AS 91603 Demonstrate understanding of the responses of plants and animals to their external environment

Relationships

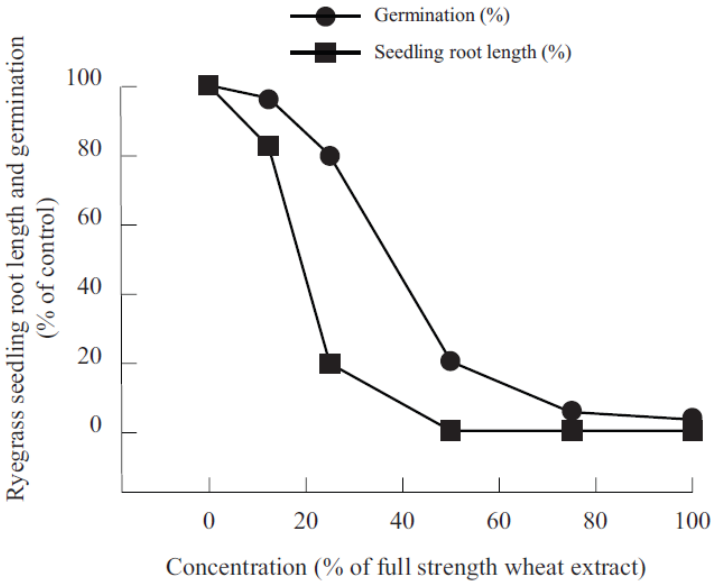
(2014, 2)

Competition between wheat and ryegrass

Wheat is an important cereal crop. Ryegrass is a weed in wheat fields. Wheat and ryegrass both belong to the grass family.

Australian scientists investigated one aspect of competition between wheat and ryegrass.

- Wheat plants were crushed up and mixed with distilled water.
- Water-soluble substances in the crushed plants dissolved in the water to make the full-strength extract.
- A series of dilutions of the full-strength extract were made.
- Ryegrass seeds were put into each dilution and the percentage that **germinated** (started growing) was recorded.
- If the seeds germinated, the **seedling root length** was also measured after 7 days.
- The results were presented as percentages of a control experiment.



The graph shows the effects of different concentrations of wheat extract on the germination of ryegrass seeds and on the length of the roots of the seedlings that grew from them.

Discuss the outcome of this experiment and what it suggests about wheat and its response to its environment.

In your answer you should refer to the graph and:

- describe the interaction between wheat and ryegrass and its importance to wheat farmers
- compare the ryegrass seedling root length and germination, with the concentration of wheat extract
- fully explain the response between wheat and ryegrass that the results of this experiment suggest
- analyse the results to suggest how this response could provide an adaptive advantage to growing wheat plants.

(2010, 1)

The orchid *Chiloglottis trapeziformis* depends on a single pollinator, the thynnine wasp (*Neozeleboria cryptoides*), for reproduction. It does this by physically mimicking and exaggerating the measurements of an attractive female wasp. The wasp-mimicking structures on the orchid are a third larger than the actual females and over five times wider. The orchid also produces ten times the concentration of a sexual pheromone (chemical attractant) produced by the female wasp.

(a) Explain why the orchid exaggerates both female **wasp-mimicking structures** and **pheromone concentration**.

(b) Once the orchid is pollinated, the chemical attractant fades and a new fragrance is **immediately** produced, which mimics that of a brooding female wasp, discouraging further visits from male wasps.

Explain how this second response by the orchid should promote **cross-pollination** of the flowers.

(c) In orchids, successful seedpod production is rare, but the numbers of seeds produced per pod are extremely high. Orchid seeds are very small and light, like particles of dust. When dispersed the seeds must connect with mycorrhizal fungi, in order to germinate, or they will not survive.

Discuss the range of strategies orchids use to maximise their reproductive success. Use the given information in this question.

In your discussion you should focus on:

- the **relationships** the orchid has with other organisms
- **how** and **why** these organisms are used by the orchid
- how the reproductive strategies used by the orchid increase its **chances of survival**.

(2009, 2)

Northern rata (*Metrosideros robusta*) is found in lowland forest throughout the North Island and near the northwest coast of the South Island. It is much more common as an epiphyte than a ground plant, and is mostly found growing on established trees such as the rimu (*Dacrydium cupressinum*). Both the rata and its host require plenty of light.

The rata epiphyte develops tuber-like swellings on its roots, which help with water storage.

Eventually roots from the epiphyte grow down the trunk of the supporting tree to the ground, forming a massive trunk and root system. This system replaces and eventually kills the supporting tree.

(a) Describe ONE advantage to the rata in becoming established as an epiphyte on the rimu.

(b) Eventually the rata replaces the host tree as the dominant emergent canopy species.

The initial relationship between rata and its host is an example of commensalism. However, this changes as the rata tree establishes itself and grows to a mature, reproductive tree.

Discuss the interspecific relationships that exist between the rata and its host as the rata grows, **and** the consequences of these changes for **both** trees.

(2009,4)

New Zealand's red mistletoe grows on native beech trees (eg *Nothofagus*) in the southern beech forests of New Zealand. It is often referred to as a hemi-parasite, rather than a true parasite.

Like other mistletoe species, red mistletoe plants have large green leaves and root-like structures called haustoria. The haustoria penetrate the host plant's bark and grow into its transport tissues (xylem and phloem). In December the mistletoe produces attractive bright red flowers.

(a) Explain why the red mistletoe is **not** considered to be fully parasitic on its host plant.

(b) Red mistletoe is one of three New Zealand mistletoes with an unusual method of pollination. They are pollinated by nectar-feeding birds such as tui. The bird must twist the flower bud to obtain its nectar. This causes the bud to spring open, showering the bird's head with pollen. There is a mutualistic relationship between the tui and the mistletoe.

Discuss the importance of **both** parasitic and mutualistic relationships in the life cycle of the red mistletoe.

In your discussion consider the impact that mistletoe has on other organisms, **both** plant and animal.

(2008,2)

Scientists have found that some plants, when attacked by herbivores, release chemicals that attract animals, e.g. parasitic wasps that prey on the herbivores.

(a) Describe the relationship between the plants and the parasitic wasps.

(b) Explain the advantages that the plants **and** the wasps gain from this relationship.

(c) Mimosa (*Mimosa pudica*) is also called the 'sensitive plant' because its leaves fold inwards when touched. This an example of a nastic movement.

Discuss the possible significance of this nastic movement in mimosa.

(2007,3)

Psyllids are small insects (3–4 mm long) that feed by sucking plant sap. In New Zealand one species of psyllid lives on *Pittosporum* trees.

Ants take honeydew from the psyllids and drive away other insects.

(a) Describe the **relationship** between (i) psyllids and *Pittosporum*, **and** (ii) between psyllids and ants.

(i) psyllids and *Pittosporum*

(ii) psyllids and ants

(b) Describe ONE way in which *Pittosporum* plants could **benefit** from the relationship with ants and psyllids.

(c) Describe the following interspecific relationships in terms of winners and losers, and give an example of each:

(i) **commensalism**

Description:

Example:

(ii) **parasitism**

Description:

Example:

(d) Interspecific competition is common in both plants and animals.

Discuss how **interspecific competition** acts to control the population size of both species involved, in either plants or animals.

In your answer, consider:

- access to / availability of resources
- reproductive success
- maximum population size and include New Zealand examples.