

DOES ROYAL JELLY MAKE A QUEEN?



Published May, 2017 | Kate Prendergast

Royal jelly. A majestic, sumptuous name for what is very much akin to worker bee snot.

Secreted from glands in the heads of nurse bee proles, this milky-colored, protein-rich substance is created for the sup of the newly-hatched *Apis mellifera*. While it is just a limited-time garnish for the 'beebread' (fermented pollen) and honey diet of young worker bees, the queen feeds exclusively on this luxury foodstuff. As a grub, she bathes in its white waters. Wriggling about in her extra-large brood cell, she absorbs in its nutrients for her developing organs. Unlike the rest of her tribe, who taste it only for their first three days after hatching, she will consume nothing else for the rest of her life.

Royal jelly and 'trophic castration'

Until recently, everyone thought royal jelly was a special, monarch-making food. And to some extent, this still holds true. After all, we know that genetically, the egg of a worker bee and the egg of a queen are identical, and that it is only the differing environmental conditions that determine their dual fates (this phenomenon is known as 'epigenetics' – whereby certain genes are activated only under specific external conditions). The theory, then, was that the nutritional benefits of royal jelly were so wholesome, it was these that gave the queen her super-bee qualities: her turbo-charged ovaries (producing up to 2,000 eggs per day), her long thick girth,

and her extra-long lifespan (up to forty times that of regular bees).

Conversely, the denial of this substance to workers was believed to be a kind of deliberate malnutrition to enforce sterility ('trophic castration' is the rather wonderful scientific term for this) – orchestrated by the hive to maintain the division of castes. If they had been fed more, it was reasoned, they too would grow queen-like. Their ovaries would not be forcibly shrunk; their powers of reproduction restored to full flourish.

Plants and bee ovaries

A 2015 study published in the peer-review journal *Science Advances* doesn't so much throw the theory out, as extend and flip it. Turns out, it's not simply the consumption of the jelly that elevates the queen above the rest. It's the fact that she doesn't eat pollen and nectar too. Unlike royal jelly, both of these substances are derived from plants – and while they're great at detoxification, which to a worker bees' nascent gonads, aren't far from poison.

ROYAL JELLY DOESN'T CONSTITUTE AN 'ON/OFF SWITCH' IN DECIDING A YOUNG BEE'S DESTINY

This is because plants contain a phytochemical called p-coumaric acid, a phenolic substance. Organic compounds known for giving flora their unique aromas and tastes, phenols are now thought to affect certain gene expressions in honey bees – including those of inhibited ovary development. It is this nutrition factor which means that, together with a reduced royal jelly diet, they become workers rather than queens.

"The newly born female larva is constrained by its inherited genomic hardware, but has considerable developmental flexibility in terms of its epigenetic software that is used for integration of environmental and genomic influences," ANU Professor Ryszard Maleszka explained in a separate paper in the journal *Epigenetics*. "The ability by members of a colony to produce a special diet was a key evolutionary invention that created a well-defined environmental trait that persists across generations."

When you think about it, it's as brutal as it is genius. For millennia, in ongoing succession, the colony is in evolutionary cahoots to debilitate the entire hive (minus one). Through this mechanism, the social order preserved, such that none but the queen reign fertile and supreme. It's like self-sabotage for survival.

"[The research] is a wonderful example of an evolutionary invention whereby common plant chemicals have been recruited to be crucial elements of gene regulation," said Professor Maleszka, speaking with *Wired* magazine online. "By using environmental ingredients honey bees found a clever solution to a challenging problem: How to generate two contrasting organisms, long-lived reproductive queens and short-lived functionally sterile workers, using the same genetic hardware."

Royal jelly still plays a significant part in the differentiated pathways of worker and queen bees. For instance, one of the main proteins in royal jelly is royalactin. Once sensed in the insect's 'liver', the bee's insulin pathway is activated – subsequently triggering the bee larvae to both accelerate nutrient uptake, and increase nutrient demand. Guzzling furiously, the queen larvae's metabolism fires, and her cells proliferate. The result? Massively accelerated growth.

In essence, royal jelly doesn't constitute an 'on/off switch' in deciding a young bee's

destiny. This is determined instead by an “elaborate network of genetic regulatory pathways,” which are in turn conditioned by the ongoing interactions between inbuilt DNA and external environment. Life: it’s a complex story.

Still, the new findings make royal jelly seem a little less glorified. From being extolled in civilizations past and present as a kind of wonder goop, one of the best things to be said about it now (quite

genuinely) is that it isn’t toxic. On the other hand, for a substance sweated out of an insect’s head, that does seem quite remarkable in itself.



ABOUT US

Blythewood Bee Company is a Bee Keeping Supplies and Honey Bee Removal service located in North Carolina and Georgia. We cater to both sides of the bee world – hobbyists and professionals, online and in-store. Call or visit us today for a free estimate.

Phone: 803-754-7577

Address: 227 McLean Rd, Blythewood, South Carolina

Email: contact@blythewoodbeecompany.com