L567. For next time read Zeh&Zeh on website.

Genetic correlation, sexual selection and selfish genetic elements…

But first some loose ends…

I should have laid this out earlier, but in the spirit of tying up loose ends and motivating disagreement…

Darwin laid out two kinds of sexual selection (i.e., variation among individuals in mating success).

1. Intrasexual selection due to male-male combat.

And

2. Intersexual selection due to female choice

That is not controversial, and is presented in all Evolution texts.

But, does that mean that

1. Hermaphrodites cannot have sexual selection?

2. That plants cannot have sexual selection?

3. That herphroditic plants cannot have sexual selection?

The class decided no to all three.

See Delph and Ashman 2006 (posted on class web site) for a contrast of interaction-dependent and interaction-independent sexual selection and the application to plants.

Genetic correlation, sexual selection and selfish genetic elements…

1. Graphical version showing a genetic correlation between the family means for daughters' preference against the mean for sons' traits.

Correlation: $r = \frac{\mathrm{cov}(x,y)}{\sqrt{\mathrm{var}(x) \bullet \mathrm{var}(y)}}$

2. Using what we know for QG, selection on the father's trait should produce a response to selection in the Daughter' preference, as well as in the male trait in sons. Graphical version below.

How to test the idea?

Stalk eyed flies. (see also Freeman and Heron, 3rd edition, page 401). Plot of body length against eye span for males and females.

Thirteen generation artificial selection experiment with Stalk-Eyed flies (Wilkinson and Reillo 1994).

Prediction: selection on male eye span length will produce a correlated response in the preference by females.

1. Control line: 10 males and 25 females picked at random every generation.

2. Long line: 10 males with longest eye span (relative to body size) picked each generation, along with 25 randomly selected females.

3. Short line: 10 males with shortest eye span (relative to body size) picked each generation, along with 25 randomly selected females.

The experiment went for 13 generations, and then female choice was determined. Specifically, at generation 13, females were given a choice between two males, matched for body size, where one had a long eye stalk and one had a short eyestalk).

Results.

1. Females from the Short line preferred to mate with males with short eyestalks. Why?

2. Females from the Control line preferred to mate with males with long eyestalks. What does that mean?

3. Females from the Long line preferred to mate with males with long eyestalks. But they did not prefer males with long eyestalks more than females from the control lines. Why?
(graphical presentation of result below)

Curious result…

Stalk-eyed flies are female biased in nature. But, the female bias became less extreme in the lines where males were selected for long stalks (i.e., sex ratio became closer to 1:1).

And it (the sex ratio) became more female biased in the lines were males were selected for short eyestalks. Why?

A surprising twist….

Suppose we had two kinds of males: X^dY males and XY males, where the d refers to "driving."

At meiosis, the driving X chromosome, X^d, kills Y-bearing sperm.

Normal X chromosomes do not kill the Y-bearing sperm.

What happens to X^d?

And what does this have to do with the stalk-eyed flies? Remember that the offspring of the lines selected for short-eye stalks had female biased sex ratios. Perhaps short eyes are genetically associated (in linkage disequilibrium) with the driving X chromosome.

Why do females prefer long-stalk males in Nature? It would now appear that either:

1. Males with long eye stalks are more likely to have a normal X (non driving) chromosome.

Or, 2. That males with long eyestalks are more likely to have Y chromosomes that prevent the action of the driving X (Wilkinson et al. 1998).

Wilkinson, G. S., D. C. Presgraves, and L. Crymens. 1998. Male eye span in stalk-eyed flies indicates genetic quality by meiotic drive suppression. Nature 391:276-279.

Wilkinson, G. S., and P. R. Reillo. 1994. Female choice response to artificial selection on an exaggerated male trait in a stalk-eyed fly. Proceedings of the Royal Society of London B, Biological Sciences 255:1-6.