

2 *Exserohilum turcicum* is a fungal pathogen. The growth of the mycelium of the fungus damages the leaves of maize plants, *Zea mays*. Leaf damage reduces crop yield.

(a) (i) Complete Table 2.1 to show **one** structural difference and **one** functional difference between *E. turcicum* and *Z. mays*.

Table 2.1

	<i>E. turcicum</i>	<i>Z. mays</i>
structural difference		
functional difference		

[2]

(ii) Describe the principles by which organisms such as *E. turcicum* and *Z. mays* are classified in the taxonomic hierarchy.

[4]

[4]

(b) Two inbred varieties of maize, SKV50 and CML153, were crossed. The resulting F1 hybrids were self-crossed to produce F2 offspring. The F2 plants were grown, and the percentage area of leaf damage caused by *E. turcicum* was measured.

Fig. 2.1 shows the results for the F2 generation. The arrows show the mean percentage area of leaf damage for the two parent varieties.

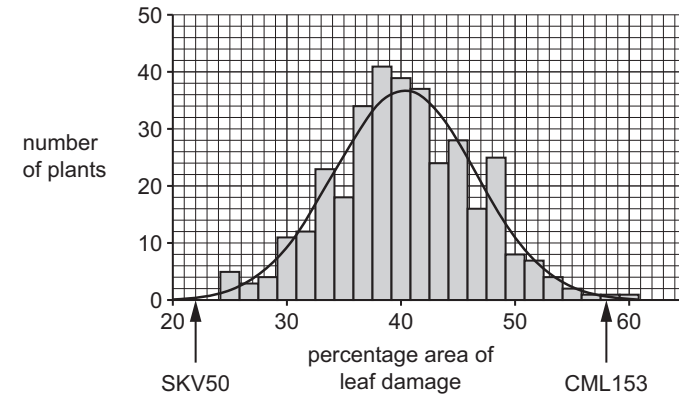


Fig. 2.1

(i) Explain how Fig. 2.1 can be used to determine which parent maize variety shows the greatest resistance to infection by *E. turcicum*.

..... [2]

[2]

(ii) State the name of the type of variation shown by the maize F₂ generation in Fig. 2.1.

Explain the **genetic** basis of the type of variation shown by the maize F2 generation.

[4]

- 8 (a) Palm oil is the most widely used vegetable oil. It is obtained from the African oil palm, *Elaeis guineensis*. Oil palms are the highest yielding vegetable oil crop, needing only 10% of the land area required by other crops to produce the same quantity of oil.

On the island of Borneo, tropical rainforests are cut down and cleared to create oil palm plantations. This has a large effect on biodiversity.

The Bornean orangutan, *Pongo pygmaeus*, is only found on the island of Borneo and is classified as critically endangered on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species™.

Fig. 8.1 shows Bornean orangutans.



Fig. 8.1

Suggest ways in which the Bornean orangutan may be conserved.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

- (b) Biodiversity can be assessed at different levels.

Outline the main levels at which biodiversity can be assessed.

.....

.....

.....

.....

.....

..... [3]

(c) The biodiversity of a habitat can be measured by calculating Simpson's index of diversity (D).

The formula for Simpson's index of diversity (D) is:

$$D = 1 - \left(\sum \left(\frac{n}{N} \right)^2 \right)$$

Key to symbols:
 n = number of individuals of each type present in the sample
 N = the total number of all individuals of all types present in the sample

A survey of shrubs and trees in a temperate woodland was carried out. The results are shown in Table 8.1.

Table 8.1

common name	n	$\frac{n}{N}$	$\left(\frac{n}{N}\right)^2$
maple	807	0.196	0.0384
alder	6	0.001	0.0000
hazel	1856	0.451	
hawthorn	82	0.020	0.0004
blackthorn	40	0.010	0.0001
willow	101	0.025	0.0006
birch	78	0.019	0.0004
wild rose	84	0.020	0.0004
oak	1036	0.252	0.0635
dogwood	29	0.007	0.0000
$N =$	4119	Total =	

- (i) Complete Table 8.1. [2]
- (ii) Calculate the value for Simpson's index of diversity (D).

$D =$

[1]

- (iii) Using your value for D , comment on the biodiversity of this temperate woodland.

.....

.....

.....

.....

.....

.....

5

[2]

6 The distribution of the large blue butterfly, *Phengaris arion*, extends across Europe and Asia. It is assessed by the International Union for Conservation of Nature (IUCN) on the Red List™ as 'Near Threatened' globally and 'Endangered' in Europe.

In Europe, *P. arion* became extinct in the Netherlands in 1964 and in the United Kingdom in 1979.

Fig. 6.1 lists the conservation status categories in the IUCN Red List™.

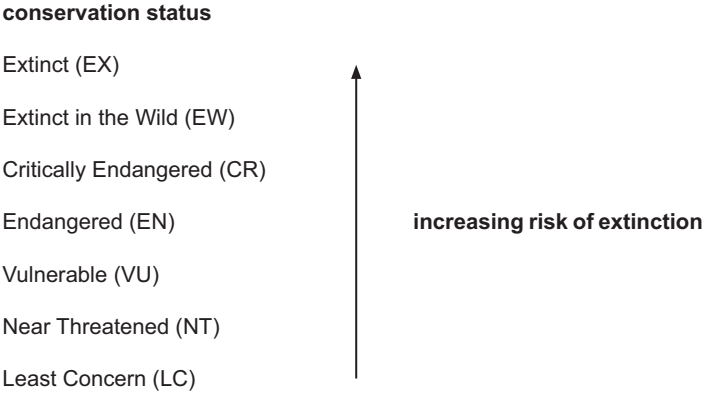


Fig. 6.1

Fig. 6.2 shows *P. arion*.



Fig. 6.2

- (a) (i) Explain how IUCN Red List™ assessments help to conserve biodiversity.

.....

.....

.....

.....

.....

.....

6

- (ii) With reference to Fig. 6.1 and the IUCN assessments for *P. arion*, suggest how the abundance of the butterfly differs across its distribution.

.....

.....

.....

.....

.....

..... [2]

- (b) *P. arion* has been successfully re-introduced in the United Kingdom at 12 sites. These sites were restored to flower-rich grassland.

The conservation management actions designed for *P. arion* also resulted in the re-establishment or increase of other species at the restored sites. These included 12 species of flowering plant, 8 other butterfly species and 4 species of other insects.

- (i) Use the information given to suggest why *P. arion* went extinct in the United Kingdom in 1979.

.....

.....

.....

..... [2]

- (ii) Outline the advantages of restoring habitats for endangered species.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 11]