Invasive Vines of Guam

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Overview

Invasive vines are weedy or exotic species that pose a major threat to tree plantings in the Western Pacific. This concern has been expressed by foresters and others in the region who grow trees for profit or pleasure. Invasive vines must be controlled to protect island forests.

This bulletin will address five areas:
1. impacts of vines on trees,
2. distinguishing features of vines,
3. dynamic nature of vine populations,
4. current four most invasive vines, and
5. recommended control measures.

The information in this technical bulletin is developed from research in the U.S. territory of Guam but can be applied to the islands in the Commonwealth of the Northern Mariana Islands, Republic of Palau, Federated States of Micronesia, and the Republic of the Marshall Islands. All photographs are the work of R. Bevacqua. The coin in some photographs is a U.S. ten cent piece or dime and is included as an indication of scale.

Introduction

Invasive vines are a major threat to tree plantings on Guam and throughout the Western Pacific (Figure 1).

Invasive vines are weeds or alien species whose introduction is likely to cause economic or environmental harm or harm to human health (Beck et al., 2017).

A vine is a woody or herbaceous plant with a long, flexible stem bearing leaves that are usually separate; lies on the ground or uses other plants for support (Raulerson and Rinehart, 2018). In tropical regions vines are sometimes called lianas.

Tendrils are a characteristic feature of vines (Figure 2). Tendrils are a thread-like organ that by its rotating growth allows a plant to become attached to another plant for support (Whistler, 1995). Tendrils often grow in a spiral form but can stretch out to twine around an object. When coiled, tendrils resemble a pig's tail and enable a vine to climb vertically.

Pacific Island environments, including those of Hawaii, are vulnerable to disruption by invasive species (Bidlack and Jansky, 2017). Six characteristics that make vines effective invaders (Virginia Department of Conservation and Recreation, 2020) are:
1. fast growth,
2. rapid reproduction,

Figure 1. The most wide-spread, invasive vine on Guam is chain of love.

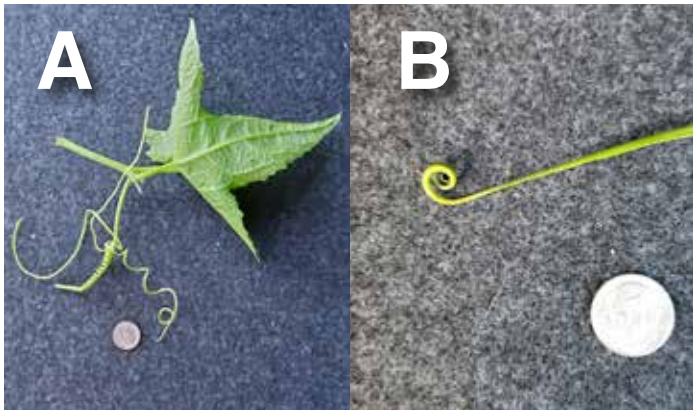

Figure 2. Tendrils are the structures that enable vines, such as luffa on the left (A) and false rattan on the right (B), to climb vertically.

3. ability to spread easily,
4. absence of natural enemies,
5. association with humans, and
6. high cost to remove or control.

Overall, invasive species, not only vines, are identified as threats to the islands of Micronesia in the Western Pacific. It is important to curb the spread of invasive species. There is a high risk that invasive species on Guam may eventually spread to these other islands.

Impacts

The relationship of a vine to a tree can be compared to that of a parasite to its host. The vine is the parasite and the tree is the host. Vines thus can have many negative effects on a tree.

Vines can cover the tree canopy and prevent sunlight from reaching the leaves (Figure 3A,B). Sunlight is essential to photosynthesis - the food producing process that takes place in green leaves. When the canopy becomes smothered by vines, the tree eventually dies from progressive weakening. Vine-infested trees are also more likely to topple in a strong wind or typhoon. The heavy weight of the vines, as well as their air resistance, make the tree top-heavy and more likely to fall in a storm. Vines that twine around or encircle a trunk can strangle the tree by girdling or stopping the flow of fluids up and down the trunk may result in the gradual death of the tree (Figure 4A,B).

Vines can be alternate hosts for agricultural pests. Luffa, for example, is a host for melon fly (*Bactrocera cucurbitae*). Vines can also harbor other pests and make it difficult to detect evidence of termites or other insect

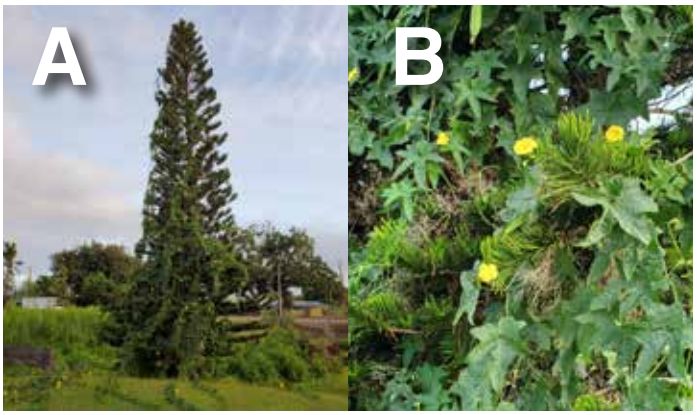

Figure 3. Trees, such as this Norfolk Island pine (A), can eventually die from progressive weakening when vines, such as luffa, cover the canopy and prevent sunlight from reaching the leaves (B).

Figure 4. Vines, such as false rattan (A), start by encircling the trunk of a young tree. As the vines increase in size and number, they encircle and eventually strangle the tree by restricting the movement of fluids up and down the tree (B).

infestations. Structural damage in trees can be obscured by vines. Wind-broken limbs, for example, can be hidden by vines and become a safety hazard for people working below the tree.

History of Changing Vine Populations

Invasive vines are not static or unchanging parts of the island environment. Their numbers can rapidly increase or decrease. Also, there is a constant threat of new introductions. These observations can be documented in a brief history of vegetation surveys on Guam.

A vegetation survey in 2019 at War in the Pacific National Historical Park on Guam provides a view of the current vine situation on Guam (Kathryn Akamine, unpublished data, Volcano National Park – Hawaii, National Park Service). The survey included 20 sample plots in the 926-acre terrestrial portion of the park. Field observations indicate four commonly recorded vine species at present are chain of love, false rattan, luffa, and mile-a-minute vine (Table 1).

Table 1. Four most invasive vines on Guam.

Common Name	Scientific Name
Chain of love or kadena de amor	*Antigonon leptopus* Hooker & Arnott[1]
False rattan	*Flagellaria indica* L. [2]
Luffa or sponge gourd	*Luffa aegyptiaca* Mill. [3]
Mile-a-minute vine	*Mikania scandens* (L.) Willd. [4]

[1](Lee, 1985), [2] (Flora of China, n.d.), [3] (US Forest Service, n.d.), [4] (Whistler, 1995)

A brief review of previous studies illustrates how the dominant vines change over time. In these earlier surveys invasive vines are sometimes included in the general category of weeds.

- In a 1905 botanical survey of the island's plants, chain of love is documented, but there is no mention of the other currently dominant vines (Safford, 1905).
- A 1985 study described the 50 most common weeds on Guam. The study included chain of love and mile-a-minute vine, but there is no mention of false rattan or luffa (Lee, 1985).
- McConnell and Gutierrez (2006) described 53 weeds occurring on Guam. They describe chain of love and mile-a-minute vine, but do not include false rattan or luffa.
- A 2011 survey (Reddy, 2011) identified the 20 most widespread, invasive plants on Guam. Chain of love was number four in terms of coverage of land and mile-a-minute was number 9. Luffa was mentioned but did not make the top 20. False rattan does not appear in the results.

The previous studies support a pattern of constant change. Chain of love (Figure 1) has a long history on Guam and continues to aggressively expand its acreage. Its control is considered a high priority (Guam Invasive Species Council, 2017). Mile-a-minute vine was first reported in 1985 and continues to be a secondary threat. Luffa was first documented in 2011 and is now actively spreading. False rattan was not recorded in any previous surveys but is now a dominant threat.

In summary, vine species and numbers can evolve rapidly over time. The species that are common today may not be the same in the future.

Four Most Invasive Vines on Guam

Chain of Love

Chain of love (*Antigonon leptopus*) (Figure 1) has a long history on Guam. Safford (1905) provides the first description of this exotic vine in his botanical survey of the island.

> "A creeper with clusters of rose-colored flowers. Cultivated in the gardens of Guam, but not common. It takes its pretty and appropriate local name (the chain of love) from the form of its flowers which look like miniature hearts of coral."

Significantly, Safford (1905) does not include this vine in his section on weeds, but over a century later, Reddy (2011) described it as the fourth worst weed on Guam, estimating that the vine covered 6% of the land. Identifying features (Figure 5A,B) include heart-shaped leaves and flower clusters that range in color from white to red but are usually pink.

Chain of love has several other common names: kadena de amor, Mexican creeper, and coral vine. Chain of love is wide-spread and a serious threat to tree plantings throughout Guam and can be found in all of Guam's villages.

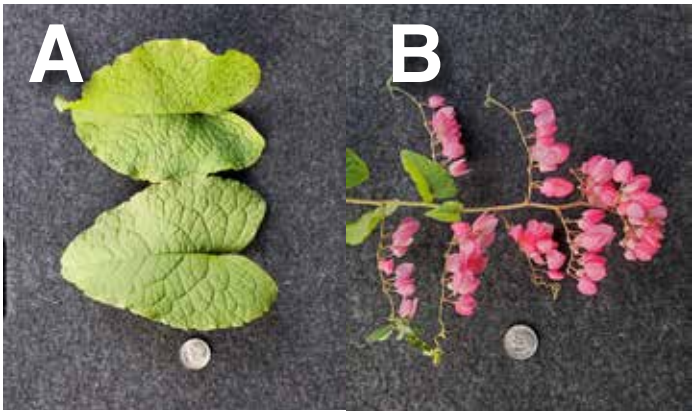

Figure 5. Chain of love can be recognized by its heart shaped leaves (A), and by its flower clusters that range in color from white to red but are usually pink (B).

False Rattan

False rattan (*Flagellaria indica*) is an indigenous, aggressive, fast-spreading vine that poses a grave threat to island trees (Yoshioka, 2008). False rattan is distributed widely on Guam, and ranges from the northern tip of the island in the Guam National Wildlife Refuge at Ritidian Point to the village of Merizo at the southern tip of the island.

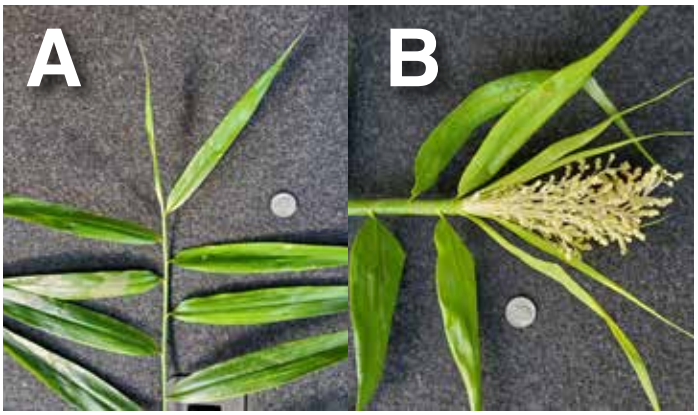

Figure 6. Distinctive features of false rattan are long, narrow leaves with a terminal tendril (A), and white clusters of flowers at the tip of the stem (B).

False rattan is a climbing vine with long, narrow leaves and woody stems. A distinctive feature of false rattan are its tendrils which are located at the leaf tip (Figure 7A) that enable it to climb into the canopy of forest trees. Though slender, they are very strong and allow the vine to ascend vertically up trees.

The flowers are creamy white and occur in large panicles or clusters (Figure 6B). The fruit are pea-sized, green while immature, becoming light brown when they ripen. The vines can form dense thickets.

Luffa or Sponge Gourd

Luffa (*Luffa aegyptiaca*) is an exotic, aggressive vine with an expanding presence on Guam. It has heart-shaped leaves, bright yellow flowers (Figure 7A), and coiled tendrils that can extend to attach to objects (see Figure 2B).

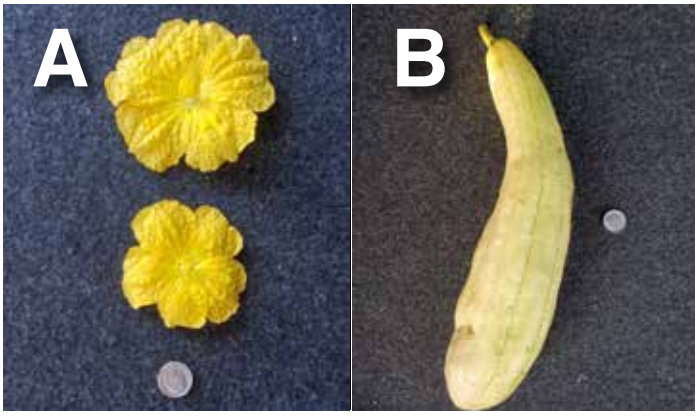

Figure 7. Luffa can be identified by its bright, yellow, flowers (A), and fruit which can be used as a rough sponge (B).

Another identifying characteristic of luffa is the fruit (Figure 7B). When growing it resembles a cucumber and has a highly netted, fibrous skeleton that can serve as a bath sponge after the soft tissue has been removed (Bidlack and Jansky, 2017). Due to this use for bathing or washing dishes, luffa is popular with home gardeners. Luffa forms dense mats that smother other vegetation and poses a serious threat (Figure 8) to trees and other plantings and may clog waterways.

Mile-a-Minute Vine

Mile-a-minute vine (*Mikania scandens*) takes its name from its ability to rapidly establish itself and then choke and smother other plants. Mile-a-minute vine is listed as one of the world's worst 100 alien species (Lowe et al., 2000). Reddy (2011) ranked this exotic, climbing vine as number nine of 20 of the most invasive plants on Guam.

Figure 8. In addition to damaging trees, vines, such as luffa, can form dense mats that smother other vegetation and clog waterways.

At present, the threat posed by this vine on Guam appears to be receding as other, more dominant vines, such a chain of love false rattan and luffa, expand their acreage.

Mile-a-minute vine has heart-shaped leaves (Figure 9A) that are arranged in opposite pairs along slender twining stems. Clusters of small, white to greenish-white flowers can be found at the end of stems (Figure 9B). The seeds are small and black with a parachute of fine white bristles.

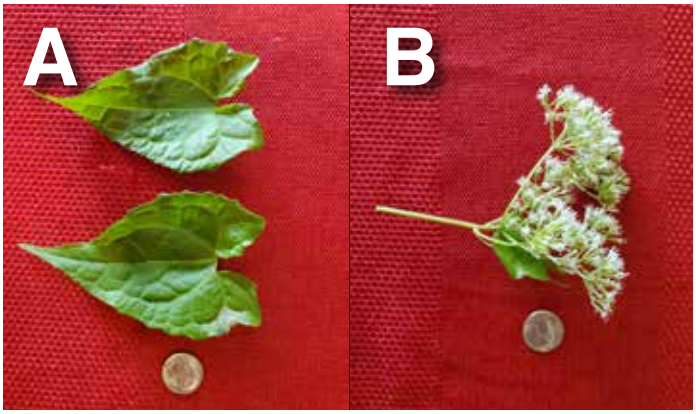

Figure 9. Mile-a-minute vine may be identified by its pointed heart-shaped leaves (A), and by its clusters of tiny white flowers (B).

Other Vines

In addition to the four dominant invasive vines described in the previous sections, there are three other exotic vines that pose a threat to trees on Guam. These are wild bittermelon (*Momordica charantia*), stinking passionflower (*Passiflora foetida*), and ivy gourd (*Coccina grandis*).

Control

It is extremely difficult to control invasive vines and there is no single solution that is effective on all species. The best approach is to integrate several different methods into an overall control strategy. Four such methods are described below.

Prevention

Prevention is the most desirable form of vine control. Prevention is defined as the act or practice of stopping an occurrence. For the Western Pacific region, prevention means keeping a potential pest from arriving on an island and becoming an invasive species. Prevention can be achieved through the enforcement of quarantine rules that prevent entry of potential pests.

Mechanical Control

Mechanical control is physical activity that inhibits unwanted plant growth. Mechanical control can manage weed populations through physical methods that remove, injure, kill, or make growing conditions unfavorable. Examples include pulling weeds by hand, mowing, mulching, and tillage. Tillage can include the use of a hand hoe, rotary tiller, or a tractor-mounted implement.

Biological Control

A long-term method of controlling invasive vines is biological control (biocontrol). Biological control is based on the use of natural enemies to control exotic and invasive pests. The natural enemies or biocontrol agents can be bacteria, fungi, viruses, or insects. Once established, these natural enemies are often self-sustaining and may not need to be reapplied. Biological control differs from tillage or herbicide use which can require many repeat applications. To be successful, the introduction of biocontrol natural enemies requires supportive research, collaboration between partner agencies, and compliance with government regulations.

Chemical Control

Herbicides or weed killers are among the most effective tools for treating invasive plants. Most, including the four previously mentioned invasive species, can currently be treated on Guam with two herbicides – glyphosate (the active ingredient in Roundup®, Rodeo®, and many other commercial products) and triclopyr (the active ingredient in Brush-B-Gone®, Brush Killer Plus®, and Garlon®). Glyphosate is an organophosphorous compound used as a broad-spectrum systemic herbicide. Triclopyr is an organic compound from the pyridine group and is also used as a systemic herbicide. Triclopyr controls dicots or broad-leafed plants but is not effective against monocots or grasses. Both these herbicides should only be applied to unwanted vegetation. For the safe use of any herbicides, always follow the label instructions provided by the manufacturer. The label will provide directions for mixing the herbicide, how and when to apply it, any personal protective equipment that must be worn by the applicator, and instructions for treating inadvertent exposure to the pesticide.

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Luffa vines smothering banana plants.

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