HODDER Education

Biological Sciences review

www.hoddereducation.com/biologicalsciencesreview

Volume 37, Number 2, November 2024

Activity

Diseases transmitted by vectors

Martin Rowland

Introduction

Use information from Amy Phelps' article, *Diseases transmitted by vectors*, and your own knowledge to answer the following questions.

Questions

1 The World Health Organization (WHO) classifies diseases or infections that are naturally transmissible between humans and other vertebrate animals as zoonoses.

Based on the infective agent, zoonoses are further classified as, for example, bacterial zoonoses, fungal zoonoses and viral zoonoses.

Use your own knowledge of biological classification to place each of the following zoonoses into the correct column of the table:

- Acquired immune deficiency syndrome (AIDS)
- Aspergillosis
- Influenza
- Salmonellosis
- Severe acute respiratory syndrome (SARS)
- Tuberculosis

Bacterial zoonose	Fungal zoonose	Viral zoonose

[2 marks]

2 Humans suffer a number of viral zoonoses, such as rabies. Viral infections can be diagnosed by either viral antigen detection or by antibody detection.

Use your knowledge of viral infection to suggest one limitation of the following.

a Viral antigen detection

b Antibody detection [2 marks]

3 Haematophagous insects are able to transmit diseases from person to person.

Give **four** features of the transmission cycle that enable haematophagous insects to act as vectors of disease. [4 marks]

4 Climate change is likely to increase transmission of diseases.

Give **one** reason why each of the following aspects of climate change is likely to directly increase disease transmission.

a A global rise in temperature.

b An increase in the concentration of carbon dioxide in the atmosphere. [2 marks]

5 The article states that human and animal interrelationships are likely to intensify worldwide over the coming decades.

Other than climate change, give **four** reasons why. [4 marks]

6 The mosquito *Aedes aegypti* is a vector of several diseases, including dengue.

Several methods of reducing populations of *A. aegypti* mosquitoes have been trialled. Two of these are:

- Insecticide – sprayed both outdoors and indoors
- Incompatible insect technique (IIT) – mosquitoes are reared in laboratories in which they are infected with *Wolbachia* bacteria. *Wolbachia*-infected males are released. If they mate with an uninfected female, the eggs will not hatch.

a Suggest **two** disadvantages of using insecticide. [2 marks]

b The release of *Wolbachia*-infected males does not result in more humans being bitten by mosquitoes. Suggest one reason why. [1 mark]

c Suggest **one** assumption that must be met if the IIT method is to be successful. [1 mark]

d If a *Wolbachia*-infected male mates with a similarly infected female, the eggs do hatch and all its male and female offspring are infected by *Wolbachia*.

Use your knowledge of bacterial infections and of animal reproduction to suggest why. [2 marks]

7 The caption for Figure 1.3, states, 'Sex was a marginally significant predictor for *Anaplasma* ($\chi^2 = 3.817$, $p = 0.051$)'.

a How many degrees of freedom (df) would be involved in finding the probability value from a chi square table? [1 mark]

b Explain why the author writes that sex was 'marginally significant'. [1 mark]

Model answers

1 One mark per correct column.

Bacterial zoonose	Fungal zoonose	Viral zoonose
Salmonellosis Tuberculosis	Aspergillosis	Acquired immune deficiency syndrome (AIDS) Influenza Severe acute respiratory syndrome (SARS)

2 **a** Short duration of vital shedding time / time between release of viruses and infection of new cell is short.

b Only applicable where no vaccination programmes are in use.

3 Parasite in blood of infected person taken up by insect as it feeds.

Parasite does not harm / kill the insect.

Parasite passes to salivary gland of insect.

Parasite in saliva that is secreted into blood of next victim.

4 **a** Ectotherms increase their range OR more migration of humans.

b Plant stomata are closed so less water is lost from them, leading to the development of pools of water that provide breeding grounds.

5 One mark for each of any four from:

- Animal husbandry practices
- Growth of companion animal market
- Ecosystem disruption
- Anthropogenic disruption of habitats
- Global travel and commerce
- Increase in consumption of meat/dairy products
- Live animal markets

6 **a** One mark for each of any two from:

- Insecticide resistance
- Kills other non-harmful / beneficial insects
- Need to repeat spraying / is costly
- Might harm humans

b Only females bite / males feed on nectar.

c Reproductive success of males is not affected OR females only mate once.

d Bacteria infect cytoplasm of cells.

Only cytoplasm of egg donated to embryo.

7 **a** 1 degree of freedom

b The calculated value of p = 0.051 is marginally above the accepted critical probability of 0.05 / of 5%.