NEW ZEALAND SCHOLARSHIP 2004

ASSESSMENT SCHEDULE FOR BIOLOGY

EVIDENCE AND SUFFICIENCY

Question One

Evidence:

Ecological:

Herbicide tolerant crops (HTC)

- increased use of the herbicides plant is tolerant to (describes ecological impact eg toxic residues in soil, runoff into waterways)
- there may also be a decrease in use of other herbicides (benefit to environment eg more diversity of plants)
- weed resistance may lead to increase in use of other more toxic herbicides (describes ecological impact)
- HTC plants could become weeds in subsequent crops as they become more difficult to eradicate
- less competition for the crop plant as the farmer can spray herbicide at anytime over crop

Insect resistant crops (IRC)

- Should reduce use of insecticides. This is beneficial to environment because:
  - more beneficial insects around as they are not killed by insecticides
  - less impact on food web as not eradicating part of the food chain
- Effect of insect resistant crops on other organisms.
  - possible effect on non target organisms who eat plant (student not expected to have read any research but could hypothesise)
  - possible impact on food web connections from a decrease in insect populations

Evolutionary

Herbicide tolerant crops (HTC)

- increased use of herbicide can result in increase in development of weed resistance to that herbicide either through exposure or through gene flow
- hybridisation (as a result of gene flow) with wild relatives may lead to the development of super weeds in farm or other environments ie weeds that are harder to eradicate
- possible pleiotropic effects of the transgenes or gene interactions may alter traits such as seed dormancy, germination, tolerance to biotic or abiotic stresses leading to increasing weediness or conversely decreasing fitness.
- HTC have a selective advantage in a farm or managed environment where herbicides are used (become a selection pressure).
- no selective advantage for HTC in natural environments (as there are no herbicides in natural environments)

Insect resistant crops (IRC)

- insects are a natural selection pressure so plants resistant to certain insects could have an evolutionary advantage (in natural environments)
- the ability of insects to rapidly adapt to environmental pressures suggests the development of insects resistant to IRC is likely
- possible pleiotropic effects of the transgenes or gene interactions may alter traits such as seed dormancy, germination, tolerance to biotic or abiotic stresses, leading to increasing weediness or conversely decreasing fitness.
- hybridisation with wild relatives (as a result of gene flow) may increase the fitness of wild plants reducing ability of natural predators to control them.

- Use of antibiotic resistance as marker genes could result in spread of antibiotic resistance into bacterial populations through horizontal gene transfer

Performance Level Requirement:
Outstanding Performance – Performance Descriptor 1:
Evidence of coverage of Ecology and Evolution to the level of Descriptor 2 and an evaluation or discussion that shows depth of understanding of the biological concepts and processes involved, through ideas such as:

- recognises that release into the farm environment has different ecological and evolutionary implications from release (escape) into natural environment.
- loss of biodiversity through loss of local species / localised extinctions caused by GM crops able to out compete local plants when growing in the natural environment (this is not the same as losing part of the food web because of IRC reducing insect numbers)
- reduction in genetic diversity - GM crops continue modern agriculture trend of reducing genetic diversity of planted crops (NB selective breeding has been reducing genetic diversity for centuries.)

Performance Descriptor 2
Coverage of Ecology AND Evolution to include:

Ecology

- impact of HTC and/or IRC on chemical usage and the ecological and/or evolutionary impact of the chemical usage
- impact of IRC on food webs or non target organisms and/or HTC on competition between GM weeds and other weeds and/or GM crop becomes a weed

Evolution

- development of pest / herbicide resistance (in weeds sprayed) and the ecological and/or evolutionary significance of this
- gene flow or pleiotropy or gene interactions or selective advantage

Performance Descriptor 3
Coverage of Ecology OR Evolution (from Descriptor 2)

Performance Descriptor 4
Partial coverage of Ecology AND/OR evolution, i.e. ideas only

Question Two (a)
Evidence

Similarities between 79° and 70°, eg
- feeding activity continuous / continues for 24 hours during polar day (summer months)
- feeding activity more intense in summer than in winter
- during times with a definite twilight period, (spring and autumn) feeding activity is predominantly diurnal
- during times with a definite twilight period, (spring and autumn) feeding activity is crepuscular (feeds at dawn and dusk).

Differences between temperatures:
At 79°
- arrhythmic in summer and winter
- had less night-time feeding activity in spring and autumn
- less intense feeding in summer

At 70°,
- arrhythmic during summer only
- during the winter showed diurnal patterns / crepuscular activity (feeds at dawn and dusk)
- had more night-time feeding activity in spring and autumn
- more intense feeding in summer

Performance Level Requirement
Performance Descriptor 2
Compares three seasonal patterns to cover all of:
- identifies one pattern (similarity or difference) in summer activity between the latitudes
- identifies one difference in winter activity between the latitudes
- identifies one pattern (similarity or difference) in spring/autumn activity between the latitudes

Performance Descriptor 3
Compares TWO seasonal patterns from Descriptor 2

Performance Descriptor 4
Identifies pattern for ONE season only

Question Two (b)
Evidence

Animals that show a bimodal diurnal pattern have their activity controlled by two biological clocks – one that controls the time of onset of morning activity and the other controlling the end of evening activity.

Performance Level Requirement
Outstanding Performance - Performance Descriptor 1 (only)
Control by two biological clocks clearly explained

Question Two (c)
Evidence
Recognition comment:

Recognises that food searching activity is more strongly controlled by access to food than light through statements such as:

- birds always anticipated food access irrespective of changes in light regime (supported by experimental evidence) OR
- If light was the stronger zeitgeber then would have seen a change in activity when the timing of the light phase changed (supported by experimental evidence)

And supporting evidence:

- Expt 1 – introduction of PAF (periodic access to food) resulted in transient but fairly rapid shift of evening activity until much closer to morning activity showing that timing of food access is acting as a zeitgeber
- Expt 2 –anticipatory activity prior to food closely followed the timing of PAF despite lights coming on 7h before food becoming available (a light-controlled clock would have been out of phase)
- Expt 3 – lack of significant transient activity following LD delay and precise nature of anticipatory feeding activity supports food-entrained clock. Also peak of activity near end of light phase for a few days that then shifted back towards end of PAF suggests food entrained clock

Performance Level Requirement
Performance Descriptor 2
Recognition comment about light AND food AND supporting evidence

Performance Descriptor 3
Recognition comment about light OR food, but no evidence explicitly referred to

Performance Descriptor 4
Evidence only referred to.

Question Two (d)

Evidence and Performance Level Requirement for Performance Descriptor 1

Answer analyses links between methods of entrainment to food and survival advantages eg

- Because of weak zeitgeber of light (during winter and summer months where there is very little change in photoperiod, while in autumn, photoperiod decreases rapidly) and only periodic access to food during winter months, it is advantageous for birds to be more strongly entrained to food as a zeitgeber to anticipate its availability
- Having food as the main zeitgeber also means a longer feeding period in autumn (when day length is rapidly decreasing) than if controlled by light. This enables better fat stores before winter.
- In spring the birds may stock up on food to facilitate successful reproduction before competitors (other non-resident birds) arrive back.

Evidence and Performance Level Requirement for Performance Descriptor 2

Must account for both food AND light as zeitgebers eg

- Because of the continuous light / dark periods of the year; light not always able to act as a zeitgeber.
- Food is essential for survival at these latitudes (build up of fat layer) so being able to anticipate seasonal food availability to synchronizing feeding to is an important survival mechanism
- Feeding continuously through summer is important to build up fat reserves for winter months.

Evidence and Performance Level Requirement for Performance Descriptor 3

Accounts for food OR light as zeitgebers

Question Three (a)

Evidence and Performance Level Requirement for Performance Descriptor 1

Shows evidence of the ability to see the interaction between environment / ecology and genetics / evolution e.g.

Some candidates may recognise that evolution can result in less not more diversity but that this is still a result of evolutionary processes such as:

- mass extinctions e.g. tuatara.
- stabilising natural selection decreases diversity within a population in a constant environment (acts to remove extremes)

Evidence and Performance Level Requirement for Performance Descriptor 2

Evolutionary theory linked to increase or decrease in diversity in named examples

Answer discusses some or all of the following concepts:

variation in gene pools / sources of variation / competition / natural selection / survival of the fittest / speciation / niche availability / adaptive radiation / common ancestry.

Evidence and Performance Level Requirement for Performance Descriptor 3

Discusses evolutionary theory, but with poor linking.

Evidence and Performance Level Requirement for Performance Descriptor 4

Describes evolutionary concepts