**Structured Data Analysis #8**

The water flea (*Daphnia sp*.) normally produces eggs asexually. Under certain conditions, *Daphnia* will switch to sexual reproduction, producing “resting” eggs that can survive dormant for many years.

The graph below shows how the day length and biomass of algae (a food source for *Daphnia*) varies over the course of the year in the habitat of *Daphnia*.



[Source: V Alekseev and W Lampert, *Nature*, (2001), **414**, pages 899–901]

(a) Identify the month during which the quantity of food is at a maximum.

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(1)

(b) Compare the changes in biomass of algae with the changes in day length from January to June.

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(3)

An investigation was conducted to determine how conditions experienced by one generation of *Daphnia* can affect resting egg production by the next generation. The investigation examined the influence of three variables on resting egg production: day length, quantity of food (photosynthetic algae), and conditions experienced by the previous generation.

The table below shows the percentage of resting eggs produced under the various conditions.

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| --- | --- | --- | --- | --- |
| **Conditions experienced by 1st generation mother** | | **Conditions experienced by 2nd generation mothers** | | **Percentage of resting eggs produced by 2nd generation** |
| **Food Levels** | **Day Length** | **Food Levels** | **Day Length** |  |
| High | Short Day | High | Short Day | 0.0 |
|  |  | High | Long Day | 0.0 |
|  |  | Low | Short Day | 52.3 |
|  |  | Low | Long Day | 38.0 |
| High | Long Day | High | Short Day | 0.0 |
|  |  | High | Long Day | 0.0 |
|  |  | Low | Short Day | 13.0 |
|  |  | Low | Long Day | 11.0 |
| Low | Short Day | High | Short Day | 0.0 |
|  |  | High | Long Day | 0.0 |
|  |  | Low | Short Day | 7.5 |
|  |  | Low | Long Day | 15.8 |
| Low | Long Day | High | Short Day | 0.0 |
|  |  | High | Long Day | 0.0 |
|  |  | Low | Short Day | 0.0 |
|  |  | Low | Long Day | 30.7 |

(c) Discuss the conditions in the 2nd generation which favour resting egg production.

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(3)

(d) Using the graph, deduce, giving a reason, whether resting egg production is likely in April.

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(1)

(e) Determine the change between the 1st generation and the 2nd generation which is most likely to trigger resting egg production.

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(1)

(f) Suggest the advantages of having asexual and sexual reproduction in *Daphnia*.

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(3)

(Total 12 marks)

(a) April 1

(b) biomass of algae levels vary / fluctuate more than changes in day length;  
day length gets longer at the same time as biomass of algae increases /   
biomass of algae peaks before the day length peaks;  
from (late) April biomass of algae drops off, while day length  
continues to increase;  
from January to April day length increases linearly while biomass  
of algae increase exponentially;  
in May, biomass of algae reaches a minimum while day  
length continues to rise;  
mid May to June, biomass of algae starts to increase again  
while day length rises to its maximum; 3 max  
*Only credit answers which include a comparison.*

(c) low food (in 7 out of 8 / most cases);  
day length does not appear to show a clear pattern;  
in three of the four groups, low food and short day results in  
resting egg production;  
low food and long day always result in egg production;  
high food never results in resting egg production; 3 max

(d) in April there is high food which does not result in resting egg production 1

(e) high food to low food 1  
*Do not credit "low food" only*.

(f) *Advantages of sexual reproduction*: ***[2 max]***  
sexual reproduction produces resting eggs when food  
conditions worsen / high to low food /   
weather conditions worsen;  
resting eggs remain dormant / survive during bad weather conditions /   
drought / cold temperatures;  
increases chance of population surviving bad weather conditions /   
drought / cold temperatures;  
sexual reproduction increases variety;  
variety increases the chances of the population surviving bad  
weather conditions / drought / cold temperatures;  
day length changes represent seasonal weather changes;

*Advantages of asexual reproduction:* ***[2 max]***  
asexual reproduction faster when weather conditions are good /   
in warmer temperatures / water is available;  
asexual reproduction is faster than sexual reproduction;  
asexual reproduction does not require the need to find a mate; 3 max

**[12]**