New research demands rethink on Darwin's theory of 'fecundity selection'

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A key concept in Darwin's theory of evolution which suggests nature favours larger females that can produce greater numbers of off-spring must be redefined according to scientists behind ground-breaking research published today (3rd November 2015).

The study, published in the scientific journal *Biological Reviews*, concludes that the theory of 'fecundity selection' - one of Charles Darwin's three main evolutionary principles, also known as 'fertility selection' - should be redefined so that it no longer rests on the idea that more fertile females are more successful in evolutionary terms. The research highlights that too many offspring can have severe implications for mothers and the success of their descendants, and that that males can also affect the evolutionary success of a brood.

Darwin's theory of fecundity selection was postulated in 1874 and, together with the principles of natural selection and sexual selection, remains a fundamental component of modern evolutionary theory. It describes the process of reproductive success among organisms, defined by the number of successful offspring which reach breeding age.

After years of research, an evolutionary biologist from the University of Lincoln, UK, has proposed a revised version of the theory of fecundity selection which recommends an updated definition, adjusts its traditional predictions and incorporates important new biological terms.

The research indicates that rather than aiding survival, too many

offspring can be extremely costly, and can in fact reduce the lifetime reproductive success of females. It highlights that in many species, mothers who produce fewer offspring tend to raise them more efficiently, and that in some cases fathers can take the lead in nurturing young by evolving 'male pregnancy'.

The study also concludes that nature will favour all physical traits that influence 'optimal' fertility in either sex, and that climate and food availability also influence the evolution of reproductive processes – factors which Darwin originally overlooked.

The research, led by Dr Daniel Pincheira-Donoso from the University of Lincoln's School of Life Sciences, reveals that phenomena such as climate change could therefore play a significant role in the fertility of species around the world.

Dr Pincheira-Donoso said: "Evolutionary theory is all about reproductive success, or the number of 'successful' offspring an individual can produce. The more successful offspring, the more genes encoding successful traits are passed on to the next generation.

"However, advances in fecundity selection theory reveal that a higher number of successful descendants can actually result from the production of fewer offspring which can be looked after more efficiently. We therefore need to acknowledge that fertility should be more efficient, not necessarily higher, and that males can have a substantial role in influencing the production of efficient broods.

"Also, a stream of evidence shows that climate and food availability play very important roles in the evolution of fecundity among species. This opens up opportunities for the development of theories involving major natural phenomena, such as rapid changes in the climate. We must explore how these climatic changes can affect the reproductive strategies

which evolution has been shaping for thousands or millions of years"

Based on previous studies of the life-history, physical and ecological aspects of fecundity, Dr Pincheira-Donoso's work also concludes that the theory should distinguish between fertility during an animal's lifetime and during one particular breeding season, rather than grouping all time periods together. This is because some animals may have one extremely large brood per breeding season, while others produce one offspring on a more regular basis, which can have enormous implications for the overall reproductive success, and hence evolutionary potential, of species.

More information: Daniel Pincheira-Donoso and John Hunt, 'Fecundity selection theory: concepts and evidence' *Biological Reviews* (2015). DOI: 10.1111/brv.12232

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