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Insemination and fertilization success of individual males in the honeybee

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The queens of honeybees and leaf cutter ants are highly polyandrous and store sperm for years to decades, which allows them to fertilize millions of eggs. As queens never remate later in their life to replenish sperm, they have become highly efficient in storing sperm and keeping them alive as well as in their sperm usage during egg fertilizations. However, the factors that determine male insemination and fertilization success have not been studied in great detail. Obviously, both natural selection for long-term sperm storage and economy as well as sexual selection such as sperm competition and/or cryptic female choice could have influenced the evolution of these spectacular reproductive traits.

Here we developed a method that allows us to distinguish the sperm of different males using a number of fluorescence dyes. We used these dyes to study both the insemination success of different males using artificial insemination as well as the usage of sperm on freshly laid eggs. We find that the different dyes used had no effect on semen viability and honeybee queens inseminated with fluorescence dyed sperm store them for several months and use them to lay eggs. We will present an overview of ongoing experimental work that quantified sperm storage and usage in both honeybees and leaf cutter ants. Our data indicate that queens of both species are highly economic in their sperm usage and typically use only 2-3 sperm for each egg fertilization. However, sperm use patterns differ substantially between species, revealing some insights into the mechanistic of sperm usage of queens as well as differential contributions of different males.