Swarming Bees are Healthy Bees

Bees swarm to reproduce and spread their genes. Healthy offspring are best produced in optimum conditions of temperature and nutrition and with a vigorous parent colony. However, like other organisms, bees will be instinctively driven to reproduce more when they are subjected to stress, danger and threatened survival.

Beekeepers are constantly being directed to control swarming at all costs, whether to improve honey harvests or reduce nuisance to neighbours. I have been wondering if a century of increasing control over honey bees' basic natural function has had an adverse impact on the health of our bees. In this article I have considered the bee's reproductive process in a natural environment to see how it benefits a colony, as well as the impact of swarm control husbandry.

Swarm preparation phase

During springtime, a colony will build up rapidly, increasing its stores, brood and adult bees. The colony maintains its brood nest temperature at 35–36°C, the optimum for rearing healthy brood. By late April or early May a healthy colony will reach a state of affluence, which will enable it to swarm.

Many beekeepers start swarm prevention inspection in March at temperatures as low as 11°C. This regular hive opening breaks open propolis and wax seals; releases heat and volatile compounds from the nest and disrupts thousands of worker tasks. The result is a stressed colony, forced to do unnecessary work and with a brood temperature below the optimum. This brood cooling can contribute to European Foul Brood (EFB).[1] The reduced nest temperature also favours *Varroa,* which has an optimum brood temperature of 33°C; enabling the colony to maintain a nest temperature of 35°C works against *Varroa*.[2]

Swarm arrival. Photo by Bernhart Ruso.

Varroa and other pathogens will thrive in fatigued and weakened colonies. To keep colonies alive beekeepers are using chemical varroacides and medications. These substances, even the organic acids and thymol, are toxic and harmful to bees.[3,4]

A colony will raise as many drones as it considers necessary. Often beekeepers cull drones as unproductive honey consumers. They also use drone brood as expendable varroa traps. This reduction of the drone population has an adverse effect on the quality of queen mating. It also consumes significant resources as the colony strives to replace essential males in time for mating.

The swarm of bees has to find a new home, build comb, stock it with stores and feed new brood. This requires bees of different ages and gland development and will not include many old foragers. An artificial swarm, which merely separates the queen and flying bees from the house-bees and brood, risks having old spent bees by the time new brood hatches out and requires feeding.

The colony raises a number of queen cells in specially constructed round cells. Queen cells are given special treatment; they are visited 10 times more often than worker bee cells during the 3–5 day larval stage to ensure the optimum development of new queens, which become almost double the weight of worker bees. Queens raised artificially from 2-day-old larvae will receive less nourishment and care.

In an unstressed colony the queen brood survival rate can be as low as 53% from egg to adult; 33% in a stressed colony.[5] The colony appears to be weeding out substandard queens during development. During artificial swarm manipulation, when we destroy unwanted queen-cells, how do we know we have selected the best two larvae? What are the chances they will fail or produce substandard queens, resulting in a queen-less or a poorly performing colony?

The swarm cluster

On leaving the nest, the swarm pours out of the hive or nest cavity and mills around before settling in a cluster on a nearby bush, tree or structure. Hundreds of forager bees become scouts and seek cavities suitable for a new home. Instinctively they know what constitutes a good cavity. After assessing a site, each scout returns to the cluster and conveys its information to the cluster-bees in a waggle dance. After considering different waggle dances and checking the sites, the bees eventually reach agreement about a site and the scouts lead the swarm-bees to the new cavity. This reconnaissance, communication and consensus-reaching is an important part of the bee's metabolism, decision-making and intelligence development. The new site is most probably 300–500 metres from the home nest.[6,7]

This has the benefits of reducing competition for forage as well as reducing the risks of transfer of pathogens by drifting or robbing. Fries and Camazine suggest[8] that inter-colony transmission of pathogens by swarming will result in a benign host-parasite relationship, but the horizontal transfer of pathogens from one colony to another by drifting, robbing and comb exchange will result in more virulence. The high colony density in large apiaries and the 'splitting' of colonies to achieve increase will favour pathogen virulence.

Building the new nest

At the new site, bees make the cavity draught-proof with propolis and start making wax. Bees construct honeycomb and forage for stores; both are needed before brood rearing can commence. A coating of antibacterial, antifungal propolis is applied to the cavity. Temperatures of up to 40°C are required to make comb[9] and the nest temperature will have to be maintained at 35°C for brood rearing. The swarm will be broodless during the nest building period. *Varroa* will have no uncapped brood cells in which to hide, and develop. They will be exposed to grooming by bees and fall to the bottom of the cavity, far from the comb.

While the new nest is being constructed, stores collected and brood started, the swarm is vulnerable to conditions of poor weather, poor forage and predators. Seeley[6] considers that about three quarters of new swarms fail. Beekeepers reduce this vulnerability by providing suitable nest sites and emergency feeding to prevent starvation, often using sugar. Sugar is a poor substitute for nutritious honey[10]; brood reared on poor nutrition will not achieve optimum development and immunocompetence will be reduced.

The home nest

The original nest is reduced by a queen, about half of its adult bees and some of the honey stores. It still has virgin queen cells, developing brood, an extant nest structure and good stocks of stores. It is quite wealthy but will not be so if beekeeper manipulation denudes it of nurse bees and honey stores.

Swarm moving up into brood box. Photo by John Haverson.

The first virgin queen could emerge eight days after the swarm departure. Other brood will have hatched. The queen will take time to mature and mate. Her egg laying may not commence for three or four weeks after the swarm departs, depending on weather conditions. Again a broodless period will work against varroa. The collection of pollen and increased foraging will indicate when brood rearing commences. Constant hive opening to check for eggs is highly disruptive to a new and developing nest.

The first virgin queen may be allowed to kill her siblings, but if the mother colony is strong and conditions are favourable, the workers may protect some virgin queens so the colony can produce secondary swarms, to spread its genes.

On the mating flights, colonies escort valuable virgin queens providing a 'herring shoal' protection effect against bird predators. Large escorts ensure successful returns whereas smaller escorts from mini-colonies, favoured in artificial breeding, suffer queen losses of some 33%.[9] On the mating flight a vigorous queen will require a good drone to catch her. Poor queens will be caught by good males but can also be caught by poor drones increasing the chances of low grade offspring.

Local bees will be genetically conditioned to the local environment. In UK this can be cool, wet weather during the swarming season. Local bees will be able to cope with inclement weather and achieve successful mating when exotic bees from warmer climates may not. The natural mating with up to 20 drones will ensure genetic diversity, essential to species survival. Nature will select for characteristics to enable survival in its environment and against pathogens. These will not necessarily be the docility, productivity and non-swarming sought by beekeepers.

Swarm hanging in a tree. Photo by scf courtesy of Vita-europe.

Afterword

The entire swarming process brings into play a huge array of diverse behaviours affected by natural selection. The colonies that survive the dangerous adventure of swarming will, on the whole, be the fittest. If we short-circuit this fundamental behavioural feature of the honey bee, we reduce the opportunity for nature to hone the fitness of the bee population.

There is growing anecdotal and scientific evidence[11,12] that wild bees are surviving and coping with varroa. It is clear to me, that the ability to swarm naturally is a significant factor in their survival. I believe we should be considering how we might better manage swarming to make use of its colony health benefits; perhaps using bait hives and informed, non-intrusive 'reading' of colony activity.[13] This might reduce honey harvests, but there would be more bees. Man can live without honey, but not without bees.

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