

# INSECTARY PLANTS FOR HAWAII



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# BEES, WASPS & FLIES





## **POTENTIAL ARTHROPOD POLLINATORS**

Although domestic honey bees contribute the most to our food crops, pollinating about \$10 billion worth of crop industries in the U.S./year, there are many alternative pollinators visiting a diversity of flowering plants in natural ecosystems. Along with honey bees, these arthropod pollinators rely on a variety of pollen and nectars to maintain their health.

## Syrphid / Hover flies (Syrphidae)



*Allograpta oblique* is commonly found in agroecosystems as shown on macadamia, Mexican sunflower, and cilantro flowers above.



Syrphid flies contributed significantly (46%) to transferring pollen from macadamia flowers (Tavares, 2013).

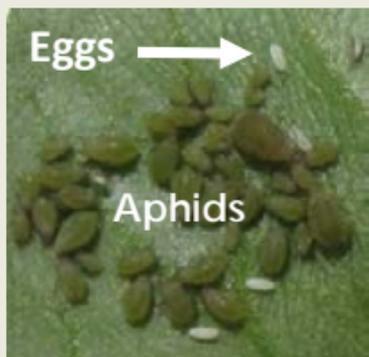


*Ornidia obesa*  
(syrphid flies)



## Syrphid / Hover flies (Syrphidae)

While the adults of syrphid flies feed mainly on nectar, pollen, or honeydew produced by aphids, over one third of species of hoverflies have larvae that eat aphids, thrips or other soft body sucking insects. Thus, hover flies eggs are often laid in a cluster of aphids. As the larvae emerged, they feed on the aphids.



***Insectary plants attractive to hover flies:*** Fennel, angelica, coriander, dill, and wild carrot, partly because they are also good hosts of aphids.





## Leaf Cutter Bee (Megachilidae)

Leaf cutter bees use cut leaves to construct nests in cavities (mostly in rotting wood or bamboo). They create multiple cells in the nest, each with a single larva and pollen for the larva to eat. They are important pollinators of wildflowers, vegetables and fruits crops. They forage throughout the day even in the hot weather. The bee pictured at the top is collecting nectar from sunn hemp flowers.

They use soft, pliable leaves from rose, grape and lagundi to make nest.



*Vitex negundo*, Lagundi

## Sweat bee (Halictidae)

Sweat bee populations can be attracted with wildflowers especially those in Asteraceae.



Though much smaller than honey bees, sweat bees can access nectar from small flowers such as buckwheat and cilantro and can access pollen from sunn hemp if the flower petals were opened by larger bees. They typically nest in soil located in a sunny location. Minimum tillage and insecticide use will help to increase populations of Halictidae and other soil nesting bees.





Green metallic  
sweat bee  
(Halictidae)



Small-size green bees visit plants in the sunflower family (*Asteraceae*) and buckwheat. They are solitary ground nesting bees, although individual bees may nest in close proximity. They build deep vertical nests in the ground or in earthen banks. To provide good shelter and habitats for green metallic bees, minimize tillage and prepare availability of shallow water sources in the ecosystem are recommended.

Female on  
sun hemp



## Carpenter bee (Xylocopinae)

Despite the potential structural damage by carpenter bees, they contribute greatly to pollination of local vegetables and fruits with larger flowers (e.g. passion fruit/ lilikoi and cucurbits). Most insects are too small to effectively pollinate large flowers. Carpenter bees carry large amounts of pollen and most importantly, they can be active all day even in the hottest weather when many bees are not active.

Male  
on Chinese violet



Uhaloa  
(*Walteria indica*)



Carpenter bees

are primitively social (forming a loose aggregation of females, including mothers and daughters). Each female will only tend to her own brood. To build a shelter for carpenter bees, tie more than ten pieces of bamboo together. Each piece should be at least  $\frac{3}{4}$ -inch diameter, ~ 1 foot long. Hang it up and avoid ants.



For more information, visit [www.uhbeeproject.com](http://www.uhbeeproject.com)



## Keyhole wasp (*Pachodynerus nasidens*)



Keyhole wasp is a solitary wasp that commonly preys on caterpillars. The wasp can be found nesting in abandoned nests of other insects, spaces between wood siding of houses, and other small holes such as that provided by wasp nesting block. Keyhole wasps do not mind living in close proximity to other solitary wasps and bees. After the keyhole wasp lays her eggs inside a hole in the wasps nesting block, she stashes prey for her young, and then gathers mud to patch up the hole. When ready to emerge, they will open a hole through the mud patch.

For more information about wasps nesting block, visit <https://www.ctahr.hawaii.edu/sustainag/news/articles/V17-Wang-Tavares-wasps.pdf>



## Aphid collecting wasps/Aphid killers/ *Pemphredon* wasps (Crabronidae)



Adult wasps attend small flowers for nectar, but will gather aphids to feed their young.



*Pemphredon* are solitary wasps, each female makes her own nest in pre-existing cavities in wood, hollow stems, even the pith of broken twigs. The female wasp collects aphids, stinging, paralyzing and crushing them in her nest (up to several dozens per cell). She will then lay an egg in a cell after the last aphid is gathered.

You can create housing for aphid collecting wasps using the wasps nesting block shown above.

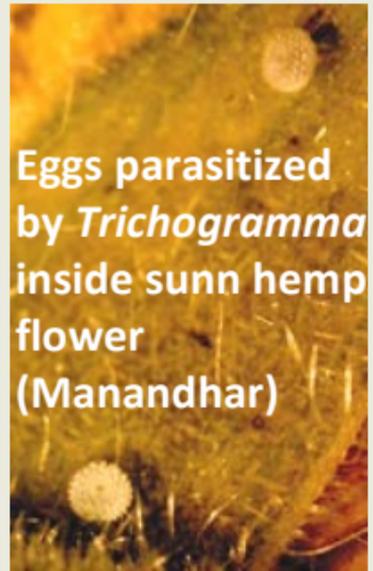


## Trichogramma wasp

The female *Trichogramma* wasps inject their eggs into the egg of > 200 species of insect pests (mostly moths or butterflies), and her larvae consume the embryo and other contents of the egg.



Lycaenidae butterfly  
on sunn hemp



Eggs parasitized  
by *Trichogramma*  
inside sunn hemp  
flower  
(Manandhar)

Lycaenidae butterfly is a common pest of sunn hemp. It lays eggs on sunn hemp flower. This attracts *Trichogramma* wasps to parasitize Lycaenidae eggs. Thus, sunn hemp acts indirectly as an insectary plant for *Trichogramma* wasps.

## *Braconid Wasp*



An army worm parasitized by parasitoid wasps on Spanish needle (*Biden pilosa*).

The Braconid wasp is among the most important of the aphid parasites, as well as, the larvae of butterflies, sawflies, moths and many beetles. If you see any caterpillars with cocoons covering it, don't remove it from your garden, it has been parasitized. This wasp will attack various caterpillars or aphids. The adults feed on the nectar from the flowers of weeds and flowers of the daisy (*Chrysanthemum*), carrot (Umbrellifers) families, oleander (*Nerium oleander*), white clover (*Trifolium repens*) and white mustard (*Brassica hirta*).



Parasitoid wasps  
(*Lysiphlebus  
testaceipes*)



Milkweed and oleander are good hosts for the milkweed aphid (*Aphis nerii*), a bright yellow aphid which are not pests of most vegetable crops.

The abundance of this aphid serves as an attractant to some parasitoid wasps, such as *Lysiphlebus testaceipes*. Parasitized aphids are mummified. Thus, planting oleander and milkweed as border hedgerows can attract parasitoids to agroecosystem.



*Diachasmimorpha tryoni* (Braconidae)



Mint



Lantana

A parasitoid of Mediterranean fruit fly, and lantana gall fly. The long ovipositor on the female of this parasitoid allows it to lay eggs into the larvae of fruit fly or gall fly.

While the females are looking for insect hosts to parasitize, they are also attending flowering plants such as mint for nectar.



# LADY BEETLES



## Seven-spotted Lady Beetles (*Coccinella septempunctata*)



Seven-spotted lady beetles consume 1,000 to 5,000 aphids in its lifetime. A female can lay over 1,000 eggs at one time. After 2-4 weeks of larva stage, they pupate. The adult last for 3-9 months.

**Eggs on dill leaves**



**Pupa on carrot flowers**

Food Source: Aphids, thrips, whitefly, psyllids, leafhoppers, moths and beetles.

Insectary plants: Cilantro, fennel, dill, and many other flowering plants.



**Adult on cilantro**



**Larva stage**

## Yellow Shouldered Lady Beetle (*Apolinus lividigaster*)



This ladybird beetle is black with a yellow face and shoulders. It is much smaller than the common red and black ladybeetle. It was introduced into Hawaii to control aphids and became a key predator of sugarcane aphids. They will also eat milkweed aphids and cowpea aphids.

Favorable insectary plants: crown flower, butterfly weed, marigold.



## Spider Mite Destroyer Lady Beetle (*Stethorus* sp.)

Small lady beetles that are easy to miss as they are 1 mm long.

Food: Mites including the broad mite, spider mite, and the false flat mite





## Common Spotted Lady Beetle

(*Harmonia conformis*)

Light red in appearance with 20 large black spots. In Hawaii, it has been observed feeding on eggs and nymphs of the acacia psyllid (*Acizzia uncatoides*) on *Acacia koaia*, an Hawaiian endemic plant (Leeper & Beardsley, 1976).



Food: Primarily psyllids, occasionally aphids



## Ash-grey Lady Beetle

(*Olla v-nigrum*)

Larvae are spiked and can consume up to 400 aphids in 2-3 weeks before pupation.

Food: Primarily psyllids, Asian citrus psyllid, leucaena psyllid, and aphids

Beside flower nectar and insect honeydew, many lady beetles are attracted to extrafloral nectaries (nectaries from plant parts other than flower). Passionflower, morning glory, hibiscus, impatient, partridge pea, and vetch are examples of plants that produce extrafloral nectaries.



Photo credit: Cynthia Bingham Keiser

## Mealybug Destroyer Lady Beetle (*Cryptolaemus montrouzieri*)

Mostly black with a tan front. Mealybug destroyer lays eggs next to prey. The larvae look like the mealybugs they prey on. Used as a biocontrol agent against mealybugs and scale insects



Larva stage

Photo credit: William Donald  
Newton



## Globed-marked Lady Beetle (*Azya orbigera*)

Grey in appearance covered with many fine bristles with two bristle-free spots.

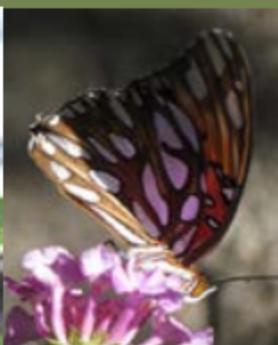


Larva stage

Food: Prefers soft scale insects e.g. green scale (*Orchus chalybeus*), mealybugs and aphids

For images of extra-floral nectaries, visit:  
<https://the-natural-web.org/2014/09/02/will-work-for-food-extrafloral-nectaries/>

# BUTTERFLIES



## Blackburn's Blue or Koa Butterfly (*Udara blackburnii*)



This is one of the two endemic butterflies in Hawaii. The slug-like caterpillar of this butterfly feeds on koa, 'A'ali'i, and other legumes' leaves.

The adults feed on the nectar of 'A'ali'i and koa flowers.

'A'ali'i is susceptible to scale insects, but the Globed-marked ladybug frequently visits this plant to prey on the pests.



'A'ali'i is a shrub < 30 feet. It is a hard wood, used by ancient Hawaiians for building houses, tools, and weapons.



Globed-marked ladybug is often attending scale insects on 'A'ali'i

# Monarch Butterfly (*Danaus plexippus*)



Crown Flower

Monarchs can live a life of two to eight weeks in a garden having their host, milkweed (*Asclepias*) and sufficient flowers for nectar.

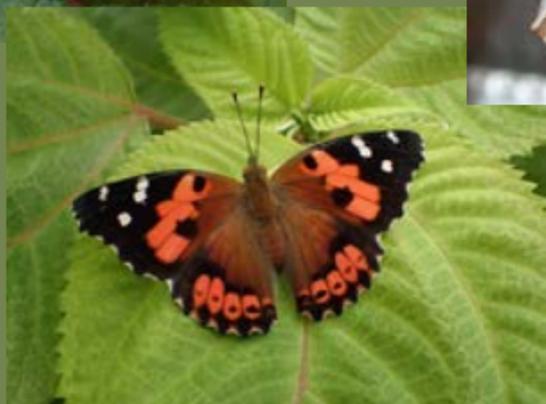
The caterpillar feeds on leaves of the crown flower or other plants in the milkweed family (*Asclepiadaceae*).



## Milkweed



# Kamehameha Butterfly (*Vanessa tameamea*)



(Pictures from Will Haines and Dan Rubinoff)

Kamehameha Butterfly is endemic to Hawaii. Māmaki and other nettles are a food source for the larval stage of this butterfly. Larvae will create a shelter by rolling up the māmaki leaves. Adults will feed on sap fluxes of koa trees. Unfortunately this butterfly is rarely found in urban gardens.



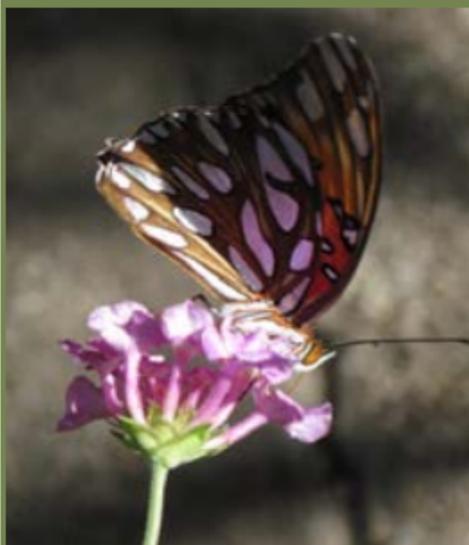
Māmaki



Māmaki inflorescence

For more information, please visit  
<https://cms.ctahr.hawaii.edu/pulelehua/Home.aspx>

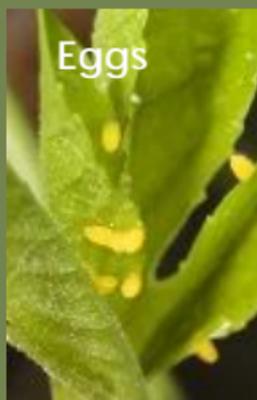
## Passion Vine Butterfly / Gulf Fritillary Butterfly (*Agraulis vanillae*)



The larvae of this butterfly will feed on the leaves of the passion vine.

This caterpillar is poisonous to many predators.

Passion vine butterflies have been seen visiting lantana. Purple and yellow flowers produced by these plants provide an energy source for butterflies in the form of nectar.



Eggs



Larva



Chrysalis

# Swallowtail Butterfly (*Papilio xuthus*)

Attract this butterfly with citrus plants. The 1<sup>st</sup> instars of this butterfly resemble bird droppings



11 days old



14 days old



16 days old



21 days old



A few days later



Osmeterium = A hidden forked structure that emerges when the caterpillar is threatened, and emits smelly terpenes to deter predators.

## Cloudless Sulphur Butterfly (*Phoebis sennae*)

The adult butterfly feeds on nectar from many different flowers with long tubes including bougainvillea, cardinal flower, hibiscus, lantana, and morning glory.

The caterpillar is yellow to greenish, striped on sides, with black dots in rows across the back. The caterpillar will build a tent in a host plant where it hides in the day. The host plant may be partridge pea (*Chamaecrista cinerea*), sennas (*Senna*), clovers (*Trifolium*), or other legumes (*Fabaceae*).



# Leaf Roller Moth (*Omiodes monogramma*)

Hawaii has 23 species from the *Omiodes* genus that are endemic moths. Feeding habits range from generalists to specialists that only feed on a single species of a native plant such as *Dianella sandwicensis* ('uki'uki). The moths roll the leaves.



Photo credit Will Haines



'Uki'uki



Photo credit Daniel Rubinoff



'Uki'uki berries

*Omiodes anastrepta* feeds on another native plant *Carex wahuensis* and was thought to be extinct.

For more information, visit  
[https://www.ctahr.hawaii.edu/rubinoffd/rubinoff\\_lab/projects/omiodes\\_moths/omiodes\\_moths.htm](https://www.ctahr.hawaii.edu/rubinoffd/rubinoff_lab/projects/omiodes_moths/omiodes_moths.htm)



# MISCELLANEOUS PREDATORY INSECTS AND SPIDERS



Picture credit: Cerruti R.R. Hooks





## Minute Pirate Bug (*Orius* sp.)



Adults and nymphs of the minute pirate bug feed on aphids, spider mites, thrips, and even small caterpillars.



When eggplant is intercropped with sunn hemp, sunn hemp acts as a trap crop for thrips and lure minute pirate bugs over. Thus it reduces thrips on eggplants.



Male flowers of *Macaranga grandifolia*

Macaranga male flowers are often populated by pollen eating thrips. While the thrips help pollinate the flowers, it also serves as a prey of minute pirate bugs.



Taro with insectary border

Other insectary plants that attract minute pirate bugs include marigold, buckwheat, and cosmos.



## Green & Brown Lacewings (Chrysopidae & Hemerobioidea)

Green and brown lacewings are predatory, especially on aphids, both as larvae and adults. Shown in these pictures are brown lacewing on an organic aquaponic taro plant. However, they can also be feeding on mealybugs, psyllids, thrips, mites, whiteflies, aphids, small caterpillars, leafhoppers, and insect eggs. The larva stage of lacewing possesses prominent mandibles with which they attack their preys. Insectary plants preferred by lacewings include red cosmos, carrot, oleander, tancy and etc. They also prefer to have access to a water puddle in their habitats.



**Taro leaf in  
aquaponics system  
with aphids.**



Picture credit: Cerruti R.R. Hooks

## Spider (Araneae)



Picture credit: Cerruti R.R. Hooks



Spiders are one of the most cosmopolitan predatory arthropods found in agro-ecosystems. They are also most resilient to environmental stress, able to survive under starvation, long life (9 months to 25 years), with all instar stages and adult feed actively as predators. They are usually polyphagous though some are specialists. Providing surface organic mulch on soil would create favorable habitat for this predator.



## Biting Midge *Forcipomyia* sp. (Ceratopogonidae)

Copyright © 2006Ed Johnson.

(Picture:Entomology Lab PR)



***Forcipomyia*** midges are the most important pollinators of cacao. The eggs are laid in rotting cacao husks, leaf litter, or rotting banana pseudostems, which add potassium into the soil. Females of the *Forcipomyia* midge bite on caterpillars to obtain protein so they can lay eggs.



Cacao

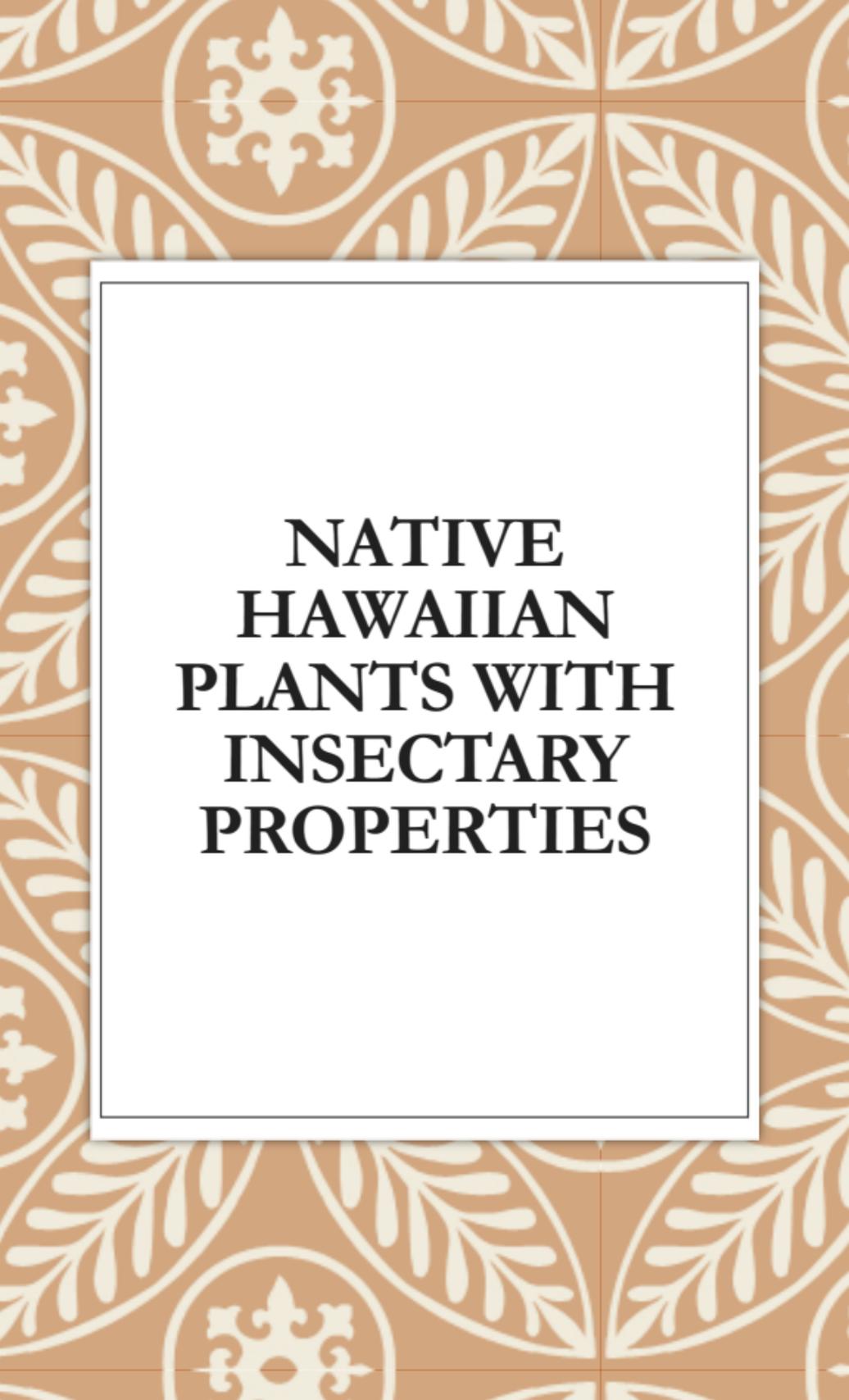


Rotten banana  
pseudostem



Thus, it is beneficial to intercrop cacao with banana plants.

Information from  
<http://entomologylabpr.blogspot.com/2013/09/pollination-of-cacao.html>



**NATIVE  
HAWAIIAN  
PLANTS WITH  
INSECTARY  
PROPERTIES**



Seven-spotted lady beetles attending mites on 'Āweoweo (*Chenopodium oahuense*).

Common spotted lady beetle was observed on *Acacia koaia* feeding on acacia psyllid eggs and nymphs.



Carpenter bees visit 'Uhaloa (*Waltheria indica*). A small shrub with fragrant clusters of yellow flowers.

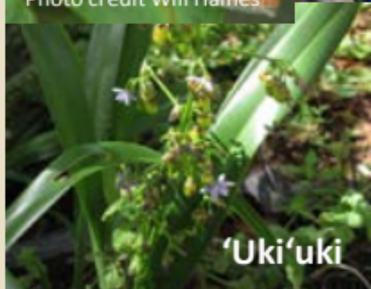
'Ilima (*Sida fallax*) is a shrub indigenous to Hawaii. The yellow trumpet flowers are used for lei and medicinal purposes. Flowers attract a variety of pollinators including hover flies and kamehameha butterflies.



Photo Credit Nate Yuen



- *Dodonaea viscosa* ('A'ali'i) attracts blackburn blue butterfly and the globed-marked lady beetle
- *Pipturus albidus* (Māmaki) attracts Kamehameha butterfly and *Udea stellata*.
- *Dianella sandwicensis* ('Uki'uki) attracts *Omiodes monogramma*





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**Department  
of Agriculture  
STATE OF HAWAII**

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