

Using the tools of population genetics to assess pollinator densities at landscape scales

Ben Oldroyd

Decades of research have largely determined the number of bee colonies that are needed per hectare in order to provide adequate pollination of our most important crops. Experiments show that 2-6 honey bee colonies per hectare are typically required to ensure optimal yields and quality. However, growers often assume that adequate pollination services are provided by unmanaged pollinators that are present either in the crop or in surrounding woodland. Yet, typically, the estimated density of honey bee colonies in agricultural areas is 0.2-0.3 colonies per hectare - an order of magnitude less than the recommended stocking rate.

Estimates of bee colony density are usually obtained by terrestrial searches on foot. They are likely to be extreme underestimates of the actual bee colony density, especially at landscape scales. New population genetic approaches to the estimation of colony density permit rapid assessment of the number of colonies in the environment across hundreds of km². Briefly, male honey bees are attracted to a queen pheromone lure suspended from a helium balloon. It is generally possible for two experienced field workers to catch 200-300 drones per day. Genetic analysis of the drones allows estimation of the number of different colonies from which they were drawn. These estimates confirm those obtained by visual assessment, that the density of bee colonies is 0.2 colonies ha⁻². However, we now need to verify the models used to convert drone genotype frequencies to colony densities, and intensively study bee densities in agricultural areas over time and space.

Finally, I will discuss new approaches to estimating the density of stingless bee colonies, also based on population genetic approaches. These too show great promise.