Monitoring kiwi pollination

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While pollination is necessary to produce most of the fruits and vegetables we eat, it is even more mandatory for kiwi. Efficient and intense pollination is needed to grow beautiful big kiwis, as we like them.

Kiwi yards are very common in the Atlantic Pyrenees. It is an agricultural sector still growing and, like many other crops, also facing the risks and hazards of nature. The stakes are high and there is still too much to be learnt. Therefore, we enrolled into the monitoring of the love affairs between kiwis and bees.

What is cross-pollination?

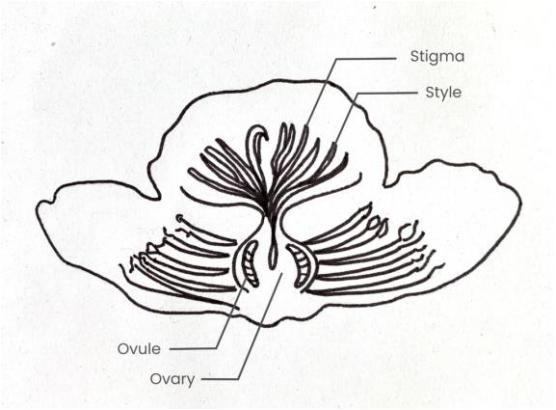
Actinidia (the kiwi plant) is a dioecious plant, which means that there are male and female plants. For the female flowers to be fertilized, the transfer of pollen from the male plants to the female plants must take place. This is called cross-pollination. In other words, the male plants will carry the pollen and the female plants will carry the flowers producing fruit.

Female flowers of Actinidia

Male flowers of Actinidia.

Therefore, there are two main constraints. The first one is that male plants must be grown close to the female plants. A ratio of 1 male for 5 females is often found. The second is that the transfer of pollen cannot be done by wind; the presence of pollinating insects is crucial: Actinidia depends at 95% on pollinators.

Beyond the necessity of cross-pollination, the Actinidia is not a plant like the others. Each flower has a lot of stigmas (about 40) and ovules (about 1500). Once deposited on the stigma, the pollen grain creates a pollen tube which crosses the style conveying the male gametes to the ovule. A lot of pollen grains will therefore allow the fertilization of a lot of ovules. In other words: the more intense the pollination, the best the fecundation which results in beautiful kiwis.



Actinidia schema (female flower)

If this seems complex, there is a third constraint: Actinidia is also a bit stingy. It has plenty of pollen, but no nectar. Zero nectar with Actinidia! Of course, bees do not like stingy plants and can quickly become disenchanted and go elsewhere.

Pollinating kiwi is quite a program

Let's make a summary of the case: we have a crop which must transfer pollen from a male plant to female plants with the help of insects. The pollen load must be important to fertilize the hundreds of ovules of each flower and moreover the insect will not have any reward in nectar for job motivation 😕.

At this point it's clear that if you want nice kiwis, you need lots and lots of bees, efficient bees! 🚀 And therein lies the question: how does pollination actually happen? What are the main drivers? How does it evolve over time?

This is what we intended to monitor in May 2021 in a kiwi farm, close to the town of Oloron in the Atlantic Pyrenees.

Real time monitoring of kiwi pollination

Actinidia blossom takes place between May and June. To follow the whole pollination, hives were equipped from May 17 to June 9, i.e., 22 days, in a 3-hectare kiwi crop.

Connected hives in a kiwi culture close to Oloron (64)

In total, 3 hives were connected, each with a scale, an internal sensor and a bee counter. The scales were custom-made to fit the frames used by the beekeeper, from the DIY kit. Nearby are installed a weather station and a Hub, which will allow us to monitor remotely.

Custom-made hive scales

Bee counter

The scale tracks the weight of the hive and informs about stores consumption or gain. Kiwifruit produces very little nectar, so the bees should only bring in pollen and draw on their reserves for the rest. The internal temperature sensor can be used to determine the amount of brood and the health of the bees. The bee counter, installed at the entrance of the hive, gives information on the entry and exit of the bees. It makes it possible to know when the bees leave the hive the most, in what kind of weather, etc. These measurements correlated with the indications given by the ambient measurements make it possible to characterize the course of the pollination campaign.

Spin-offs

At the end of the campaign, which lasted 22 days, we acquired a very consequent database that teaches us a lot. The analysis is still in progress but already, very clearly, there are several aspects that can be advantageously exploited by the beekeeper and/or the farmer:

Monitoring and forecasting the dynamics of the colonies allows the beekeeper to identify in time the necessary actions, especially for feeding. We are talking here about prevention rather than cure. It is necessary to preserve the colonies from weakening because the next nectar flow (chestnut) is at stake.

For the farmer, we have seen at what point the bees lose interest in the crop and move on to "something else". This combined with a week of bad weather will result in lower efficiency and an actual pollination that lasted a handful of days.

With these data and lessons learned, we are already looking forward to the next flowering. For sure, next year we will be able to plan ahead for this type of operation to improve its efficiency.

If the next time at the supermarket you find big and beautiful kiwis, tell yourself that Mellisphera may have been there 

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