

Moths and Darwin

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Mark Andersen — 16 Jun 1998, 09:26

From: David_Lebling at avid.com

From: Dan Parmenter <dan at lec.com>

What would Dollo have to say about that? Did the Peppered Moths' (as they are called) coloration actually "revert" or did they simply evolve their white color a second time?

I think the general explanation that is given in genetics textbooks is not that the moths "evolved" a black color and then a white color.

Rather, there was (and is) a certain amount of genetic variation in the moth population.

Yes. This is the crucial point. Natural selection relies on variability and works at the population level -- Lamarckism doesn't need variation between individuals, and works at the individual level. Here's my Reader's Digest Condensed Version of natural selection: While on the Beagle, Darwin noticed three things about plants and animals:

1) Individuals of plant and animal species are as different as individual humans.

2) These differences are heritable.

3) Sometimes, these differences are differences in traits that can influence survival and reproduction.

Natural selection is NOT a hypothesis or theory to explain these three phenomena. Rather, it is the inevitable logical consequence of these phenomena, in the same way that the conclusion of a mathematical theorem is the inevitable logical consequence of its assumptions. Failure to realize this has led to lots of unnecessary conflict between biologists and non-biologists, and among biologists as well. This same failure of understanding also led Popper to the erroneous conclusion (which he later retracted, by the way) that evolutionary biology is not science, because it does not make predictions.

When pollution made the trees dark, there was selective pressure that favored darker colored moths (i.e., birds found and ate the light-colored ones). So, after a while, the population was mostly dark-colored, but this didn't mean that the gene for light-colored-ness disappeared: it just got less prevalent. Eventually, the pollution was cleaned up and the selective pressure went the other way, as the dark moths became more noticeable, so the occasional light colored moth was able to reproduce, leaving more light colored moths, and so on.

Exactly. This is the way natural selection works: by shifting the mean of a trait (or the fractions in the population that show discrete traits).

If the soot had gone on long enough, it is possible to imagine that every light colored moth would have been eaten, in which case when the trees turned white again, that species of moth would have been in a major pickle.

Yes again. Natural selection can exhaust genetic variation.

There are no simple statements about genetics.

Well, maybe. Certainly true once you get past Punnett squares and one- or two-locus two-allele systems with dominance.

If there is some representation of cayenne pepper genes in the moth population, then eventually dyeing the trees red will create selective pressure favoring red moths.

If the alleles for red coloration are there in the population. If not, the moths might have to become cryptic in some other way. Perhaps selection might favor small-bodied moths that could hide in cracks in the tree bark, for instance. If the genes for the ideal solution aren't available, natural selection can usually manage to jury-rig something that works. Or not (which is one cause of extinction).

By the way, I like the idea that the noisy thing in the Saltus mine is some kind of machine. Here's one hypothetical time line: During the First Empire (or the Age of the Monarchs), the underground treasury is established, with a mechanical guardian (or several) to keep an eye on things. Life goes on above ground, the farming village of Saltus is founded, and the regime that supported (or needed) the underground treasury passed away. Later, as the sun begins to die and the climate begins to worsen and the crops begin to fail, someone (who, I wonder?) advises the good people of Saltus to take up mining and the first shaft is sunk, by chance (perhaps) near the underground treasury. At the beginning of the Age of Autarchs, the young cacogen Inire discovers the underground treasury and assigns some guardians of his own to keep an eye on it.

cheers,
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