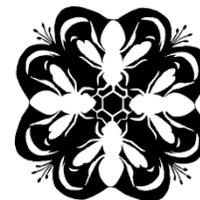


Pollinator Friendly Gardens in Hawaii

Ethel M. Villalobos, Emma Shelly, Jonathan Wright, and Cathy Tarutani



UH Honeybee Project



A small Eden of greenery for one person, a source of fresh herbs for another, a miniature jungle of papayas and ginger plants for others. Hawaii's gardens adopt many personalities depending on their purpose and owner's taste. And, with the large number of tropical plants available for selection in Hawaii, local gardens are often unique mixes of aesthetically pleasing elements and practical selections favored by backyard growers.

People who love gardening and horticulture are vigilant with respect to the condition of their plants, and keep a close eye on insect or disease threats, as well as the blooming cycle and fruit production in their gardens. Recently gardeners on Oahu and the Big Island of Hawaii have been worried, not as much about pests, but rather about the sudden decline in honeybees and insect pollinators in general.

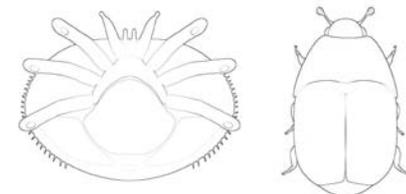
The surprisingly low numbers of honeybees in some areas is primarily due to a "one-two-punch" caused by arrival of new honeybee pests and an increase in viral diseases. The local honeybee populations thrived under the mild climate of Hawaii until 2007, when the Varroa mite arrived. This parasitic mite is considered one of the most devastating pests of honeybees because it not only feeds on their blood but it also transmits a potentially deadly viral disease, called Deformed Wing Virus, to the colonies. The combo of the mite and virus are believed to be involved in large colony losses all over the world. Additionally, since 2010 the local bees are also facing the small hive beetle, a pest that feeds on hive materials (pollen and honey) as well as on developing bees.

Since the arrival of these new pests Oahu and the Big Island have lost most of the feral colonies of honeybees that provided pollination services to farmers and urban gardens. The local beekeepers have also lost a large number of hives due to the new pests, but the managed colonies are slowly starting to make a comeback. In fact, the bees seen foraging on the local gardens are most likely workers bees from a nearby apiary.

The sudden decline of honeybee populations in Hawaii has made the public much more aware of the ecological and economic importance of insect pollinators in general, as such, there is

Varroa and small hive beetle

Varroa destructor, a parasitic mite that feeds on the hemolymph (blood) of developing and adult bees. As a result the bees have a reduced life span and compromised immune systems. In addition, the mite acts as an "incubator" for the Deformed Wing Virus, which results in catastrophic bee losses for the colony.



The small hive beetle, *Aethina tumida*, is a recent arrival to Hawaii. The female beetles lay their eggs inside the hive, where the larvae grow consuming pollen, nectar, and developing bees. The warm and moist climatic conditions of Hawaii suits the beetle biology and results in elevated population levels which can overcome weakened hives easily.

much interest in how to modify gardens and farms to make them "pollinator friendly". Urban and rural garden areas can contribute to the health of pollinators by following a few simple tips can result in a big improvement for these important insects.

- Use a variety of plants, rather than a single type. This will ensure there is always something in bloom in the garden and you are providing food for a variety of pollinator types (see garden guest box for more information on the types of pollinators you might encounter).
- Plant the same species in clumps. As a rule, the larger the floral display, the more attractive the patch will be to the pollinators.
- Become familiar with bee friendly plant species
- Avoid modern "hybrid doubles" which tend to have less pollen and nectar than their simple counterparts.
- Choose plants that are not pest susceptible, to reduce the need for pesticide applications
- Reduce pesticide use and/or select least toxic materials whenever possible
- If using pesticides, read labels carefully and apply in the evening when most insects are not active
- Spare some dead branches as nesting sites for solitary bees, especially leafcutter bees (see below).

The most common pollinators found on local gardens fall into three large categories: bees, hover flies, and butterflies. There are many species of bees that visit urban gardens, most of which were introduced to Hawaii. Among the most common are the European honeybee (*Apis mellifera*), the much larger and heavier carpenter bee, and several species of leafcutter bees. Some leafcutter bees superficially resemble honeybees, but can be distinguished because they collect pollen on hairs on the underside of their abdomen, instead of their hind legs as honeybees do. Hoverflies, some of which have metallic colors are also effective pollinators of fruit trees such as mangoes and cocoa. Butterflies, including skippers, will feed on many garden flowers, but to encourage them, it is also necessary to plant larval food for their young.



Top row, from left to right: Honeybee on macadamia flowers, Carpenter bee on a winter melon flower, Leafcutter bee collecting a leaf segment to line her nest. Leafcutter bees tunnel in dead wood branches to create a cavity that is lined with leaves and tree sap.

Bottom row: Passion vine butterfly flying, and a hover fly.

Choosing suitable forage plants: To make significant changes to a garden it is important to understand that pollinators are seeking nutrition from the nectar and pollen of flowers and that not all flowers are equally profitable, nutritionally, to these beneficial insects. For example, flower structure may restrict access to the nectar to some pollinators, for example long corolla flowers, such as Pentas, may produce copious nectar but are too deep for the short tongues of bees and hover flies. In this case, butterflies with their long tongues can reach the nectar while the short tongue pollinators may only collect pollen. Some common ornamentals maybe very colorful and attractive to us, but are meant to be pollinated by birds and provide little food for insect pollinators. This is the case for bromeliads, birds of paradise, and ginger plants.



Bird of Paradise and ginger blooms are example of bird pollinated flowers that are not meant to feed insect pollinators.

It is possible to add bee friendlier flowers by adding either potted plants or planting shorter species between the taller ones that already exist. Creating "strata" or layers in a garden can increase visual appeal and allows for greater floral diversity in a small space.

Most bees and pollinating flies will visit short corolla flowers and daisy type flowers (Family Asteraceae) in which they can easily access nectar and pollen.



Gerbera, an ornamental plant in the daisy family, is an example of a flower shape that is easily accessible to most insect pollinators. The close up photo (right) shows that what appears to be a single flower is a collection of very small individual disk flowers that produce nectar and pollen .



Many herb species are also great forage for pollinators, especially honeybees. Mint, sage, rosemary, oregano, and thyme are a few of the many plants that can be used to attract pollinators. Many of these herbs belong to the Lamiaceae family, and tend to have long spikes of small flowers (called inflorescences). These spikes produce flowers of a period of several days and the bees learn that resources are available and keep re-visiting the patch in search of the new blooms.

Thai basil flowers (left) and the sage inflorescences (right) are examples of bee friendly herbs



Exotics versus native

Gardeners should also be aware of another complication, which is particularly serious for the conservation of native forests in Hawaii. Exotics, which are loved by pollinators, may become invasive species and spread to native ecosystems. Lantana and False heather (also known as Hawaiian Heather) have diminutive flowers that



are loved by many pollinators. Unfortunately, these two ornamentals are considered invasive. Another example is wedelia, a popular ground cover that also ranks very high in the list of invasive species.

Luckily, there are a number of native Hawaiian plants that can attract pollinators, these include hardy species such as Ohi'a lehua, Naupaka and Ilima. There are also many local nurseries that sell these particular species and many more, which can be easily incorporated to the urban landscape.



European honeybee on a yellow Ohi'a (left) and a native yellow face bee on a red Ohi'a at Volcano National park (right). Yellow face bees, genus *Hyaleus*, are most commonly found only in native habitats, thus is unlikely that they will use gardens in urban areas. A sweat bee (Family Halictidae) on a ilima flower. Sweat bees are small to medium size bees that can also contribute to pollination in urban landscapes.

Edible gardens

For backyard growers interested in more than an herb garden there are a number of crop plants that provide ample resources for their insect visitors. Plants in the melon family (Cucurbitaceae) such as pumpkins and watermelons, are bee dependent and require adequate bee visitation to produce fruits. Winter melon and sweet potato (middle and far right respectively) are examples of crop plants that are commonly planted in Hawaii and that have a need for bees. Buckwheat (far left) is an example of a cover crop that brings nutrients to the soil while providing forage to many different kinds of pollinators, including honeybees.



In summary, local gardens and farms constitute a great resource for beneficial insects including pollinators. Gardens with a large variety of flowering plants are able to support a more diverse and abundant community of pollinators, thus contributing to the conservation of these important insects.

If you would like more information about the status of honeybees in Hawaii, please visit: <http://www.uhbeeproject.com/>

To learn more about butterflies and butterfly plants please go to: <http://butterflysocietyofhawaii.org/>

If you are interested in native plant recommendations please browse the websites below and or visit your local botanical garden:

- <http://www.plantpono.org/>
- <http://www.hbws.org/cssweb/print.cfm?sid=1155>
- <http://plant-materials.nrcs.usda.gov/hipmc/>
- <http://www.hawaiiannativeplants.com/about-us/faqs.html>

For more technical information on native plants, please visit the UH Botany Department Hawaiian Plant Genera website at: <http://www.botany.hawaii.edu/faculty/carr/natives.htm>

This effort was partially supported by the USDA National Institute for Food and Agriculture, Project 16-954 administered by the College of Tropical Agriculture and Human Resources, University of Hawaii at Manoa. Photos by E. Shelly, E. Villalobos, T. Ito, S. Nikaido, and B. Kimak. Insect graphics by Jonathan Wright. If you would like to use any of the images in this article, please request permission to the UH bee project.