University of Hawai'i at Mānoa
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Honey as an alternative rooting stimulant for cuttings

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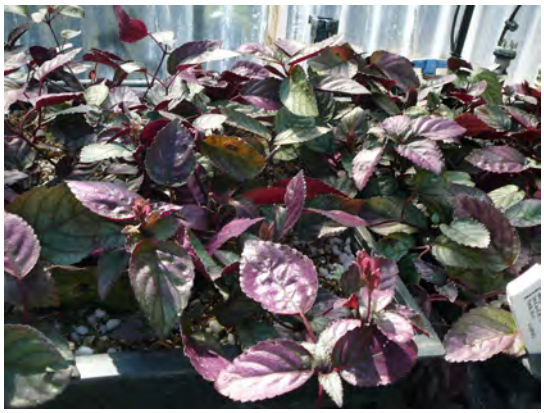
Abstract

This project was a series of experiments to test diluted honey as an alternative to commercial rooting hormones to stimulate new root growth on cuttings with ground cover and woody shrub plant species. The species used for these experiments included *Hemigraphis alternata*, *Plumbago zeylanica*, *Arachis hypogaea*, *Vitex rotundifolia*, and *Hibiscus clayii*. The hope was to discover if honey was a safer and more cost effective way to propagate native species.

Tip cuttings were dipped in diluted honey; either Hormex #1 or Rhizopon #3, or, as controls, no treatment. The cuttings were then placed in prepared trays of ¾ perlite and 1/4 vermiculite substrate. The ground cover species rooted within 1 to 3 weeks, whereas the Hibiscus clayii took 11 weeks to root. All cuttings were weighed on a gram scale both before treatment and after removal from the substrate.

The ground cover species (*Hemigraphis, Arachis, Plumbago*) rooted at a higher percentage or at a similar rate, but with higher gram weights than those cuttings exposed to hormone treatment or controls. The *Vitex* suffered a high death rate, probably because of snail predation and exposure to cool temperatures. The *Hibiscus* rooted better with the hormone treatment, but only with an overall total of 24% rooted. Further research efforts could include using higher percentages of honey in the diluted water, higher percentages of synthetic auxin in the commercial rooting hormones, trying a combination of honey and hormone treatment, and taking cuttings during the warmest summer months.



Hemigraphis alternata
Photo: Candace Firth

Introduction

The successful propagation of plants is a necessary component of gardening and horticulture. Clonal propagation with stem cuttings is one of the most common methods of propagation (Evans and Blazich, 1999). Both commercial rooting hormones and honey have been used in propagating cuttings. Many cuttings will root themselves, since all plants contain "auxin", a hormone that helps plants coordinate growth. Commercial rooting hormones, such as Rhizopon and Hormex contain synthetic auxin, a commercial version of the growth hormone, in varying amounts (Phytotonics, 2012; Hormex.com, 2017). On the other hand, honey contains many kinds of sugars, amino acids, minerals, antioxidants and gluconic acid (Mandel and Mandel, 2014). These chemicals give honey both antibacterial and antifungal properties, which help prevent root rot and maintain a cleaner environment for root growth. Honey might prove to be a safe, cost effective, and easily used method to help cuttings grow adventitious roots. The goal of this study was to compare honey and commercial rooting products to demonstrate

which rooting stimulants work best with cuttings from various plant species.

Vitex rotundifolia
Photo: Celeste Makrevis

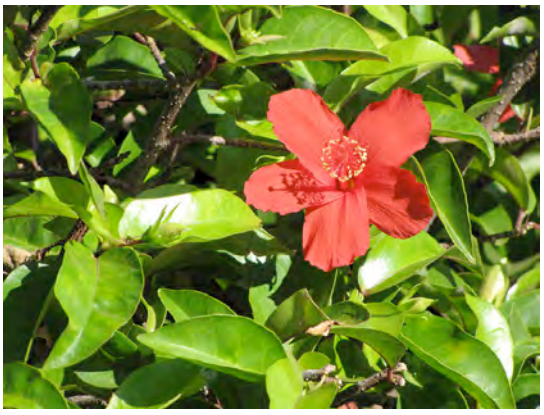
Honey has already been used to root some plants. One study (Smith, McCaughey and Kemmer, 1969) compared eight different kinds of honey vs. sugar alone in rooting *Chrysanthemum* and *Pyracantha* cuttings. Rosemary (Melia, 2016), blueberries and roses (Mehta, 2013), and vegetables (Hopper, 2016) have been rooted using honey. Other articles in the popular literature promote honey as a rooting stimulant (Phipps, 2016, Shelle, 2016). However, none of these examples have compared honey with commercial rooting products in controlled experiments. If honey proves to be an effective rooting stimulant, it would be cost effective, easily available, and safer for public use.

There are six different plant hormones; they are signal molecules in very low concentrations that trigger various plant activities (Weier, et. al., 1979). Auxin causes cells in shoots and roots to grow (Dictionary.com, 2017, Hopper, 2016). IAA (indoleacetic acid) is the naturally made auxin. However, it changes when exposed to liquid, so it cannot be used commercially (Mauseth, 2014). Synthetic auxin is IBA (Indole-3-butyric acid). Commercial hormone products, such as Rhizopon AA #1, #2, #3 and Hormex 1, 3, and 8 dry powder mixtures contain IBA. They have been commonly used to root cuttings, especially by large growers (About Rhizopon, 2016; Gustafson and Kadman, 1969). The numbers after the product name refer to the percentage of IBA (Indole-3-butyric acid) in each mixture. In this study we used Rhizopon AA #3 (.1% IBA) and Hormex 1, (.1% IBA).

Brassinosteroids are another plant hormone, which are involved with root and stem growth. If brassinosteroids synthesis is disrupted, the plants develop abnormally (Mauseth, 2014).

Plant Species Chosen

The plant species chosen for this study are ones that have successfully been previously propagated with commercial hormone products. The research question we posed: "Will equivalent results occur with honey as with specific commercial hormone products?" Some ground cover plants, such as *Arachis hypogaea* (peanut plant), *Hemigraphis alternata* (hemigraphis), the Hawaiian native ʻIlieʻe, *Plumbago zeylanica* - white plumbago, and Pōhinahina - *Vitex rotundifolia* (vitex), were chosen for their easily rooted characteristics. A fifth species was added to check for ease of rooting a woody shrub: Kokiʻo ʻula, or *Hibiscus clayii*. *Hibiscus clayii* is a Kauaʻi endemic, critically imperiled species because of damage by feral pigs, deer, and goats on Kauaʻi, and is under threat by invasive plant species (NatureServe, 2015). It is relatively



Hibiscus clayii
Photo: Starr Environmental

slow growing, as compared with other hibiscus species (Native Plants: Hawaii, 2009). It is one of only 6 native Hawaiian hibiscus (out of 300 species globally.)

Methods

The National Tropical Botanical Garden is in a unique position to host experiments like this which demand replication using large numbers of plants over long periods of time because of the constant need for plant material for the Botanical Garden. The Botanical Garden's South shore nursery provides plants for all three Kaua'i gardens (10,000+ plants per year) as well as for outside restoration projects in partnerships with multiple other organizations (22,000+ plants per year). The Nursery is in large part a conservation nursery and is always interested in ways to more effectively produce large numbers of native plants for restoration.

For all tip cuttings, the cut was made just below a node, leaving three to five inches of stem. The cuttings were prepared and stuck in a ¾ perlite, ¼ vermiculite mixed substrate. The honey treatment was made from 2 cups of boiled water mixed with 2 tablespoons of honey, and then cooled, (Melia, 2016) Product used: Wild Mountain Brand, Raw 100% Pure, $5.98 for a 1 lb. jar at Kaua'i local store.

Plumbago zeylanica
Photo: Starr Environmental

The cuttings were dipped into the honey solution and then placed into one of the propagation flats (50 cuttings/flat). For the synthetic hormone group, the 50 cuttings were dipped in hormone and placed in a separate flat. Products used: Rhizopon #3, $44.40 for a 1 lb. container (Hummert, 2017); Hormex #1, $37.47 for a 1 lb.container (Hormex, 2017). The 50 control cuttings were prepared in the same way, and then placed into a flat with no treatment.

Each flat was placed into a mist house being misted for 10 seconds every 30 minutes around the clock. The cuttings were removed from the substrate as soon as most cuttings in any flat showed root growth, weighed on a gram scale, potted in a coir/perlite mix, with Osmocote. The ground cover species rooted in 1 to 3 weeks; the *Hibiscus clayii* took 11 weeks to root. All pots were placed in a shade house.

Cuttings/plant species

- 50 *Hemigraphis* cuttings dipped in honey; 50 cuttings were control
- 50 *Arachis* cuttings dipped in honey; 50 cuttings coated with Hormex #1; 50 cuttings were control
- 100 *Plumbago* cuttings dipped in honey; 100 cuttings coated with Hormex #1; 50 cuttings were control
- 300 *Vitex* were cuttings were dipped in honey; 300 were coated with Rhizopon AA #3; 300 cuttings were control
- 150 *Hibiscus* cuttings were dipped in honey; 150 were coated with Rhizopon AA #3; 150 cuttings were control.

Results

The purpose of this study was to discover how honey would stimulate root growth, as compared to cuttings coated in synthetic rooting hormone. The research question was where honey fits within the spectrum of available rooting stimulants.

Percentage of cuttings rooted and average weight in grams						
	Honey	Weight	Hormone	Weight	Control	Weight
Hemigraphis	94%	4.08 g			88%	2.22 g
Arachis	92%	4.70 g	78%	4.25 g	40%	0.70 g
Plumbago	99%	2.90 g	99%	3.10 g	99%	3.00 g
Vitex	Cooler temperatures and snails hindered results					
Hibiscus	18%	3.81 g	44%	4.77 g	11%	2.64 g

Discussion and Conclusions

Different results were found by the types of plant species and the rooting stimulant used. *Hemigraphis* and peanuts plants showed higher percentages rooted and heavier cuttings for those dipped in honey, with or without synthetic hormone, and controls. The Plumbago cuttings showed virtually no differences, whether dipped in honey, hormone powder, or control. The Vitex cuttings failed, due to cool weather and snail predation. The Vitex cuttings were taken in December and January. Temperatures during those months are typically 6 to 7 degrees F cooler and in July and August. (Beal, 2015). The cooler months may have caused the high death rate of the 900 cuttings. Hibiscus clayii showed the highest percentage rooted when treated with hormone powder. However, out of 450 total Hibiscus cuttings, only 24% rooted.

Honey did demonstrate an ability to root plant species included in the ground cover group. *Hemigraphis*, peanut plant and *Plumbago* all rooted successfully when dipped in diluted honey. Honey was not as successful as the synthetic hormone, Rhizopon AA #3, with rooted cuttings from *Hibiscus clayii*. It may be that the *Hibiscus* cuttings were taken in the spring, rather than during warmer summer months, reducing overall rooting. The *Hibiscus* cuttings also showed some slug and snail damage, lowering the percentage rooted and the final gram weights. Woody plants, such as *Hibiscus*, may need a higher percentage of diluted honey or commercial auxin to root more successfully.

As a next step, a further study could add another condition: dip the *Hibiscus* cuttings in a higher percentage of honey in the diluted solution, and, then dip those same cuttings in synthetic rooting hormone. Maybe the combination of the honey's sugars and antibacterial qualities, plus the higher percentage of auxin, would produce a higher percentage of rooted cuttings than either condition alone. Any future studies would be best done during the warmer summer months, also using slug and snail bait. Other varieties of native *Hibiscus* could also be included.

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