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HOW MALE FRUIT FLIES LEARN THE RULES OF COURTSHIP

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A male fruit fly on a metal disc.

Fruit flies that grow in a set up where there is a predominance of males over females inherently understand which females will accept their sexual overtures, according to a new study published online in the journal *Animal Behaviour*. Sexual behaviour can be inherited as well as learnt, this is the slant of the study, which was led by researchers from Indian Institute of Science Education and Research, Mohali.

When male fruit flies approach females to mate with, they spend time in a courtship — which includes following and circling the female, producing a song using wing vibrations, licking or attempting to mount the female, etc. The females respond either positively or negatively. A typical rejection reaction can involve a ‘wing flick’ to indicate they are not interested. “Most of the time, the female just moves away,” explains Nagaraj Guru Prasad, from the Department of Biological Sciences at IISER, Mohali, who led the study.

On average a male fruit fly spends between a few tens of seconds to a minute on a female before giving up. After doing this many times, the flies get to recognise which females would have them and which would reject them. Then they save time by wooing only those females that would accept their overtures.

The question the researchers ask is how would this learning capacity change when there is a selection pressure on them? Namely, if the flies were placed in an environment with an excess of male flies over female flies, they would experience a selection pressure. This is because when there are many males and few available females, there is higher competition between the males and this would effectively affect their chances of passing on their genes to their progeny. Thereby, the males most adept in finding acquiescent females will be selected over those who do not.

In the experiment, fruit flies (Drosophila melanogaster) were raised in two types of surroundings: One in which there was an excess of males, such that the male-female ratio was 3:1, and another in which the ratio of males to females was 1:3. This was ensured as follows: “Every generation, flies from every population are collected within 6 hours of coming out of the puparium. This ensures that they are virgins. They are then combined in the required sex ratios,” says Dr. Prasad. This means that every second week, people have to be up through the night for one week to collect flies as virgins. “This has been done every second week for the last 12 years,” he says. The populations were thus selected for over 250 generations.

In these populations, sexual selection is always present; however, the degree varies. Dr. Prasad explains this, “We achieve this by varying the operational sex ratio and using male-biased and female-biased populations. We wanted to know – if the degree of sexual selection varies, does it affect learning ability?”

The results were surprising. They tested male flies from both groups – with high selection pressure and low selection pressure – by training them with females who were receptive and those who were not. They found that there was little difference in the ability to learn to discern between the two types of response from females. However, the flies that were brought up in a

high-selection pressure environment – with higher number of males as compared to females – inherently had the ability to make this discrimination.

That is, even when they were not trained to discriminate between willing and unwilling females by being shown both types of responses, they could make out the difference. Thus, the learning had been coded into their genes. “Taken together, these results show that sexual selection may not result in improved learning abilities but can lead to the evolution of an improved innate ability of males to assess the receptivity of females,” says Dr. Prasad.

In the larger context, this shows that certain abilities that are otherwise “learnt” can be made “innate” by selection. Dr Prasad, adds a note of caution, “However, this carries a cost and therefore evolves only when the benefits outweigh the costs.”

Next the group is trying to generalise the result. “We have looked at learning in the courtship context. However, learning and cognitive abilities extend beyond that- learning of various other types. We are trying to see if our results are generalisable to all types of learning and cognition,” he says.

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