A Level Biology B

H422/02 Scientific literacy in biology

Question Set 20

1. (a) Fig. 7 is a diagram of a maize plant showing the male and female flowers.

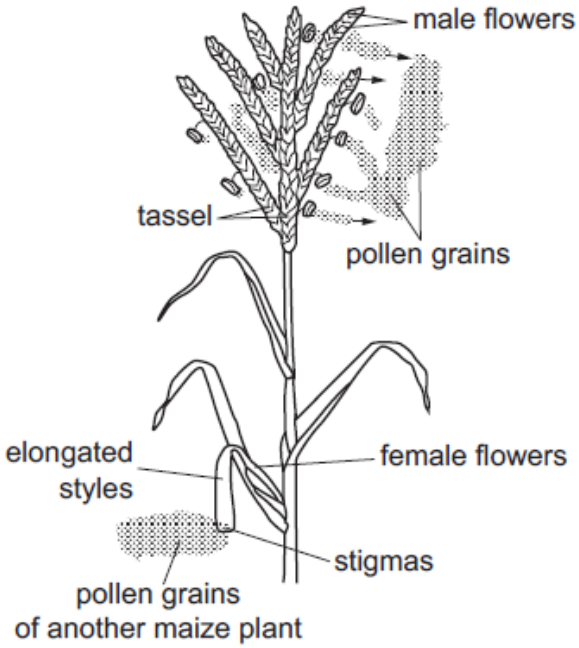

Fig. 7

Using the information in Fig. 7, identify **one** way in which maize is adapted for wind pollination.

[1]

(b) When maize pollen grains land on the stigma of a maize plant, a pollen tube grows towards the ovule.

Describe the events that lead to the formation of the embryo **and** the endosperm.

[3]

(c) **(i)** As well as being a popular food (corn on the cob), maize is a useful model for studying patterns of inheritance. Each maize cob contains hundreds of seeds known as kernels.

In maize, one gene determines the colour of the kernels, which is either yellow or colourless.

Another gene determines the amount of endosperm in each kernel. Kernels filled with endosperm are smooth whereas kernels with shrunken endosperm appear wrinkled.

Two pure breeding strains of maize were crossed. One strain had smooth yellow kernels.The other strain had wrinkled colourless kernels.

All the kernels of the offspring (F_1) were smooth and yellow.

The plants in the F_1 generation were then crossed with plants that had pure-bred wrinkled colourless kernels.

State the parental genotypes **and** gametes of this cross.

Use the following to represent the alleles:

- **A** and **a** for colour (yellow or colourless)
- **B** and **b** for appearance (smooth or wrinkled).

[2]

(ii) Using a genetic diagram and your answer to **(c)(i)**, predict the **phenotypic ratio** that you would expect from the second cross.

[2]

(iii) The actual results of the second cross are shown in Table 7.1.

Phenotype	Number of kernels
Smooth yellow	275
Wrinkled yellow	277
Smooth colourless	235
Wrinkled colourless	213

Table 7.1

Calculate χ^2 for these data.

Use the formula: $\chi^2 = \Sigma\frac{(f_o - f_e)^2}{f_e}$

You may use the table below for working out.

[3]

(iv) Table 7.2 shows a χ^2 probability table.

Degrees of freedom	Probability (p)				
	0.50	0.10	0.05	0.01	0.001
1	0.46	2.71	3.84	6.64	10.83
2	1.39	4.61	5.99	9.21	13.82
3	2.37	6.25	7.82	11.35	16.27
4	3.36	7.78	9.49	13.28	18.47

Table 7.2

What can you conclude about the results shown in Table 7.1 based on the χ^2 value you calculated in **(c)(iii)**?

[1]

(v) Suggest an explanation for your conclusion in part **(iv)**.

[2]

Total Marks for Question Set 20: 14

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