.	Medium height plant. Fast growing. When the terminal is cut off, several side branches are produced.
White Fish Bone	10 x 3½ inches; medium texture and twisting. Apex strongly recurving.	Green with rose red margins. Area adjacent to leaf margin is yellow.	Small to medium height plant. Fish bone (protrusion of midrib) is small when plant is young but increases in size as plant matures.