

Born to Rule the Hive: Queen Bee Development and the Craft of Commercial Queen Rearing

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A single fertilised egg, no different from thousands of others in the hive, can become either a short-lived worker or a fertile queen, the choice made almost entirely by diet, not genetics. Beekeepers have turned this biological switch into a precise and repeatable craft called **commercial queen rearing**. Breeders graft young larvae into artificial cells, let nurse bees rear them into queens, mate them, and ship them worldwide to keep colonies productive and crops pollinated. This article traces that journey: how a queen develops, how she is reared commercially, how her travelling feed is made, and how the cage that carries her is built.

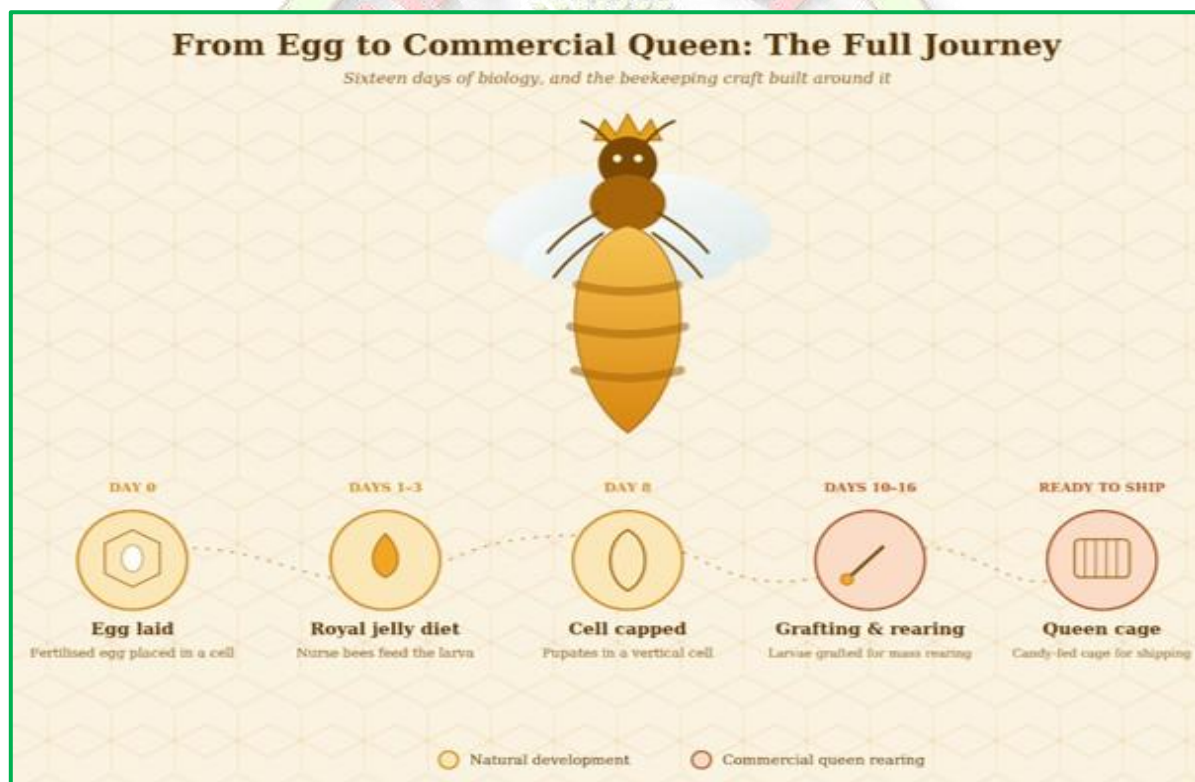


Figure 1: From fertilised egg to commercial queen: key stages in queen development and rearing

Biology of Queen Development

Caste Determination and Royal Jelly

All female honeybee larvae initially receive royal jelly from nurse bees. Larvae destined to become queen continue to receive abundant royal jelly (protein-rich secretion from nurse bees' hypopharyngeal and mandibular glands) throughout larval development, whereas worker larvae undergo a different nutritional regime. From day four, worker larvae switch to pollen

and diluted honey, while a queen-destined larva continues to receive royal jelly throughout. This sustained diet triggers ovarian development, a longer body, and the glands that later produce queen pheromone.

Queen Cell and Developmental Timeline

Queens are reared in a distinctive peanut-shaped cell that hangs vertically from the comb, unlike the horizontal cells used for workers. Development from egg to emerged adult takes about sixteen days — faster than a worker (21 days) or drone (24 days). Colonies rear queens naturally when swarming, superseding a failing queen, or replacing one lost suddenly; commercial breeders recreate these same conditions to trigger queen cells on demand.



Figure 2: Microscopic view of honeybee eggs at the early developmental stage

Artificial Queen Rearing

Grafting and Cell-BUILDER Colonies

Breeders select a strong "breeder queen" colony for desirable traits — gentleness, productivity, disease resistance — and graft day-old larvae from it into plastic queen-cell cups using a fine tool. These grafted bars are placed into a crowded, queenless "cell-builder" colony, whose nurse bees accept the larvae as queen candidates and rear them with abundant royal jelly, a method popularised by G. M. Doolittle.

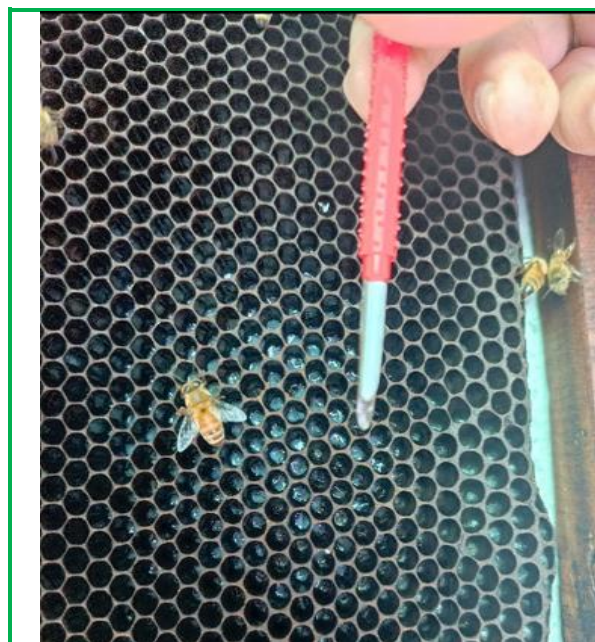


Figure 3: Selection of a young honeybee larva for grafting using a grafting tool



Figure 4: Grafting of a young honeybee larva into an artificial queen-cell cup

Mating and Grading

About ten days after grafting, ripe queen cells are moved into small mating nucleus colonies, where each virgin emerges, matures, and mates in flight with multiple drones before returning to lay eggs. Once her brood pattern confirms successful mating, she is caught, evaluated, marked with a colour-coded dot for her birth year, and prepared for sale or introduction.

Nutrition and Preparation for Queen Rearing

Natural and Commercial Royal Jelly

Nurse bees convert pollen and honey into royal jelly through their hypopharyngeal and mandibular glands, feeding it to all young larvae and continuously to queens. Royal-jelly producers graft larvae in bulk into widened cell cups within strong colonies, then harvest the pooled jelly with a spatula around sixty to seventy-two hours later, before refrigerating it quickly to preserve quality.



Figure 5: Commercially available royal jelly



Figure 6: Grafted artificial queen-cell cups arranged on a cell bar for queen rearing

Queen Candy for Shipping

Once a queen has been successfully reared and mated, she may need to be transported to another colony or apiary. This is where the queen cage and its food provision become essential. A different feed, queen candy or fondant, is made for shipping: powdered sugar kneaded with a little honey or invert syrup into a firm, crystal-free dough. A plug of this candy is packed into the queen cage, feeding the queen and her attendants in transit while giving the receiving colony time to accept her scent as workers slowly chew through it.



Figure 7: Placement and inspection of queen-rearing frames within a honeybee colony

The Queen Cage Design and Chambers



Figure 8: Developing queen cells maintained on artificial cell bars during queen rearing



Figure 9: Developed, capped queen cells being weighed to monitor developmental progress during artificial queen rearing

Most commercial cages, such as the JZ-BZ style, are moulded from food-safe plastic, though the traditional wooden Benton cage is still used. Each cage has three parts: a main chamber for the queen and a few attendant bees, a ventilated mesh section that lets colony bees sense her scent, and a candy chamber packed with queen candy at one end.

Shipping and Introduction

The candy chamber is packed, the queen and attendants are placed in the main chamber, and the cage is sealed for transit. On arrival, it is hung between brood frames; over one to three days workers chew through the candy plug, growing accustomed to the queen's scent before releasing her — greatly reducing the risk of rejection.

Commercial Significance

Commercial queen rearing allows beekeepers to replace failing queens, strengthen colonies and maintain desirable traits such as productivity, gentleness and disease resistance. Reliable queen production is therefore important not only for honey production but also for maintaining colonies that provide essential pollination services.

Conclusion

A sustained diet of royal jelly during larval development can transform the developmental fate of a young honeybee larva, producing the reproductive centre of the colony—the queen. From selecting a young larva and carefully grafting it into an artificial cell to nurturing the developing queen and preparing her for introduction, queen rearing combines a remarkable piece of insect biology with considerable beekeeping skill. The next time a queen arrives in a small cage, it carries not just a valuable insect, but the reproductive future of an entire colony. The next time such a cage arrives in the post, it carries sixteen days of biology, over a century of beekeeping skill, and the future of an entire colony.

References

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