Assessment Schedule – 2009

Scholarship Biology (93101)

Evidence Statement

Question One

Evidence statement

- **Evolutionary processes (E)**

	Evidence		Justification
EN	• Vacant / available / new **n**iches in NZ.	**EN$_J$**	• No mammalian / bat / named animal **competitors** (for the niche) present (not predators).
EG	• **G**eographic isolation through Tasman sea.	**EG$_J$**	• Isolation of gene pool / no gene flow / reproductive isolation allowing speciation / allopatric speciation.
EF	• **F**ounder effect so small numbers / gene pool / gene pool not representative of ancestral population.	**EF$_J$**	• Potential **rapid** spread / increase in frequency of favourable alleles / mutations.
EM	• **M**utation prior to / soon after arrival in NZ allowing for new adaptations for ground dwelling.	**EM$_J$**	• Adaptations for wing folding so they can act as legs for ground movement (though still able to fly).
ES	• Natural **s**election / **s**election pressures for (alleles / adaptations) ground dwelling way of life.	**ES1 $_J$** **ES2$_J$** **ES3$_J$** **ES4$_J$**	• Improved diet as varied (invertebrates, fruit, pollen, nectar) / more energy rich / greater availability throughout the year. • Energy savings as reduced need to fly (so energy can be spent elsewhere eg growth , warmth). • Lack of ground dwelling (nocturnal) predators. • Increased frequency of favourable alleles eg wing folding.
EW	• **Co-evolution** with Wood rose to give mutualistic / beneficial relationship / describes benefits.	**EW$_J$**	• Bat benefits from nectar which is high in energy / nutritious food.

- **Factors for co-existence (F)** ST = short tailed bat; LT = long tailed bat

	Evidence		**Justification**
G	• States / describes competitive exclusion / **G**ause's principle.	**G$_J$**	Niche differentiation to **reduce** interspecific competition / competition between the two bat species.
FACTORS			
F1	• Roosting position in (beech) forest o ST – low / near ground in trees o LT – high in trees.	**F1$_J$**	Reduced competition for space / nest sites.
F2	• Habitat (utilisation) (Fig 1b) o ST – prefers red beech (55 passes per night) o LT – prefers forest edge (110 passes per night).	**F2$_J$**	Reduced competition for food.
F3	• Food preference o ST – adapted to omnivorous diet / wide variety of food / mainly ground feeding o LT – adapted to insectivorous diet feeding in air.	**F3$_J$**	Reduced competition for food / habitat.
F4	• Activity patterns (Fig 2 and 3) o ST – emerges 1.5 hours after sunset (fig 3) and has 2 peaks – one after dusk and one near dawn (crepuscular) (Fig 2) o LT – emerges ½ hr after sunset (fig 3) and has no dawn peak (fig 2).	**F4$_J$**	Differences in emergence and peak activity times reduces competition for food.
F5	• Seasonal activity o ST – Higher activity in winter months than LT bats.	**F5$_J$**	Increased availably / wider range of food for ST compared to LT.

Judgement statement

8	• Four E justified • Competitive exclusion principle justified; three F justified
7	

6	• Three E justified and one E described. • Competitive exclusion principle justified ; two F justified and one F described
5	
4	• One E justified and two E described **OR** two E justified **OR** four E described • Competitive exclusion principle described ; one F justified and two F described **OR** two F justified **OR** 4 F described
3	
2	• Five ideas provided which are relevant to the question.
1	• Some ideas provided which are relevant to the question
0	• No evidence provided which is relevant to the question

Question Two

Evidence statement

- **Genetics and inheritance (G)**

	Evidence		**Justification**
GM	• Mutation produces new allele / lactase persistance.	**GM_J**	• Mutation prevents switching off of lactase producing allele / gene (so lactose still digested in adulthood).
GG	• Mutation occurred in (formation of) gametes.	**GG_J**	• Inherited and enters gene pool.
GA	• Allele is **a**utosomal / not sex linked.	**GA_J**	• On chromosome 2 / not on sex chromosomes.
GE	• **E**pigenetic / **e**nvironmental factor influences expression.	**GE_J**	• Weaning switches off lactase gene.
GD_J	Mutated allele is dominant **linked to:** always expressed when present so individual is lactase persistent / suitable Punnett / description of inheritance of dominant allele (eg only one copy needed).		

- **Role of cultural evolution (C)**

	Evidence		**Justification**
CN	• Mutation neutral at first . **OR** • Mutation selected against.	**CN_J**	• No selective advantage as no dairy farming / milk not drunk post weaning. • Energy not wasted by production of lactase throughout lifetime.
CS	• Mutation selected for / **s**elective advantage.	**CS_J**	• Improved diet as milk (drunk post weaning with dairy farming) is rich in energy / protein / vitamin D so improved health / survival.
CF	• Higher frequency of allele in gene pool in dairy farming areas.	**CF_J**	• Improved fitness / survival of offspring.
CR_J	• Role of cultural evolution is that it is the cultural activity of dairy farming that has provided the selection pressure for the mutation / lactase persistent allele (which is biological evolution).		

- **Reasons for current frequency distribution (F)**

	Evidence and Justification
$FH1_J$ **$FH2_J$**	High frequency of lactase persistence • in (one of) Europe / Nth Africa as these are **the areas where dairy farming developed** and milk drinking became common (as allele selected for) in (one of) Nth America / Australia / NZ as **gene flow** / **high migration** from Europe where dairy farming developed / mutation occurred / high frequency of lactase persistent allele.
$FL1_J$ **$FL2_J$** **$FL3_J$**	Low frequency of lactase persistence • In (one of) Asia / Sth Africa / indigenous peoples of Australia / indigenous peoples of Nth America as these are **areas where no dairy farming developed** (and has still not developed to a large extent) (so no selection pressure for lactase persistent allele). • In Asian / named Asian country as there was **limited gene flow** / **low migration** from areas where dairy farming was developed / mutation occurred / high frequency of lactase persistent allele. In (one of) indigenous peoples of Nth America / indigenous peoples of Australia / American Blacks as little interbreeding with migrants (who had high frequency of allele in their gene pool) OR in American blacks who originated from areas of low frequency of allele in Africa / areas in Africa where there was no development of dairy farming.

Note : not related to modern day dairy farming and / or milk in the diet today.

Judgement statement

8	• Two G justified; three C justified including CR_J; three FH / FL
7	
6	• One G justified and one described; two C justified including CS; three FH / FL
5	
4	• One G justified or two G described; one C justified and one described; two FH / FL Evidence may come from **TWO** areas if well covered eg two G justified and / or two C justified and / or two FH / FL.
3	
2	• Five ideas provided which are relevant to the question.
1	• Some ideas provided which are relevant to the question
0	• No evidence provided which is relevant to the question

Question Three:

Evidence statement

- **Events and processes (E)**

	Evidence		Justification
E1	***Musa acuminata*** **(AA = 22)** ***Musa acuminata*** **(AA = 22)** Non-disjunction in meiosis Diploid Gamete (AA = 22) meiosis (A = 11) Haploid gamete **AAA [triploid / 3N] zygote**	**E1J**	• (Complete) **nondisjunction** in meiosis • **Autopolyploidy** (as same species) • AAA offspring new species as sterile / can't interbreed / asexual reproduction only
E2	***Musa acuminata*** **(AA = 22)** ***Musa balbisiana*** **(BB = 22)** meiosis (A = 11) Haploid gamete meiosis (B = 11) Haploid gamete **AB [hybrid] zygote**	**E2J**	• **Hybridisation** (**not** polyploidy) • AB offspring new species as sterile / can't interbreed / asexual reproduction only
E3	***Musa acuminata*** **(AA: 2n = 22)** ***Musa balbisiana*** **(BB: 2n = 22)** meiosis (A = 11) Haploid gamete Non-disjunction in meiosis (BB = 22) Diploid gamete **ABB [triploid / 3N] zygote**	**E3J**	• (Complete) **nondisjunction** in meiosis • **Allopolyploidy** (as different species) • ABB offspring new species as sterile / can't interbreed / asexual reproduction only

Note if no flow diagram must have a full, logical description of the process

- **Genetic processes (G)**

	Evidence		Justification
G1	• **Mutation**(s) within AAA genome produced variations resulting in different phenotypes (somatic not gametic mutation).	**G1$_J$**	• Different (mutant) phenotypes were asexually propagated becoming the three cultivars .
G2	• Original parents that produced the AAA species had variations in genotype caused by the processes of independent assortment, crossover and recombination, fertilisation.	**G2$_J$**	• Variations were passed on to offspring to give different phenotypes in the AAA species from which the cultivars were developed. (As AAA plants are sterile so any variation had to have occurred in their parents prior to the AAA species being produced through polyploidy.)

- **Experimental factors (F)**

	Evidence		Justification
FB1 **FB2**	Up to two of : • Same species / cultivar • Same age • Same size / shape / SA • Same amount of ripeness.	**FB1$_J$** **FB2$_J$**	• no genetic differences affecting speed of ripening • same degree of ripening at the start • same exposure to ethylene • same amount of ethylene produced.
FI	• Air tight container same size / shape.	**F1$_J$**	• Controlled exposure to ethylene.
F2	• Controlled conditions eg temperature / time / spacing of bananas.	**F2$_J$**	• Would affect rate of ripening / chemical reactions.
F3	• **Wide** range of ethylene concentrations.	**F3$_J$**	• Allows pattern or trend to be made / ensures valid range of IV.
F4	• Record ripeness eg colour / firmness.	**F4$_J$**	• Measurement of DV as appropriate.
F5	• Repeat trials / large numbers per trial.	**F5$_J$**	• Related to reliability of results eg overcome experimental errors / individual differences / outliers / provides more data for application of statistics.
FE	• Sources of error identified (minimum two).	**FE$_J$**	• Related to validity of experiment (experiment measures what it is meant to measure) - results come from varying the concentration of ethylene only (as all other variables controlled).
F6	• Concentration of ethylene includes zero concentration.	**F6$_J$**	• (As a control) to allow comparisons to be made / ensures ripening caused by ethylene.

Judgement statement

8	• Three E justified; one G justified; four F justified and linked to errors / reliability / validity
7	
6	• Two E justified ; one G described; two F justified and three F described **OR** two E justified and I E described; three F justified and two F described
5	
4	• Two E described, one G described; four F described or two F justified **OR** one E justified and two E described; three F justified and one F described. **OR** three E described; one F justified and four F described
3	
2	• Five ideas provided which are relevant to the question.
1	• Some ideas provided which are relevant to the question
0	• No evidence provided which is relevant to the question