The dark side of sexual selection

A casual reader of the behavioural ecology literature might think that sexual selection is a positive, evolutionary benefit to females. Females can directly choose a mate, or let males compete to mate can be understood in terms of conflict between the sexes in the way that reproductive success is optimized. A competitive male that outsignals or outfights other males will mate with more females and thus sire more offspring, even if his actions lead to a reduction in each mated female's reproductive output. The higher the potential variance in male mating success, the more important sexual selection becomes, and the greater the likelihood that it will lead to the evolution of traits incidentally harmful to females. Female-male choice is one, but by no means the only, female adaptation that results from competition between males for mates. How females balance the costs of courtship and harassment by males with those of mating (e.g. sperm toxicity and vulnerability to predators) is a crucial aspect of female ecology. Variation in female tendency to remate greatly influences the strength and form of sexual selection in a population.

Sexual selection stopped

In a new study, Holland and Rice employed an innovative experimental technique to examine the long-term costs of intersexual conflict. They recognized that enforcing monogamy in the naturally promiscuous fruitfly Drosophila melanogaster would effectively remove the opportunity for polyandry and thereby negate the importance of male competitive adaptation. Moreover, males from the monogamy treatment, three males competed to mate with each female in three replicate lines. There were few consistent differences in morphology after ten generations of the monogamy and sexual selection treatments, but the effects on age-specific mortality were palpable. In most cases, individuals from the sexual-selection lines lived longer than individuals from monogamous lines. The lower overall mortality in sexual-selection lines supports the notion that sexual selection leads to increased adult viability, possibly as a result of female choice for males with 'good genes'.

The apparently contradictory result might be due to a simple difference between studies in the length of time that courtship and mating could occur. Promislow and Smith's team allowed males and females to interact for only three hours. This is sufficient time for males to court a single female, and females to exercise pre- and postcopulatory choice. According to their own observations, however, it is not long enough for multiple mating to occur. In Holland and Rice's experiment, males and females interacted for five days, allowing ample time for multiple mating, with consequent sperm competition and cryptic female choice. It would appear, therefore, that the costs of sexual selection can be laid at the door of postcopulatory processes. In Drosophila this makes sense, because the frequency of remating and sperm toxicity are both known to reduce female longevity. Holland and Rice's study also conflicts with several recent studies where multiple mating increased offspring viability, with no apparent cost to females. Interestingly, the common explanation in these studies is that cryptic female choice reduces genetic incompatibility. If true, we would not necessarily predict that polyandry will cause a long-term increase in a population's reproductive output, because female choice for compatibility is idiosyncratic rather than for universally better 'viability genes'. Experimental approaches that manipulate the opportunity for pre- and postcopulatory sexual selection might reveal not only whether genetic incompatibility favours a tendency for females to mate multiply, but also whether polyandry allows the continuing segregation of incompatible alleles in a population.

Resistance is inevitable

The net effect of sexual selection on a population's reproductive output depends on the relative costs and benefits. Postcopulatory costs resulting from sperm competition have been well publicized. Even these costs tocourters are not ignored. The risk of injury during coercive mating attempts and energetic postcopulatory costs to courters are known to be important. Moreover, male exploitation of existing female
sensory preferences might result in females mating suboptimally\(^4\)-\(^6\). Female resistance to these costs should be selected for in just the same way as resistance to adaptations for male sperm competition\(^2\). We need to calculate the relative magnitude of the costs of these different sexually selected processes (as well as the size of the benefits accrued). No doubt Holland and Rice’s study will spawn more refined investigations of the population-level effects of various sexually selective processes under a diversity of conditions. These might reveal whether sexual selection has longer-term effects that are, on average, advantageous or costly at levels above the individual.

Holland and Rice\(^2\) have previously suggested that resistance by females to male display, coercion, and harmful male competitive adaptations can influence the outcome of male competition, resulting in a process they dubbed chase-away sexual selection. Resistance might take the form of females requiring greater stimulation to mate, or chemical defences against seminal-fluid components that bias the outcome of sperm competition\(^8\). In each case, it might drive further exaggeration of male display or seminal selflessness.

Chase-away was proposed\(^9\) as a general mechanism of sexual selection emerging from intersexual conflict. In 1972, Trivers\(^2\) showed us that conflict of selfishness might the outcome of sperm competition\(^5\). In 1972, Trivers\(^5\) showed us that conflict of selfishness.

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### References

3. Rowe, L. et al. (1994) Sexual conflict and the evolutionary ecology of mating

### Coming soon in TREE:

- Animal behaviour: an essential component of invasion biology, D.A. Holway and A.V. Suarez
- Sexual conflict and the evolutionary ecology of mating
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\(^2\) F. Courchamp, T. Clutton-Brock and B. Grenfell
\(^3\) T.R. Christensen and B. Wallen
\(^4\) L. Partridge and M. Mangel
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**NEWS & COMMENT**

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