MODULE CODE: M4X01940
ENVIRONMENTAL BIOLOGY EXAM 2021

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1. Using examples, discuss how a diverse gene pool is important to conservation biology.

LECTURE SLIDE MAP:

- What is Evolution?
  - Macro v Micro
  - Natural Selection
    - Environmentally Dependent
    - Variation Dependent
    - X-genes
    - As an Evolutionary Mechanism
      - Fitness
    - Population Genetics
      - Stabilising Selection
      - Directional Selection
      - Disruptive Selective
  - Genetic Drift
    - Effects
  - Mutation

Diverse gene pool or genetic diversity is defined as the range in the genetic composition within species, population or community. As it is known, each individual is unparalleled because of the similarities and variation in the genes (segments of DNA on chromosomes), that can relate to their physical appearances. These differences can expand as an outcome of many other processes, such as physical or demeanour solitude of populations, and mutations.

Diverse gene pool is important because it assists preserve the health of a population and other species, by adding alleles that may be rich in defying diseases, other stresses and pests. Each individual or the entire population is allowed by wide variation of the different set of genes to be able to withstand Environmental stress in any way. The greater the variation among individuals within a species, the greater the likelihood that some will be able to adapt to different environmental conditions and that the species will survive major changes in their

surroundings, such as global warming, when many of these same species do not have the ability to withstand the increase in pollution in the environment can result in infertility or death from these conditions.

This process is called Natural Selection, in which it depends on the environment and requires existing heritable variation in a group and leads to a loss of genetic diversity in specific habitats and also to speciation where, one or more species give rise to a new and clearly different species.

Natural Selection

According to an article from National Geographic, over time, these advantageous traits become more common in the population. Through this process of natural selection, favourable traits are transmitted through generations. It is one of the methods that conducts evolution and support to explain the variety of life on Earth (Elliot, 2002). Natural selection enhances the preservation of a group of organisms that are best adjusted to the physical and biological conditions of their environment and may also result in their improvement in some cases. Some characteristics, such as the male peacock's tail, actually decrease the individual organism's chance of survival. To explain such anomalies, Darwin posed a theory of "sexual selection." In contrast to features that result from natural selection, a structure produced by sexual selection results in an advantage in the competition for mates (Rafferty, 2020).

The great theory of Darwin of evolution by natural selection is relatively simple but, often misinterpreted, imagine a population of mice:

1. **There is a variety in traits**: some mice are black, and some are tan.
2. **There is differential reproduction:** Since the environment can't support unlimited population growth, not all individuals get to reproduce to their full potential. The tan mice tend to get eaten by birds and survive to reproduce less often than black mice do.
3. **There is heredity:** The surviving black mice have black baby mice because this trait has a genetic basis.
4. **End result:** The more advantageous trait, black coloration, which allows the mice to have more offspring, becomes more common in the population. If this process continues, eventually, all individuals in the population will be black.

Examples:

There are trees that have more genetic diversity than the other vascular plants like grasses. It applies to both the populations as well as the various species. One part of the diversity happens due to the size of the geographic range of each of the species, those trees are called **Woody Plant Species**. Depends on how far they can move via their genetic information. For instance, processes of wind pollination or animal seed dispersers. Although, a lot of the diversity of these woody plants is still a mystery. The explanation is that it ties to the evolutionary past of the separate species.

Domestic Dogs: Humans have been long breeding different species of dogs for making something new with different traits. However, we see that this genetic variability is reduced as their operative population size is restricted by humans who control their access to mates. On the other hand, the genetic variation has anyway developed because of the diverging of various breeds.

Generalist versus Specialist Species: When we say generalists, we refer to the adaptable species which adapts their behaviour to plus diet as per the changes in the environment. For instance, coyotes are a perfect example of this species.

On the other hand, specialist species are those who develop quite specific traits that allow them to benefit from one certain resource. For instance, hummingbirds are examples of this species. An environment that has more inconsistency favours the generalist species more as well as the genetic diversity of these.

Genetic Drift

Is the alter in allele frequencies in a population from generation to generation that occurs due to chance events. To be more exact, genetic drift is change due to "sampling error" in selecting the alleles for the next generation from the gene pool of the current generation. Although genetic drift happens in populations of all sizes, its effects tend to be stronger in small populations.

Bottleneck effect – the size of a population is severely reduce4d very quickly, such as in a natural disaster. **Founder effect** – where a small group of individuals breaks off from a larger population to establish a colony ((LO)).

As opposed to natural selection, does not take into account an allele's advantage (or harm) to the individual that carries it. That is, a beneficial allele may be lost, or a slightly harmful allele may become fixed, purely by chance.

A beneficial or harmful allele would be subject to selection as well as drift, but strong drift (for example, in a very small population) might still cause fixation of a harmful allele or loss of a beneficial one.

Examples:

When people who have the gene causing a specific genetic trait, like freckles, reproduce with people who do not have the gene, no freckles, the gene can become more popular (nearly everyone in that population has freckles) or totally disappear from the population (no one has freckles at all).

A wildflower population consisting of blue, purple and pink flowers is subjected to a mudslide that kills most of the blue ones. As time progresses, blue flowers eventually die out, leaving only purple and pink wildflowers (Betts).

Mutations

Mutations are changes in the structure of the molecules that make up genes, called DNA. The mutation of genes is a significant source of genetic variation within a population. Can be random (for eg., when replicating cells make an error while reproducing DNA) or happen as a outcome of exposure to something in the environment, like prejudicial chemicals or radiation.

If the environment changes rapidly, some species may not be able to adapt fast enough through natural selection. Through studying the fossil record, we know that many of the organisms that once lived on Earth are now extinct. As example we have the Dinosaurs, an invasive species, a disease organism, a catastrophic environmental change, or a highly successful predator can all add to the extinction of species.

Today, human actions such as overhunting and the destruction of habitats are the main cause of extinctions. Extinctions seem to be happening at a much faster rate today than they did in the past.

Conclusion

All this considered, the inherited and related characteristics for a population are crucial and essential thanks to the genetic variation, through the system of mating, the history of the species, the evolutionary history and the level of environmental heterogeneity it is possible to find a level of genetic diversity. To allow the genetic improvement of each species, it is necessary to meet the needs depending on the environment in which it is found. It defines the potential fitness of each specie and its long-term endurance.

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