



## *Tournefortia argentea* (tree heliotrope)

Boraginaceae (borage family)

*amoloset* (Chuuk, Losap, Etal); *chen* (Yap); *evu*, *roronibebe* (Fiji); *hunig*, *hunek*, *hunik* (Mariana Islands); *irin* (Nauru); *kiden* (Marshall Islands); *sesen* (Pingelap); *sruksrub* (Kosrae); *tabinu* (Society Islands); *tai'inu*, *tau'unu* (Cook Islands); *taihuni* (Niue); *taubunu* ('Uvea, Tokelau, Tuvalu); *tausuni* (Samoa); *tchel* (Carolinian in Mariana Islands); *te re* (Onotoa); *te ren* (Kiribati); *titin* (Pohnpei); *toubuni* (Tonga); tree heliotrope, beach heliotrope, velvet leaf soldier-bush (English); *yamolebat* (Puluwat)

Harley I. Manner and Craig R. Elevitch



PHOTO: C. ELEVITCH

Tree heliotrope is a wonderful tree for public places in coastal areas.

### IN BRIEF

**Distribution** Common throughout Polynesia, Micronesia, and Melanesia; also present throughout the Indian Ocean region.

**Size** Typically reaches 6 m (20 ft), with similar crown diameter.

**Habitat** Restricted to coastal environments, 0–15 m (0–50 ft) elevation with rainfall of 300–5000 mm (12–200 in).

**Vegetation** Associated with strand plants.

**Soils** Prefers light and medium texture soils; tolerates shal-

low, saline, and infertile soils.

**Growth rate** Slow growing, <0.75 m/yr (30 in/yr).

**Main agroforestry uses** Screen against salt spray, coastal soil stabilization, homegardens.

**Main products** Medicinal, fuelwood.

**Yields** No data available.

**Intercropping** Rarely used in farm cultivation.

**Invasive potential** Moderate; has naturalized where introduced by people, such as Hawai'i. Rarely considered a pest.

## INTRODUCTION

Tree heliotrope is native throughout the Indo-Pacific region, except Hawai'i, where it has been introduced in modern times. Where the tree is native, it is very important in traditional cultures of the Pacific islands. The species is also important for its ecological benefits, particularly as a barrier to salt spray, a windbreak on exposed coasts, and for its presumed role in coastal stabilization. It is capable of growing near the ocean in saline conditions and in nutrient-poor sands and rocky soils.

Tree heliotrope plays a significant role in the handicrafts, tools, canoe building, traditional medicine, and rituals of atoll island cultures. Unfortunately, it is not readily recognized by institutional agroforestry because it doesn't have nitrogen-fixing capabilities, grows slowly, and has limited use as a timber species. Little research has been conducted on this species in terms of its productivity, life cycle characteristics, and its potential as an agroforestry species.

This species is a strand plant; that is, it is restricted to coastal environments. Although rarely considered a pest, it has potential for invasiveness when introduced to new coastal environments. On some islands, the plant is endangered because of its use as a readily available fuelwood.

## DISTRIBUTION

### Native range

Tree heliotrope is an Indo-Pacific strand plant of sandy or rocky coasts, often found near to the water's edge. It is native to tropical Asia, Madagascar, tropical Australia, Malesia, Micronesia, and Polynesia (excluding Hawai'i).

### Current distribution

Indigenous to most islands of the Pacific except Hawai'i where it has become naturalized and common after modern introduction. Rare in peninsular Malaysia and Singapore Island.

## BOTANICAL DESCRIPTION

### Preferred scientific name

*Tournefortia argentea* L. f.

**Family** Boraginaceae, borage family

### Non-preferred scientific names

*Argusia argentea* (L. f.) Heine

*Messerschmidia argentea* (L. f.) I. M. Johnst.

*Tournefortia arborea* Blanco

*Tournefortia sarmentosa* sensu Christian non Lam.

*Tournefortia sericea* Cham.

### Common names

*amoloset* (Chuuk, Losap, Etal)

*chen* (Yap)

*evu, roronibebe* (Fiji)

*hunig, hunek, hunik* (Mariana Islands)

*irin* (Nauru)

*kiden* (Marshall Islands)

*sesen* (Pingelap)

*sruhsruh* (Kosrae)

*tabinu* (Society Islands)

*tai'inu, tau'unu* (Cook Islands)

*taihuni* (Niue)

*tauhunu* ('Uvea, Tokelau, Tuvalu)

*tausuni* (Samoa)

*tchel* (Carolinian in Mariana Islands)

*te re* (Onotoa)

*te ren* (Kiribati)

*titin* (Pohnpei)

*touhuni* (Tonga)

tree heliotrope, beach heliotrope, velvet leaf soldierbush

(English)

*yamolehat* (Puluwat)



Tree heliotrope (foreground) and *Thespesia populnea* (background) growing at water's edge at Pago Bay, Guam, indicating the trees' tolerance of saltwater. PHOTO: H. MANNER



**Left:** An inflorescence at the end of its flowering cycle, with fruits forming on the interior where the first flowers opened and the remaining flowers opening on the apical portions. Note a medium-size praying mantis at the lower right of the inflorescence for scale. **Right:** Bark is light gray or brown and deeply corrugated. PHOTOS: C. ELEVITCH

### Size and form

This small to medium size, spreading tree typically grows to 6 m (20 ft). The canopy diameter is generally about 1.5 times the height. In Nauru, a size range of 2 to 12 m (6.6 to 39 ft) in height is reported.

### Flowers

The inflorescence is pubescent and conspicuous, composed of numerous, small, white, sessile flowers arranged in multi-branched, terminal, paniculate or scorpeoid cymes. Its individual flowers are 6 mm (0.24 in) in diameter and 2 mm (0.08 in) in height. Both calyx and corolla are five-lobed. The tree begins flowering in several years when grown from seed. In most areas, its flowers bloom nearly continuously throughout the year. On Midway, it is reported to flower and seed from May through November (USFWS 2000).

### Leaves

A conspicuous feature of tree heliotrope is its light green, silky, pubescent leaves, which have a silvery gray sheen. The slightly fleshy, obovate to oblanceolate leaves are simple, alternate, and whorled (spiraled) at the branch tips, 10 to 30 cm (4–12 in) in length, and 3 to 12 cm (1.2–4.8 in) in width.

### Fruit

The smooth fruit is greenish white to brown globose, 5–8

mm (0.2–0.3 in) long (pea sized), and minutely apiculate, ultimately dividing into two to four pale nutlets. The nutlets turn light brown when dry. Two to four seeds are enclosed in a corky tissue.

### Bark

The bark is light brown or gray and deeply corrugated.

### Roots

Tree heliotrope has very strong vertical and lateral roots that anchor it even in the harshest coastal conditions.

### Similar species

Its distinctive leaves and inflorescences make it difficult for it to be mistaken for any other species in its range.

## GENETICS

The variability of tree heliotrope has not been studied. Also, no varieties have been distinguished for this wide-ranging species.

## ASSOCIATED PLANT SPECIES

This species can be found as a solitary individual or as part of a strand community. In the drier northern Marshall Islands atolls, it forms a monodominant forest.

## Associated native species

Tree heliotrope often forms the seaward fringe of vegetation. Associates in the strand include naupaka (*Scaevola taccada*), beach hibiscus (*Hibiscus tiliaceus*), milo (*Thespesia populnea*, portia tree), *Ipomoea pes caprae*, and *Vigna marina*.

In dry regions of the Marshall Islands, open stands of tree heliotrope are underlain by a herb layer of *Lepturus repens*, *Sida fallax*, *Portulaca* spp., and *Fimbristylis cymosa* (Mueller-Dombois and Fosberg 1998).

In Guam, this species is found on limestone slopes in association with *Pemphis acidula* and *Bikkia tetandra*.

In Kure, “a *Tournefortia* forest has developed, often reaching heights in excess of 18 feet [5.5 m] tall. *Tournefortia* generally grows between the coast and the band of naupaka ringing the island, often being the closest plant to the ocean” (Starr et al. 2001).



Young tree heliotrope leaves showing whorled arrangement and the silky white pubescence on the underside. PHOTO: H. MANNER

## ENVIRONMENTAL PREFERENCES AND TOLERANCES

### Climate

Tree heliotrope grows in equatorial to subtropical maritime climates of the Indian and Pacific oceans.

### Elevation range

1–15 m (3.3–50 ft)

### Mean annual rainfall

300–5000 mm (12–200 in)

### Rainfall pattern

Grows in climates with summer, winter, bimodal, and uniform rainfall patterns.

### Dry season duration (consecutive months with <40 mm [1.6 in] rainfall)

4 months, seems to be tolerant of drought conditions

### Mean annual temperature

23–29°C (73–84°F)

### Mean maximum temperature of hottest month

26–32°C (79–90°F)

### Mean minimum temperature of coldest month

20–26°C (68–79°F)

### Minimum temperature tolerated

18°C (64°F) (estimate)

### Soils

This species is commonly found on sandy beaches and rocky coral limestone slopes where soils are very thin. These soils are typically shallow, well drained, and of low fertility (deficient in iron, nitrogen, potassium, and trace elements). Most of the exchange capacity of these soils is found in the soil organic matter, which is often low. The soils are mainly Lithosols and Inceptisols.

### Soil texture

It prefers light- and medium-texture soils (sands, sandy loams, loams, and sandy clay loams).

### Soil drainage

It requires free drainage.

### Soil acidity

Neutral soils (pH 6.1–7.4)

### Special soil tolerances

Tree heliotrope tolerates shallow, saline, and infertile soils.



**This example of an ocean-battered tree in Kona, Hawai'i is growing on nearly bare lava where the sand has apparently been washed away from under it over the years.** PHOTO: C. ELEVITCH

## Tolerances

### Drought

This species is tolerant of drought, as it is present on many drought-prone islands.

### Full sun

It is tolerant of more than full sunlight, because the strand environments it inhabits includes strong reflections from the sand and ocean.

### Shade

No information.

### Fire

No information.

### Frost

It is not likely to tolerate frost.

### Waterlogging

In all probability, this species is not tolerant of waterlogging, as it is not found in swamps. While it grows close to the ocean where the water table is often less than 1–2 m (3.3–6.6 ft) below the surface, in coastal locations there seems to be sufficient root aeration associated with tidal fluctuations and the porous nature of sandy soils.

### Salt spray

The tree is tolerant of salt spray and is often covered with luxuriant foliage even on windward coasts.

### Wind

It is commonly found where winds are steady and strong.

### Other

It can grow very close to the ocean, even where occasional waves wash over its root system or batter the lower trunk and roots.

## GROWTH AND DEVELOPMENT

There is little direct information on the growth and development of tree heliotrope. The tree is relatively slow growing, with an estimated growth rate of less than 0.75 m (2.5 ft) per year.

## PROPAGATION

Tree heliotrope is easy to propagate by seeds, cuttings, or air-layering.

### Seedlings

#### Seed collection

Mature seeds are available most of the year. Collect ripe fruits from the tree. Seeds are mature when the fruit turns translucent and becomes soft.

#### Seed processing

Remove the fleshy outer part of the fruit by rubbing them together under water. Then air-dry the seeds or plant them directly. The seeds are enclosed in a corky tissue that turns from white to brown with exposure to air.

#### Seed storage

Seed storage characteristics are unknown. However, because the seeds float and are dispersed by ocean water, it seems likely the seeds will live at least a few weeks in storage if kept cool.

#### Germination

No seed pretreatment is necessary. The seeds can be sown directly in containers 6 mm (0.25 in) deep or pre-germinated in trays. Germination takes 2–4 weeks. Seedlings can be grown in full sun or partial shade.



**Ripe fruits (left) and dried seed nutlets (right).** PHOTO: C. ELEVITCH

### Media

A standard well drained potting medium is acceptable. Since the tree is often planted in sandy coastal environments, it may be advantageous to use some sand in the planting mix, thereby acclimatizing the tree to field conditions.

### Time to outplanting

Tree heliotrope seedlings grow slowly and take 12 months or longer to reach an acceptable size for outplanting. The size at outplanting should be about 35 cm (14 in) tall, with a woody stem 10 mm (0.4 in) in diameter at the base.

### Guidelines for outplanting

Due to the slow growth, seedlings should be well marked with flagging or otherwise protected from foot traffic, maintenance, etc.

### Vegetative propagation

Tree heliotrope can also be propagated by standard cutting or air-layering methods. Cuttings of 15–30 cm (6–12 in) of hardened or green wood can be used, although green wood is more susceptible to rotting. Cuttings root in 3–6 weeks. Both cuttings and air-layers begin flowering within 1–2 years.

## DISADVANTAGES

Scant information is available on this very useful species. Its slow growth is a drawback that hinders its use in soil stabilization in coastal regions.

### Potential for invasiveness

Although listed as a weed by some sources (e.g., HEAR



**A caterpillar feeding on the flowers.** PHOTO: H. MANNER

2004), there is little information to suggest that this species has a high potential for invasiveness. However, it has been introduced into Hawai'i and the northwestern Hawaiian Islands (Kure, Midway, Pearl and Hermes Reef, Lisianski and Laysan Islands, and the French Frigate Shoals), where it has become naturalized and is now relatively common. Merlin et al. (1994) states that this plant is an early colonizer of hot, salty, windswept coastal environments and is succeeded by larger, slower growing trees.

In various parts of the Indo-Pacific, this species is often threatened because its wood is used for firewood for beach barbecues.

### Pests and diseases

Tree heliotrope is relatively free of pests and diseases. It is, however, subject to infestation by heliotrope moth larvae. Root rot is also a problem if the soil is too wet.

## AGROFORESTRY/ENVIRONMENTAL PRACTICES

Ecologically, tree heliotrope is a very important tree species in many islands of the Pacific. The tree serves as a nesting site for some ocean birds and is a valuable species in coastal protection and as a salt spray barrier.

### Mulch/organic matter

Leaves are considered an important mulch on atoll islands (e.g., Kiribati).

### Soil stabilization

While there is little data on this species regarding its functions, the fact that this is a pioneer species in nutrient-depleted coastal environments suggests that it may play an



**A large tree in a homegarden in Tongatapu, Tonga.** PHOTO: C. ELEVITCH

important role in soil stabilization.

### **Homegardens**

It makes a good shade tree in coastal-area homegardens.

### **Windbreaks**

As a salt-spray tolerant species, it is an important wind and salt spray barrier.

### **Animal fodder**

The leaves are an important pig food in Tokelau and Micronesia (Nauru) (Thaman 1993).

### **Wildlife habitat**

On Midway Island, this species serves as a nesting site for the red-footed booby (*Sula sula*) and the great frigate bird (*Fregata minor*) (USFWS 2000).

### **Bee forage**

Flowering nearly continuously throughout the year, tree heliotrope is a good source of bee forage. The flowers also attract numerous butterflies, which inspired the Samoan name for the plant, moega pepe, “bed for butterflies.”

### **Fish/marine food chain**

The leaves are used as fish bait in Tokelau (Thaman 1993).

### **Coastal protection**

It has excellent potential for shoreline stabilization and wind protection.

## **USES AND PRODUCTS**

Tree heliotrope figures prominently in the cultural ecology and ritual of many atoll islanders. The leaves are often eaten as a vegetable and used as pig fodder. The wood is used in house construction, canoe parts, and handicraft items, knife and other tool handles, frames for diving goggles, gongs, and canoe bailers.

The leaves are widely used in traditional medicine and rituals, from curing childrens’ rashes, diarrhea, and fish poisoning (in Nauru) to medicinal teas, steam baths, and to stop bleeding and cover bruises, to name a few. The leaves are also used to cure diseases caused by the violation of sea taboos.

### **Nut/seed**

As a toy, the nutlets are used as “peas” in pea-shooters (such as hollow papaya petioles).

### **Leaf vegetable**

Eaten as a raw “salad” by fishermen in Kiribati (Thaman 1993). In India, the leaves are also eaten raw because of their flavor, which is said to resemble parsley.

### **Other vegetable**

Leaves are stuffed into cooking pigs in Tokelau as a spice (Thaman 1993).

### **Medicinal**

Throughout the Pacific islands, tree heliotrope is highly valued for its medicinal properties. In Nauru, the meristem and root inner bark are pounded to prepare medicine for curing childrens’ rashes, diarrhea, and fish poisoning (Thaman et al. 1994). In the Marshall Islands, the leaves

“are used to make a medicinal tea, in steam baths, to stop bleeding, and to cover bruises” (Merlin et al. 1994).

In Kosrae, leaves are used in a medicinal steam bath as a restorative after a women gives birth (Merlin et al. 1993). The soft inner part of the bark from the “snake-shaped” roots is mixed with coconut meat and used to treat hemorrhoids (wuno in komajmaj) (Merlin et al. 1994).

In Tonga, an infusion of the leaves is taken internally to treat poisoning caused by eating tainted fish. This infusion or leaf juice is also applied to infected cuts and stings from certain poison fish (Whistler 1992b).

In Fiji, a remedy containing root extract is taken to treat rheumatism. Other plant parts are reputedly used to treat weakness following childbirth (Smith 1991).

### Timber

In Namoluk Atoll, Chuuk the timber is sometimes used for house posts (Merlin and Juvik 1996). In Kosrae the timber is used as a building material.

### Fuelwood

The wood is burned for fuel throughout the Pacific. It is a very handy wood at beaches, which leads to its rarity in some cases. The wood is also used for making fire by friction in Kiribati.

### Craft wood/tools

Throughout the Pacific, the wood is used to make gongs, canoe bailers, tool handles, and handicrafts (Whistler 1992a). In the Marshall Islands, the wood is used for handles for knives and machetes and frames for diving goggles. In Namoluk it is fashioned into diving goggles and masks (Merlin and Juvik 1996). In Kosrae, it is also used for diving goggle frames.

### Canoe/boat/raft making

In the Marshall Islands and Namoluk, the wood is used for poles for connecting outriggers to canoes. It is also used for canoe hulls and parts (Thaman and Whistler 1996).

### Tannin/dye

In Tahiti, the leaves are used in the preparation of a red dye (Whistler 1992a).



**These trees shade public tables along the shoreline in Nukualofa, Tonga (top) and Kona, Hawai'i (bottom).** PHOTOS: C. ELEVITCH

### Cosmetic/soap/perfume

In Kiribati, leaves used as a female deodorant (Thaman 1993). In the Marshall Islands corpses are treated with crushed leaves as a preservative and to minimize odor (Merlin et al. 1994).

### Garland/lei

The flower and fruit clusters make an attractive component



in garlands.

### **Ceremonial/religious importance**

In the Marshall Islands, corpses are bathed in saltwater soaked with the leaves. In Namoluk, young unopened leaves are used to treat people affected by sea spirits. Also, the immature flower stalk is used in love magic (Merlin and Juvik 1996). Also in Namoluk, the woody material near the ground is used to cure diseases caused by the violation of sea taboos (Merlin and Juvik 1996).

### **Ornamental**

A very attractive ornamental tree in homegardens as well as a welcome shade tree on beaches and other hot, sunny community gathering places. The plant is also said to be suited for container growing as a bonsai.

### **Other**

Crushed leaves are used to prevent fogging of diving goggles and masks.

## **URBAN AND COMMUNITY FORESTRY**

Tree heliotrope is an ideal tree for seaside and near-shore landscaping and public areas. It withstands the sun, wind, and salt spray, and, once established, grows with little care and is relatively free from pest and disease problems. It is particularly valued for the shade it provides in its favored coastal environments.

### **Size in an urban environment**

The tree typically grows to 6 m (20 ft), although exceptional specimens can grow to 12 m (40 ft). The canopy is domed and spreading.

### **Rate of growth in a landscape**

The rate of growth is moderate, about 0.75 m/yr (2 ft/yr).

### **Root system**

It has a tough root system that allows it to persist even in harsh coastal conditions. The tree's use in homegardens throughout the Pacific indicates that the root system is unlikely to be highly competitive or cause problems in landscaping.



**Trees can be periodically pruned back to control their size.** PHOTO: C. ELEVITCH

### **Products commonly used in a Pacific island household**

Products from tree heliotrope are primarily used by atoll islanders. The leaves are used as a vegetable or spice, or fed to pigs. The wood is useful for an array of crafts and utility items. The leaves are used medicinally as traditional treatments for numerous ailments. The flower and fruit clusters are used in leis.

### **Light requirements**

The tree grows best in full sun.

### **Water/soil requirements**

Tree heliotrope is at home in sandy and limestone seashore soils. These soils are typically low in available nutrients and shallow. Even though these locations are periodically overwashed with ocean water, the tree likely does not tolerate waterlogged soils, and it requires free drainage.

### **Life span**

The life span of the tree is unknown but is expected to be at least several decades.

### **Varieties favored for use in urban areas**

There are no known varieties of tree heliotrope.

## Seasonality of leaf flush, flowering, fruiting

The tree grows nearly continuously. It generally flowers and sets fruit continuously throughout the year.

## Exceptional ornamental values

Tree heliotrope is a very attractive, medium-sized ornamental. The silky leaves, which have a silvery sheen, are distinctive. The curly inflorescences and fruit clusters are also an interesting feature. The umbrella canopy and grayish, deeply corrugated bark complete the picture of a visually attractive tree.

## Use as living fence, hedge, or visual/noise barrier

Beach heliotrope will not tolerate extensive pruning or shearing, but it has been used as an untrimmed hedge or barrier plant (Staples and Herbst 2005). Given the broad canopy, such uses would require a wide planting area.

## Birds/wildlife

The flowers attract bees, wasps, moths, and butterflies.

## Maintenance requirements

Once established, the tree requires little maintenance such as fertilizing, pruning, or thinning. Light fertilization with a balanced organic fertilizer may be beneficial to hasten growth but is not necessary when the tree is grown in its favored seaside environments. The tree can be lightly pruned to maintain a desired shape, although it is recommended to leave substantial foliage when pruning.

## Special considerations regarding leaf, branch, and fruit drop in normal conditions and storms

The tree is very wind tolerant. It does drop older leaves, which often dry out and persist as a leathery mulch.

## Nuisance issues

None.

## Hazards

None known.

## Common pest problems

The tree is rarely affected by any pests. Where present, in Oceania including parts of Micronesia and throughout Indo-Australia, it is subject to infestation by heliotrope moth larvae (*Utetheisa pulchelloides*). Where moth damage is severe, trees can be periodically sprayed with “BT” (*Bacillus thuringiensis*) products; pyrethroids can be used as contact insecticides (S. Nelson, pers. comm.). Freely drain-

ing soil is required to avoid root rot.

## Other comments about this species in urban environments

Because it is one of the few trees that will grow along sandy shorelines, it is subject to being cut down as a convenient source of firewood for beachgoers.

## COMMERCIAL CULTIVATION

The commercial potential for tree heliotrope is greatest for nurseries to grow out seedlings for use in coastal stabilization, home landscaping, and street and park trees.

## PUBLIC ASSISTANCE AND AGROFORESTRY EXTENSION

Extension offices for agroforestry and forestry in the Pacific: <http://www.traditionaltree.org/extension.html>

## INTERNET

USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network—(GRIN) National Germplasm Resources Laboratory, Beltsville, Maryland. <<http://www.ars-grin.gov/var/apache/cgi-bin/npgs/html/taxon.pl?412122>>.

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Species Profiles for Pacific Island Agroforestry ([www.traditionaltree.org](http://www.traditionaltree.org))

## *Tournefortia argentea* (tree heliotrope)

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