

A Level Biology A
H420/02 Biological Diversity

Question Set 11

The cheetah, *Acinonyx jubatus*, is a member of the cat family, Felidae.

Cheetahs display less intraspecific variation than other members of the family Felidae. Fig. 20.1 shows the mean body length of a population of cheetahs from southern Africa. The error bars on Fig. 20.1 show the standard deviation of mean body length.

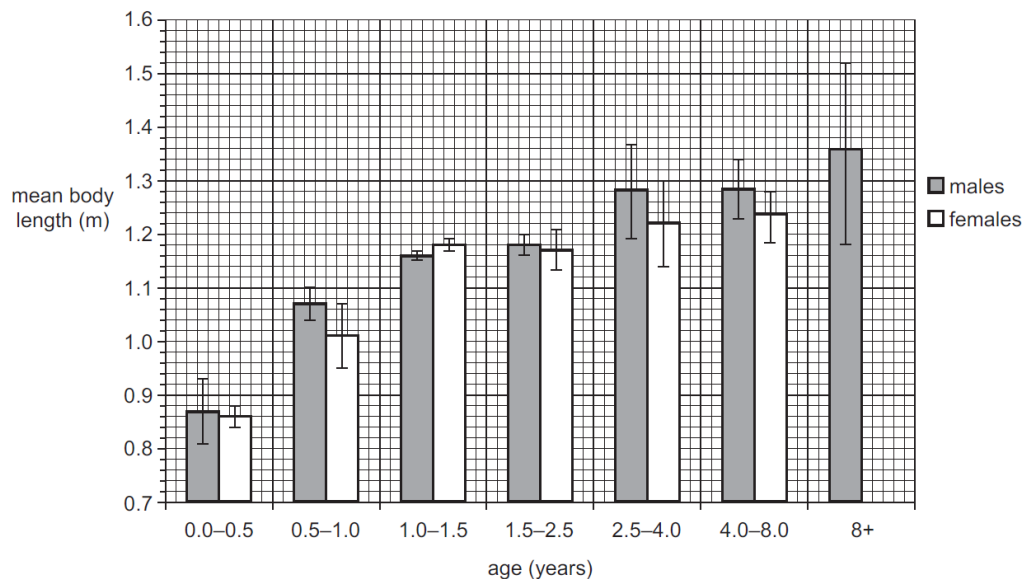


Fig. 20.1

- (a) (i) At between 2.5 and 4 years old, the mean length of female cheetahs is less than that of males.

Calculate how much shorter than males female cheetahs are.

Show your working. Express your answer as a percentage to **two significant figures**.

$$\frac{1.28 - 1.22}{1.28} \times 100 = \frac{0.06}{1.28} \times 100 \rightarrow \text{Answer } 4.7\% \quad [2]$$

- (ii) Using only Fig. 20.1 and your answer to (i), what can be concluded about the **significance** of the difference between the length of male and female cheetahs aged between 2.5 and 4 years?

Explain your answer. **Nothing can be concluded because no t-test has been done** [2]

- (iii) A student looked at Fig. 20.1 and wrote:

“The longest male cheetah that was measured was 1.52 m long”.

Explain whether the information in Fig. 20.1 supports the student’s answer.

No because the standard deviation is not the same as range - doesn't include all the outliers. [1]

- (iv) State the likely causes of variation in body length in cheetahs.

Genes and environment [2]

- (b) The population of cheetahs has been declining for the past 100 years and is estimated to be between 6000 and 7000.

Within the remaining cheetah population, intraspecific genetic diversity is very low. One isolated population of cheetahs in Iran has fewer than 100 individuals.

- (i) State one way in which genetic diversity can be measured. [1]
Genetic polymorphism
- (ii) It is thought that the modern cheetah population has low genetic diversity because the population, relatively recently, experienced a genetic bottleneck.

Explain why a genetic bottleneck can lead to low genetic diversity.

Because many alleles are lost (when population drops) and the modern population would have descended from few survivors, gene pool is small decreasing genetic diversity. [2]

- (iii) Scientists are concerned about genetic drift in the remaining cheetah populations. Explain why genetic drift is likely to be of particular concern in the population of 100 cheetahs in Iran. [2]

Because one individual has proportionally higher effect on small population thus it's more likely that alleles will be lost from population.

- 1 (c) Madagascar is a large island off the coast of Africa that once formed part of the mainland.

The fossa, *Cryptoprocta ferax* is the top predator on Madagascar.

The fossa shares many physical similarities with cats but it is not a member of the family Felidae. It is related to the mongoose.

The mongoose is a much smaller mammal that lives on the African mainland. Fig. 20.2 shows a fossa and a mongoose.

fossa



mongoose



Fig. 20.2

- (i) The mongoose is a smaller mammal and also has proportionally longer fur.

State one other difference, visible in Fig. 20.2, between a fossa and a mongoose.

Fossa has longer legs than mongoose.

[1]

- (ii) When the island of Madagascar became separated from the African continent, there were no members of the cat family, Felidae, on the island.

Outline how a fossa could have evolved from a much smaller, mongoose-like ancestor.

[4]

Allopatric speciation could have occurred. The mongoose population undergoes random mutation and since the environmental factors are different, the selection pressure is different. Those with beneficial features have a higher chance of surviving and reproducing, passing on the alleles to the next generation. This is a directional selection.

- (iii) Islands, such as Madagascar, often have species that are different from those on the nearest land mass because they are reproductively isolated.

State three other conditions that must be present in order for speciation to occur.

mutation
directional selection
time

[3]

Total Marks for Question Set 11: 20

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