

Insect pollination of wild and cultivated vanilla in Peru

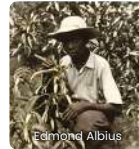
Sandra K Evans and Huw Evans

Introduction

Vanilla is part of the orchid family and is the second most expensive spice in the world (the first being saffron). 98% of the vanilla we consume today is synthetic, while the remaining 2% is cultivated. 100% of cultivated vanilla is hand pollinated; this manual and labour intensive process is further complicated by the vanilla flower only being open for one day. Indigenous to Central and South America, insect pollinated wild vanilla is rare, impractical to harvest, and not commercially available. If the pollination could be automated, vanilla could become one of Peru's largest exports.

Background

The vanilla plant avoids self pollination using a mechanical system, the mechanism relies on the visiting insects to be specific dimensions. Different species of vanilla come in different sizes, requiring different sized insects for successful pollination. When French colonialists first brought vanilla back to Europe 1819, it would not fruit (produce pods) due to a lack of native pollinators. At the age of 12, a young slave called Edmund Albius discovered the physical mechanism and developed a method that made it possible to pollinate vanilla by hand.



Aims and Objectives



The primary objective of this study was to identify the wild pollinator of *Vanilla pompona*, known for its large aromatic pods, allowing cultivation in its natural habitat, generating valuable income for indigenous communities who are stewards of this species' habitat. Working with an indigenous community in Ucayali region of Peru, we used chemical lures, sound recording equipment and camera traps to identify what we believe to be the wild pollinator of this plant - *Eulaema cingulata*. Second objective was to explore the use of honey bees as pollinators of cultivated vanilla at San Rocco (Junin region), the first and largest producer of *Vanilla planifolia* in Peru.

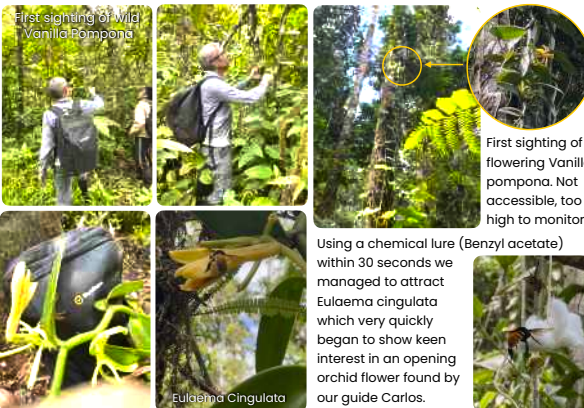


Wild Vanilla Pompona

Our Mission: To identify the wild pollinator of vanilla in the Peruvian rain forest.



Amalia lives in a small semi closed community in the heart of the Peruvian rainforest. She is a school teacher and has started cultivating *Vanilla pompona* to help subsidise her small cacao plantation, all to help feed her young daughter Alexa. Transported by her brother and guided by her cousin, we set off into the rain forest in search of wild *Vanilla pompona*.



Next Steps: Establish if *Eulaema cingulata* can be reared as livestock.



In a similar way that bumble bee colonies have been bred in cardboard boxes to pollinate crops in poly tunnels, research suggests a similar approach can be taken with large orchid bees.



Cultivated Vanilla Planifolia

Our Mission: To verify if a honey bee has the correct dimensions for pollination.



San Rocco is the first and remains the largest producer of *Vanilla planifolia* in Peru. Covered growing areas provide both shade and bio isolation as the plant is not indigenous to Peru. San Rocco also produces coffee and honey managing their own honey bee colonies.

Plan A: "Flower at hive entrance" The first attempt to lure a honey bee into an orchid flower was to add some honey and leave the flower at the entrance to a hive. Unfortunately the africanised bees attacked the flower confusing it as an intruder.



Plan B: "Forage flower" Hoping the bees would treat forage with greater compassion, we baited an orchid flower placed further away from the hive trying various rewards. From right to left: brown sugar syrup, white sugar syrup, honey from shop, home brew swarm lure made using aniseed tea, bees own honey type 1 and bees own honey type 2. None succeeded.

Plan C: "Coma bee" Put a bee in the freezer, insert unconscious bee in a flower, then observe if the bee triggers the pollination mechanism when it gains consciousness and reverses out.



Plan D: "Dead bee on wire" Take a dead bee, that was possibly in the freezer too long, put it on a wire (we salvaged from an old brood frame), physically guide the bee into a vanilla flower, withdraw the bee to see if it collects a parcel of pollen on its thorax. Then push that bee back into a different flower observing the pollen being deposited.



We have videos we can show at the poster presentation

Next Steps: Establish if honey bees can be trained to visit orchid flowers.



Bees have been employed to detect land mines, using a reward (sugar syrup) with an added odour of TNT, the bees learn to associate the reward with the smell of landmines. When the feeder is closed the bees seek the same scent elsewhere. The next step is to adopt this approach but using the smell of orchid flowers.



PP-586 [Pollination and Bee Flora]

Insect pollination of wild and cultivated vanilla in Peru

Sandra Kordić Evans

Department of Innovation, Beehero Inc, Palo Alto, CA, USA

Vanilla is the second most expensive spice in the world. 98% of vanilla flavour used by the food industry is synthetic, the remaining 2% is extracted from cultivated vanilla. 100% of the cultivated vanilla is hand pollinated. Indigenous to Central and South America, insect pollinated wild vanilla is rare, impractical to harvest, and not commercially available. Insect-flower interactions typically revolve around basic needs like nutrition, oils, resins, shelter and warmth. Vanilla orchids tend not to offer nutritional reward but the flower's fragrance acts as a chemical signal that attracts male bees, which collect and use it to enhance their attractiveness to females when mating. The primary objective of this study was to identify the wild pollinator of *Vanilla pompona*, known for its large aromatic pods, allowing cultivation in its natural habitat, generating valuable income for indigenous communities who are stewards of this species' habitat. Working with an indigenous community in Ucayali region of Peru, we used chemical lures, sound recording equipment and camera traps to identify what we believe to be the wild pollinator of this plant - *Eulaema cingulata*. Second objective was to explore the use of honey bees as pollinators of cultivated vanilla at San Rocco (Junin region), the first and largest producer of *Vanilla planifolia* in Peru. The pollination mechanism of the vanilla flower is tightly dependent on the physical dimensions of the visiting pollinator as the removal of pollinia requires a set of specific movements by the visiting bee. Literature suggests honey bees may possess the appropriate physical attributes to trigger this pollination mechanism. However, worker honey bees lack motivation to visit these flowers due to the absence of a nutritional reward. Initially, sugar solution was used to attract the honey bees to the flowers but without success, so the experiment was performed using sedated and euthanised bees with supporting wires demonstrating that worker honey bees reliably remove the pollinia of the *Vanilla planifolia*. The next step is to train the bees to visit the flowers utilising the scent/reward system, originally used to locate land mines by the US military back in the 1990's.