INSECTARY PLANTS FOR HAWAII

Koon-Hui Wang, Shelby Ching, Jane Tavares, Jensen Uyeda, Joshua Silva
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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.
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).
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.
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.
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.
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.

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 ¾-inch diameter, ~ 1 foot long. Hang it up and avoid ants.

For more information, visit www.uhbeeproject.com
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.

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

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.

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

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

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 parasitized, they are also attending flowering plants such as mint for nectar.
LADY BEETLES
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.

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

Insectary plants: Cilantro, fennel, dill, and many other flowering plants.
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 (Acizza 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.
Mealybug Destroyer Lady Beetle
(Cryptolaemus montouzieri)

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.

Globed-marked Lady Beetle
(Azya orbigera)

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

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 lady beetle is often attending scale insects on ‘A‘ali‘i
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).
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.

For more information, please visit https://cms.ctahr.hawaii.edu/pulelehua/Home.aspx
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.
Swallowtail Butterfly (Papilio xuthus)

Attract this butterfly with citrus plants. The 1st 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.
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* (ʻukiʻuki). The moths roll the leaves.

**Omiodes anastrepta**

*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
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.

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.

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

Thus, it is beneficial to intercrop cacao with banana plants.
NATIVE HAWAIIAN PLANTS WITH INSECTARY PROPERTIES
Seven-spotted lady beetles attending mites on ʻĀweoweo (*Chenopodium oahuense*).

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

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

ʻIlima (*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** (ʻAʻaliʻi) attracts blackburn blue butterfly and the globed-marked lady beetle

**Pipturus albidus** (Māmaki) attracts Kamehameha butterfly and *Udea stellata*.

**Dianella sandwicensis** (ʻUkiʻuki) attracts *Omiodes monogramma*
This project is funded in part by Hawaii Department of Agriculture, USDA NIFA AFRI on Small- and Medium Size Farms Program (project # 2014-68006-21860) entitled “Center of Rural Agricultural Training and Entrepreneurship (CRATE) for the Pacific”, and supported through collaboration with CTAHR programs: SPM (Sustainable Pest Management Lab), SOAP (Sustainable and Organic Agriculture Program), LIFE (Local & Immigrant Farmer Education Program), and CTAHR Cooperative Extension Program. Special thanks to Donna Meyer for technical assistance.