



**BIOLOGY**  
**HIGHER LEVEL**  
**PAPER 2**

Candidate number

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Wednesday 7 May 2003 (afternoon)

2 hours 15 minutes

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**INSTRUCTIONS TO CANDIDATES**

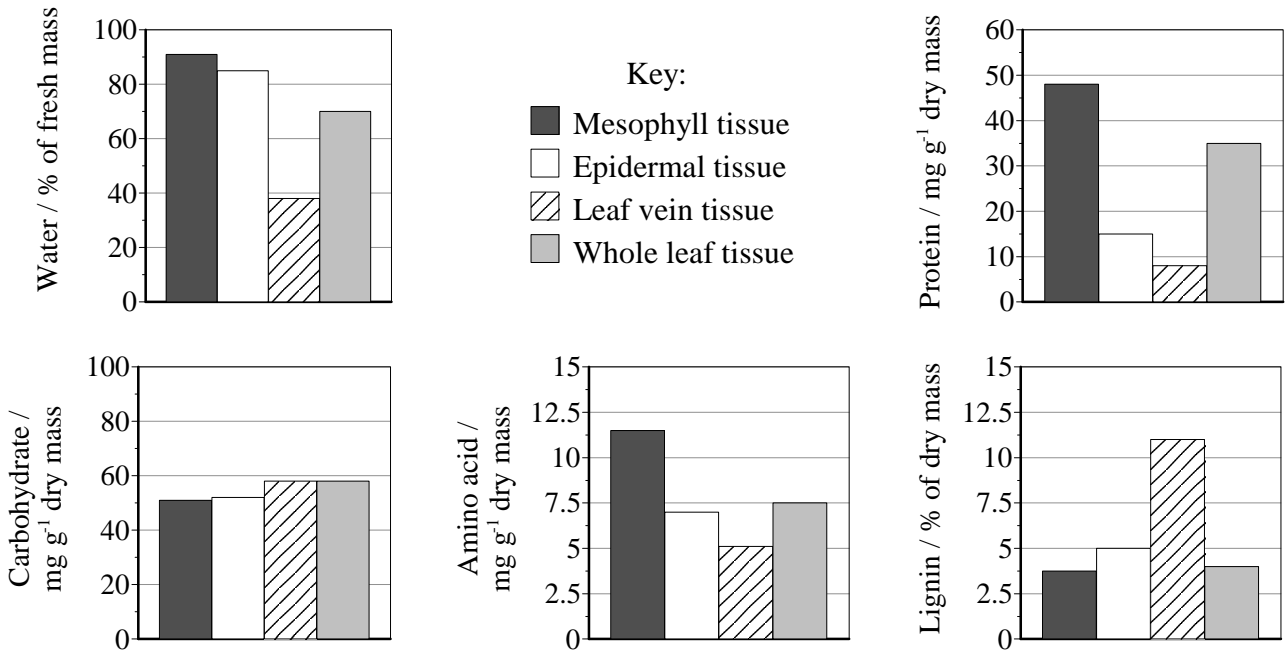
- Write your candidate number in the box above.
- Do not open this examination paper until instructed to do so.
- Section A: answer all of Section A in the spaces provided.
- Section B: answer two questions from Section B. Write your answers on answer sheets. Write your candidate number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the numbers of the questions answered in the candidate box on your cover sheet and indicate the number of sheets used in the appropriate box on your cover sheet.

SECTION A

Answer all questions in the spaces provided.

- 1. The larvae of leaf miners (*Chromatomyia milli* and *C. nigra*) feed on the internal plant tissues of leaves and grass blades. They prefer to avoid woody tissues, such as those tissues that contain the polymer lignin. Leaf miners tend to select tissues with a high nutrient content.

The graphs below show the nutritional quality for different leaf tissues and the whole leaf.



[Source: Scheirs *et al.*, *Ecological Entomology*, Blackwell Science Ltd, (2001), 26, page 512]

- (a) Describe the relationship of lignin content with respect to the different tissues of the leaf and the whole leaf. [2]

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- (b) Compare the quantity of protein in the different leaf tissues. [3]

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(Question 1 continued)

- (c) Discuss the nutritional quality of the epidermal tissue and leaf vein tissue. [3]

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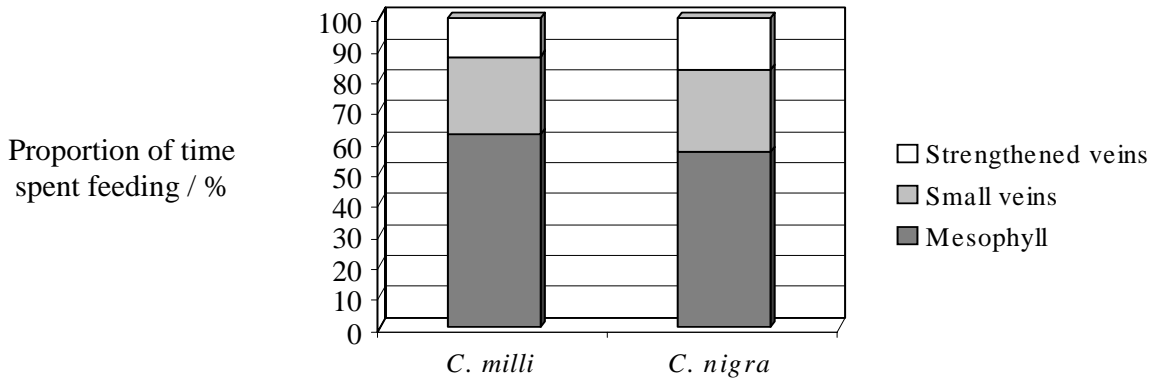
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The graph below shows the proportion of time spent feeding by two species of leaf miner in different areas of the leaf: mesophyll, small veins and strengthened veins (reinforced veins with fibres).



[Source: Scheirs et al., Ecological Entomology, (2001), 26, page 509]

- (d) Compare the feeding patterns of C. milli and C. nigra on the different tissues of the leaf. [3]

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- (e) Suggest reasons for the preferences of the leaf miners in feeding on different parts of the leaf. [3]

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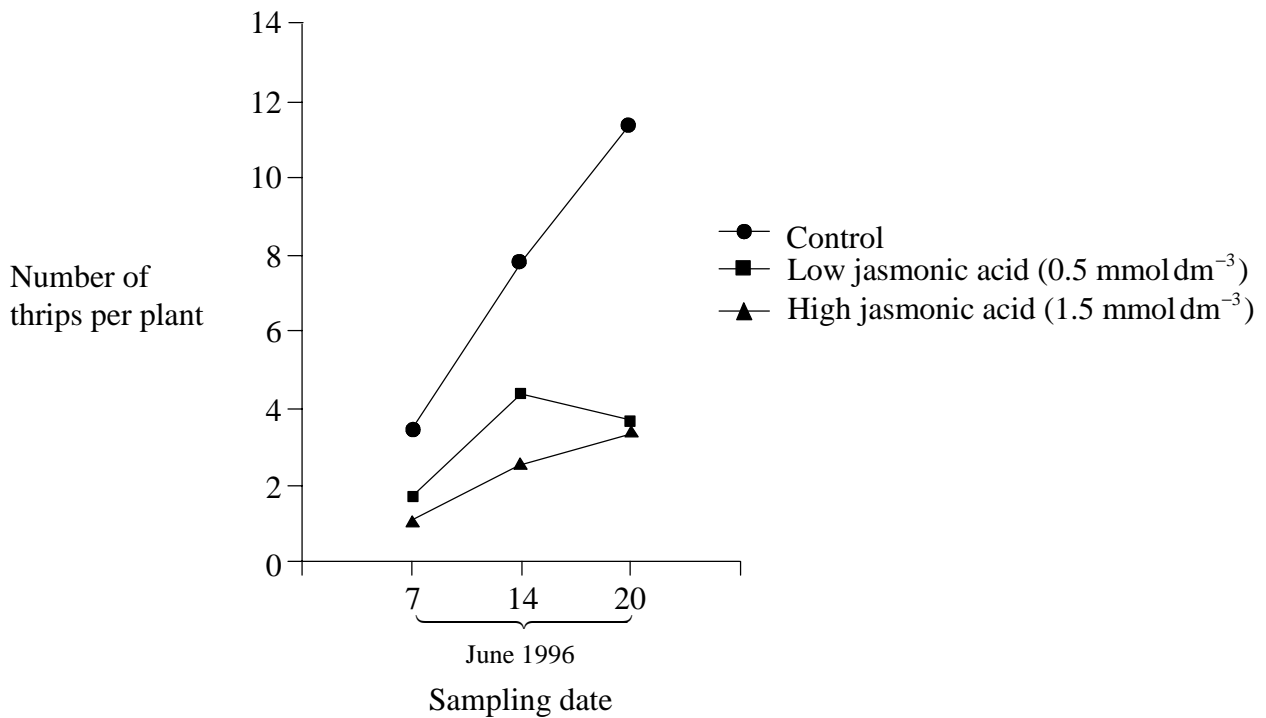
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(Question 1 continued)

Production of jasmonic acid, a plant hormone, can be induced within a plant when it is eaten by a herbivore. Jasmonic acid may play a role in defence of plants through the production of compounds which affect the growth of herbivorous insects.

The graph below shows the abundance of thrips (an herbivorous insect) on control tomato plants and on plants sprayed with low or high levels of jasmonic acid. The number of thrips on each plant was counted on three different dates.



[Source: Thaler *et al.*, *Ecological Entomology*, Blackwell Science Ltd, (2001), 26, page 318]

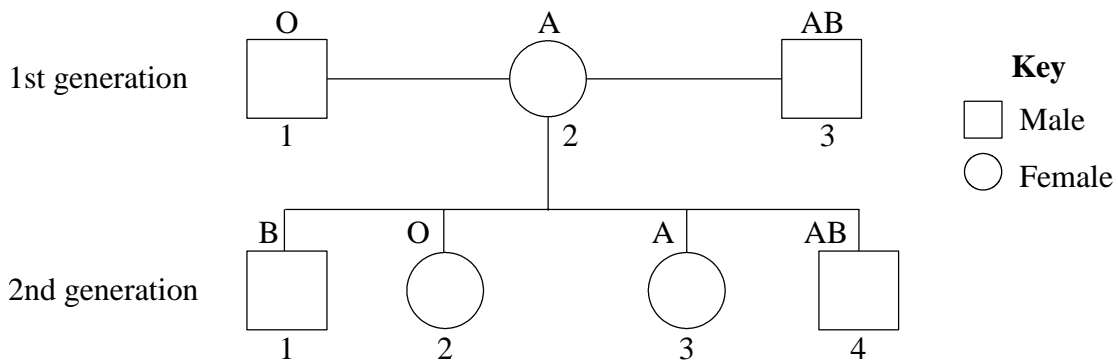
(f) Compare the number of thrips on control plants to those treated with jasmonic acid. [2]

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(g) Using the information provided, suggest a way to make future tomato plants more insect resistant, other than by spraying the plants. [2]

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2. The following diagram represents a two generation pedigree showing the blood groups of the individuals. The female has been married to two different individuals.



(a) Define the term *co-dominant alleles*. [1]

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(b) Deduce with a reason the probable father of 2nd generation-1. [2]

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(c) If 2nd generation-3 marries a man with blood group AB, predict the possible genotypes of the children. [3]

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3. (a) Define the term *active site* of an enzyme. [1]

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(b) Outline how enzymes catalyze biochemical reactions. [2]

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(c) Explain the effect of pH on enzyme activity. [3]

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(d) State **three** functions of lipids. [2]

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**SECTION B**

Answer **two** questions. Up to two additional marks are available for the construction of your answers. Write your answers on the answer sheets provided. Write your candidate number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.

4. (a) Draw a diagram of the ultrastructure of an animal cell as seen in an electron micrograph. [6]
- (b) Describe the process of active transport. [4]
- (c) Explain the process of aerobic respiration including oxidative phosphorylation. [8]
5. (a) Draw the structure of a dicotyledenous animal-pollinated flower. [6]
- (b) Compare the adaptations of xerophytes and hydrophytes. [8]
- (c) Describe how water is transported in a plant. [4]
6. (a) Define the terms *active*, *passive*, *natural* and *artificial immunity*. [4]
- (b) Explain the role of antibody production with regard to vaccinations. [8]
- (c) Describe the roles of nerves, muscles and bones in producing movement. [6]
7. (a) Outline the process of fertilization in humans. [6]
- (b) Describe how sexual reproduction promotes genetic variation within a species. [4]
- (c) Explain how energy and nutrients enter, move through, and exit a food chain in an ecosystem. [8]
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