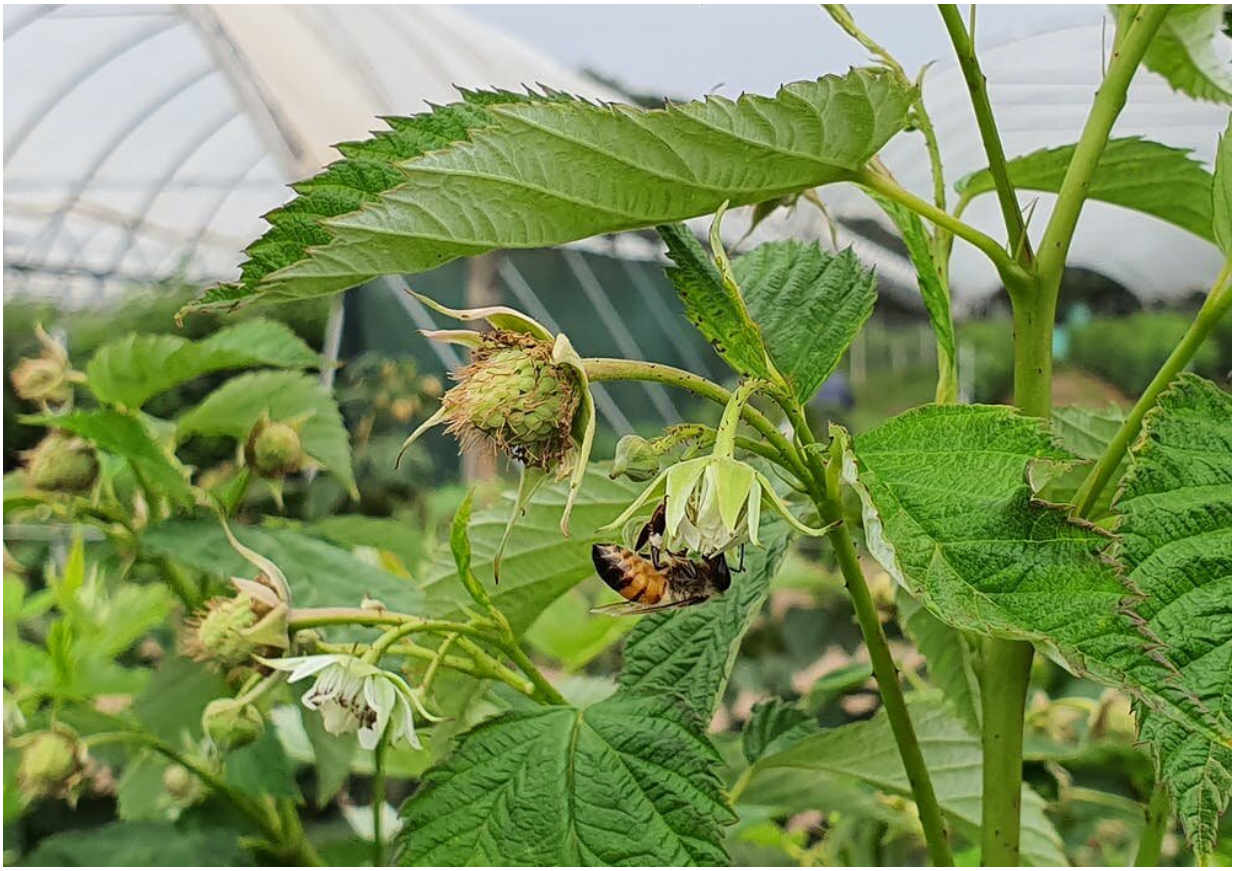
One, then some: How to count like a bee

May 20 2020, by Scarlett Howard and Adrian Dyer



A honeybee pollinating a strawberry plant flower in a greenhouse. Credit: Adrian Dyer/RMIT University

If you were a honeybee, how would you choose where to find flowers? Imagine your first flight out of the hive searching for food. What would you do if you saw flower patches with one flower, or three, or twelve, or

twenty?

Our new study, published in the *Journal of Experimental Biology*, tested honeybees on exactly this question. We wanted to understand how honeybees choose where to forage in environments like greenhouses where our food is pollinated, in local parks, or in our own backyards.

Specifically, our research looked at whether honeybees with no specific numerical training could choose a flower patch based on the quantity of flowers it had.

We found the bees could tell the difference between groups of one vs. four flowers—but not between, say, four vs. five. Basically, they couldn't differentiate between groups of two or more flowers.

A mathematical matter of life and death

The ability to tell the difference between two quantities can mean life or death for an animal. "Quantity discrimination" can be vital for survival in tasks including:

- resource comparison: choosing a larger quantity of food
- aggressive interactions: choosing to avoid conflicts with larger groups of individuals, and
- avoiding predators: choosing to stay with a larger group of animals of the same species to reduce your chance of being eaten.

Backyard flowers; which patch to choose if you were a bee? Credit: Adrian Dyer/RMIT University

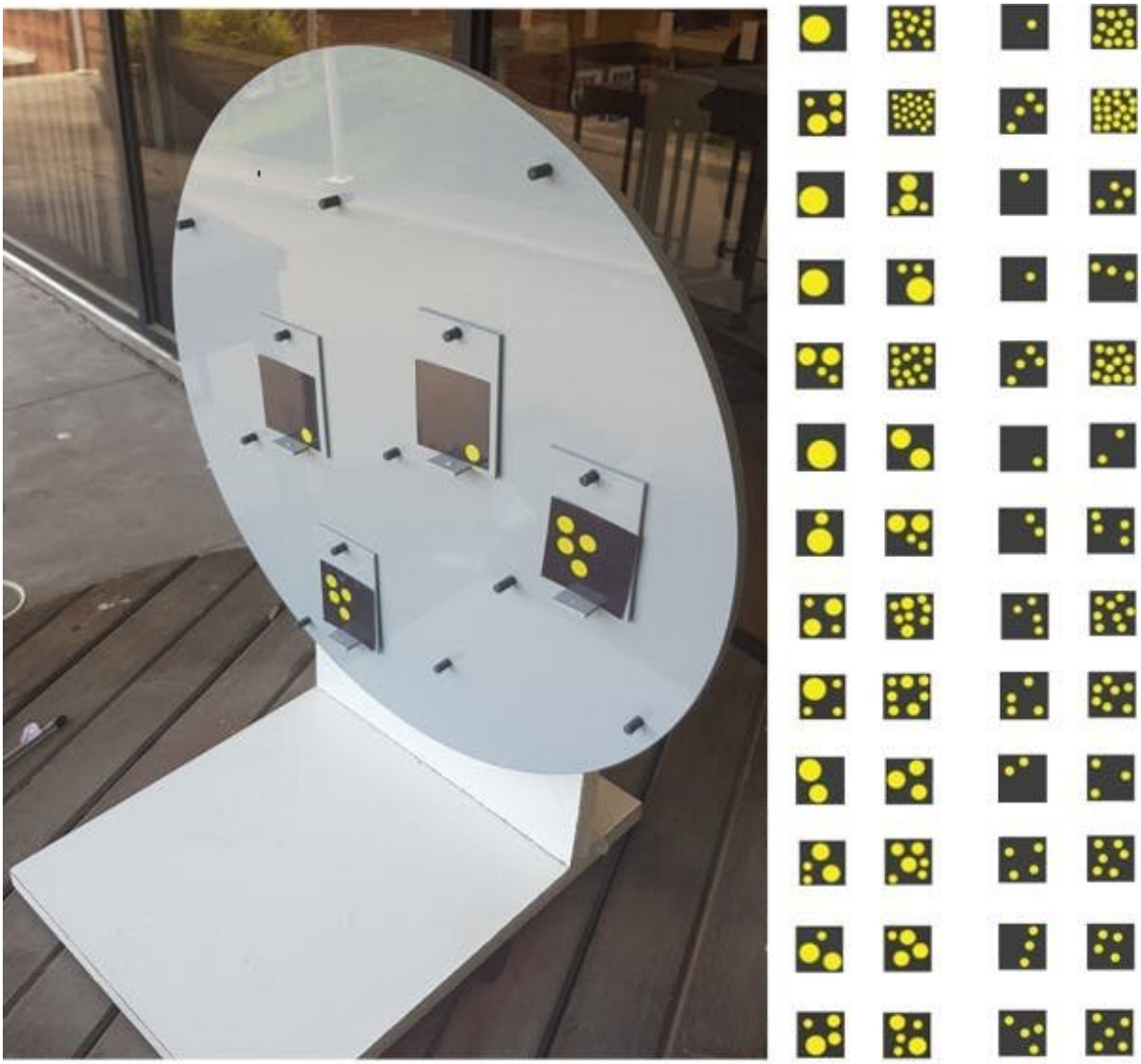
We are gaining a better understanding of quantity discrimination across the animal kingdom. Primates and other mammals, amphibians, reptiles, birds and fish all display some form of quantity discrimination in day-to-day tasks. For example, fish use quantity discrimination to stay in larger groups to reduce the chance of being eaten by a predator.

However, little is known about spontaneous number choices by insects.

How do bees choose where to forage?

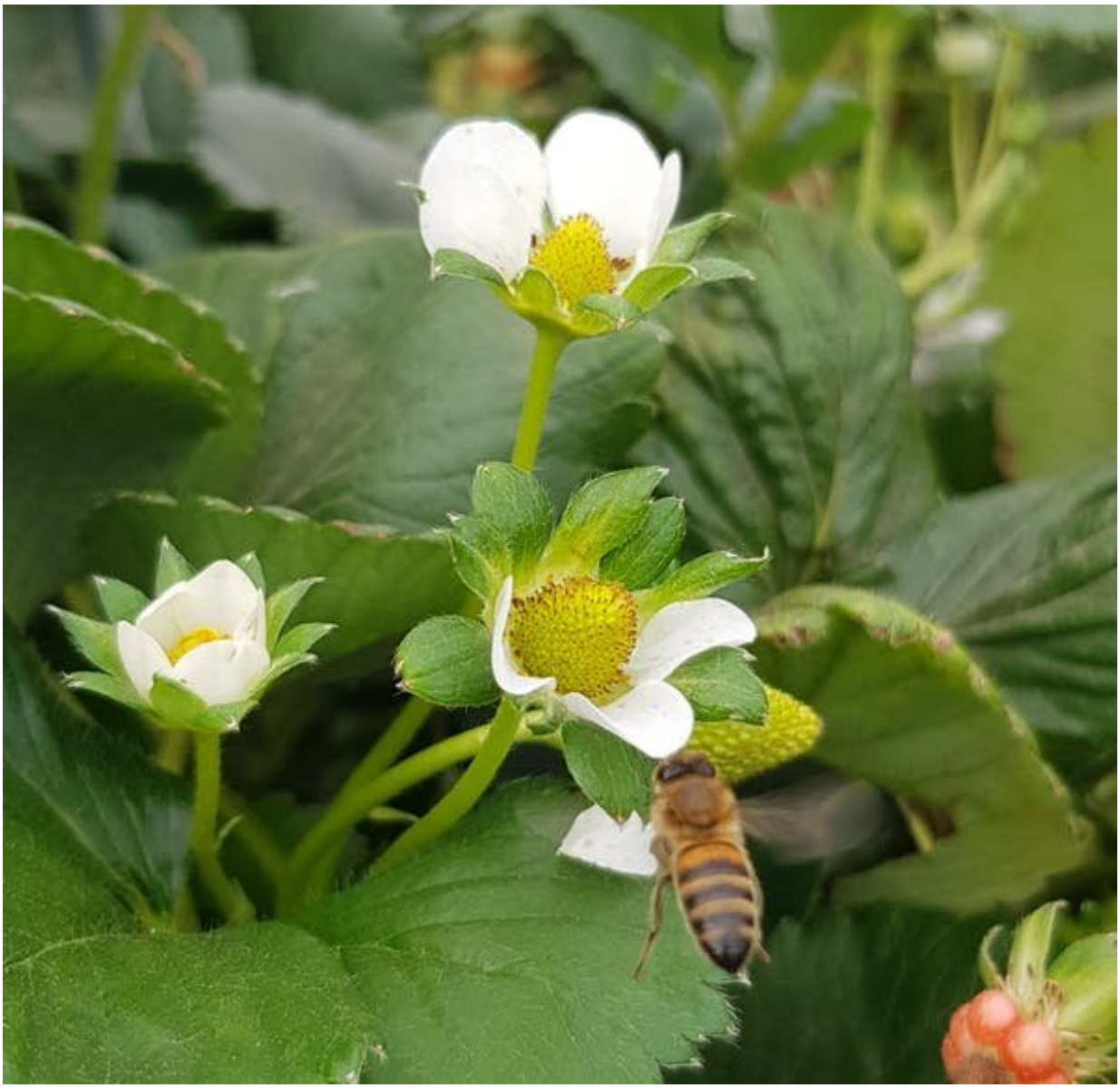
Honeybees assess the available flowers based on several factors, including scent, colour, shape and size.

Honeybees typically visit around 150 individual flowers per flight from the hive to collect resources such as nectar or pollen. For a honeybee, a high quantity of flowers in a single area would mean less energy exertion than having to fly to many flower patches with less flowers.



The experimental set-up (left) and the quantity comparisons (right). Honeybees succeeded at spontaneously discriminating between 1 vs 12, 1 vs 4, and 1 vs 3 flowers, but no other comparisons. The honeybees were trained to associate

single yellow dots with sugar water before being shown quantity comparisons. Credit: Scarlett Howard



A honeybee flies towards three flowers. Credit: Scarlett Howard

Using different numbers of artificial flowers, we wanted to test whether individual honeybees could discriminate between a range of quantities, and how they might determine the quality of a flower patch.

Our honeybees were shown pairs of flower quantities ranging from easier number comparisons (such as one flower vs 12 flowers) to more challenging scenarios (such as four flowers vs five flowers).

Interestingly, despite previous findings that trained honeybees can discriminate between challenging quantities and can also learn to add and subtract, the bees performed poorly in our spontaneous number task.

We found they were only able to discriminate between one vs 3, one vs 4, and one vs 12 flowers—wherein they preferred the larger quantity. When one flower was an option they succeeded, but confused any comparisons between groups of two flowers or more.

This result suggests flower patch choice based on numerical-type cues is difficult for honeybees. And this has implications for how flower displays are interpreted.

With today being World Bee Day, why not take the opportunity to discover what bees are doing in gardens near you. Chances are they're going to any flower patch with more than one flower, rather than paying much attention to absolute numbers.

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https://phys.org/news/2020-05-bee.html