

Susceptibility of Stored Food to Insect Infestation

Standards: SCSh 1-5 & 8, SB 4f, SB 5e

Background: Humans desire a safe and nutritious food supply that is free of insect infestation, insect feces, excessive insect parts, and microbes that could be transmitted by insects. A wide variety of beetles have evolved to feed in raw food types and processed foods. "Stored products" include all durable agricultural food types that can be dried and stored in bulk, such as cereal grains, oil seeds and legumes. Recent postharvest losses have been estimated at \$5 billion per year in the U.S., mainly due to insects and microbes. Insecticides can be used to protect raw grain, but few insecticides are labeled for this use and insects are evolving resistance to commonly used insecticides. Researchers at universities and government agencies are looking for alternatives to chemical pesticides (including biological controls) for grain protection and to develop methods of Integrated Pest Management for stored products. Insects have infested stored food products since the beginning of human civilization. Interestingly, many of the pest species found in stored products do not normally occur on wild host plants, but are fully adapted to the storage system. Common storage pests include the red flour beetles, sawtoothed grain beetles and the more serious internal grain feeders such as the lesser grain beetles and rice weevils.

Problem: How well adapted are common stored product beetles to surviving on various stored food types?

Food Products

- Corn
- Cotton Seed
- Peanuts
- Wheat
- Soybeans



Beetles

- Lesser Grain Beetles (LGB)
- Rice Weevils (RW)
- Sawtoothed Grain Beetle (STGB)
- Red Flour Beetle (RFB)



Hypothesis: Make a prediction on which stored food product each type of beetle will survive the best on.

- | | |
|---------------|----------------|
| • LGB - _____ | • STGB - _____ |
| • RW - _____ | • RFB - _____ |

Procedure: Group's assigned food type - _____

- 1) Obtain 12 regular quart size mason jars.
- 2) Measure out and place 200.0 ± 1.0 g of your group's food type in each jar.
- 3) Aspirate and put 25 LGB in 3 different jars. (25 individuals in each jar)
- 4) Label the jars with the beetle type and your group's name.
- 5) Repeat steps 3 and 4 with the other beetle types.
- 6) Place jars in designated area and leave them alone for 2 weeks.
- 7) After 2 weeks, dump each jar out one at a time and count the number of live beetles. (Note: LGB and RW are internal feeders and may have bore inside the food product.)
- 8) Record number of live beetles in "Table 1 – Group Data".
- 9) Calculate the survival rates of beetles for each jar by dividing the number of live beetles in the jar after 2 weeks by the number of beetles that were put in the jar originally and multiplying it by 100.
- 10) Calculate average survival rate for each beetle species.
- 11) Make a bar graph comparing the average survival rates for the different stored product beetles on your group's food type.
- 12) Complete "Table 2 – Class Data".
- 13) Make a bar graph of the class data for the survival rates of the different species of beetles on the various food types.



Results: Complete the tables and graphs below.

Table 1 – Group Data

Food Product - _____				
Type of Beetle	Replication	# of Live Insects After 2 weeks	Survival Rate (%) (# Live / Starting #) × 100	Average Survival Rate (%)
LGB	1			
	2			
	3			
RW	1			
	2			
	3			
STGB	1			
	2			
	3			
RFB	1			
	2			
	3			

Table 2 – Class Data

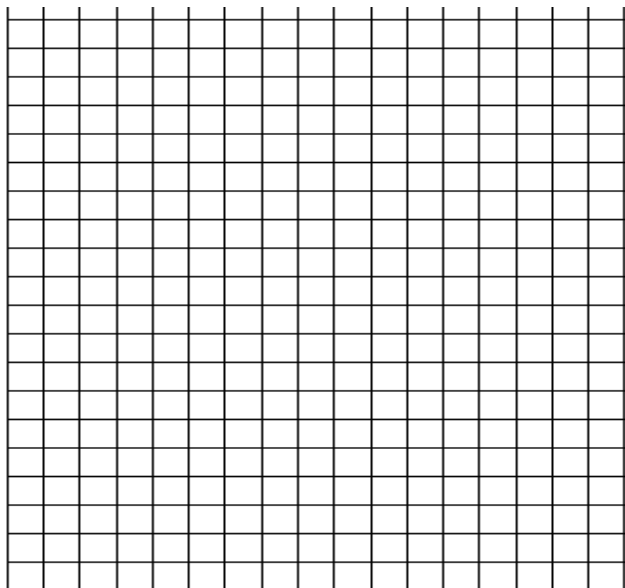
Food Type	Type of Beetle	Average Survival Rate
Corn	LGB	
	RW	
	STGB	
	RFB	
Cotton Seed	LGB	
	RW	
	STGB	
	RFB	
Peanuts	LGB	
	RW	
	STGB	
	RFB	
Soybeans	LGB	
	RW	
	STGB	
	RFB	
Wheat	LGB	
	RW	
	STGB	
	RFB	

Name _____

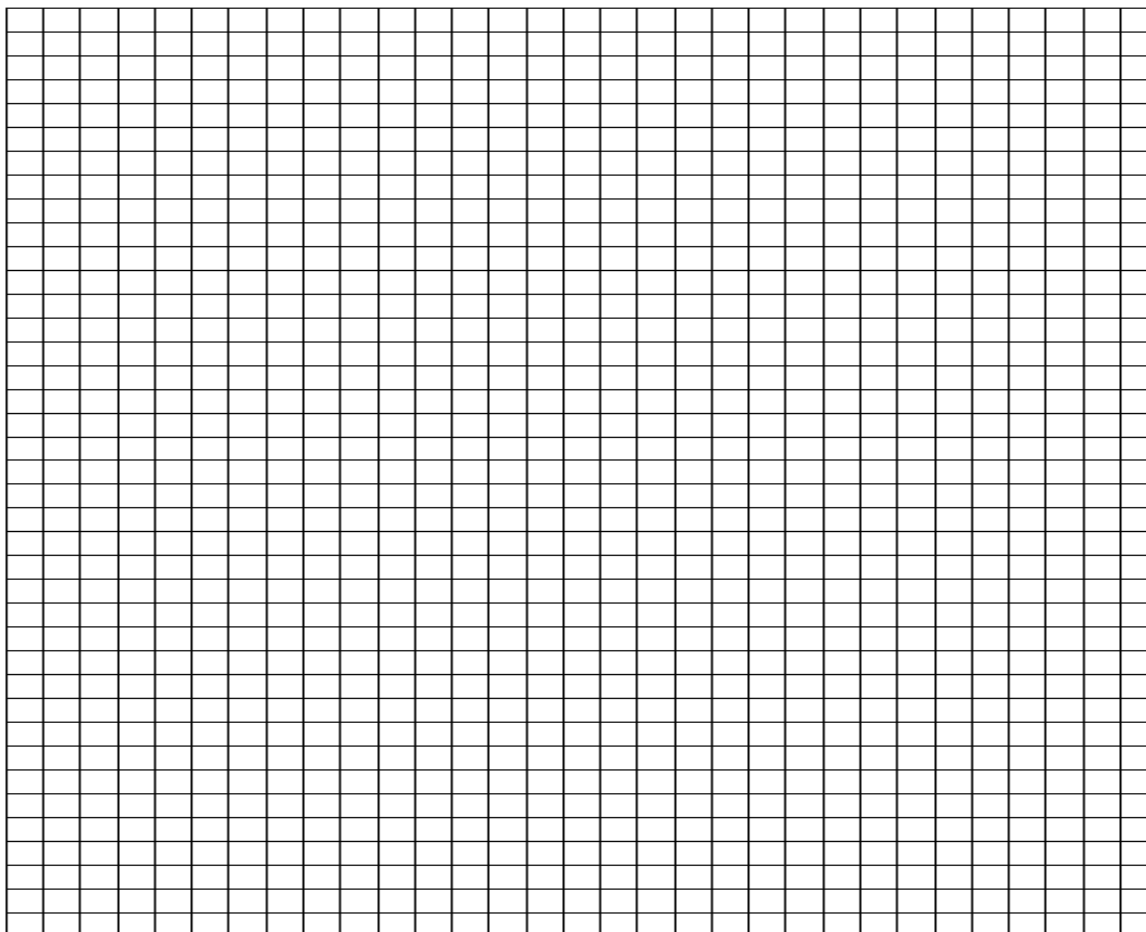
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Conclusions:

- 1) What are “stored products”? _____

- 2) Name 2 stored products that were used in this experiment. _____
- 3) What is the estimated cost of recent post-harvest damage to stored products in the U.S.?

- 4) What are the 2 main causes of post-harvest damage? _____
- 5) Explain 2 problems with using insecticides to protect grain. _____

- 6) What is an alternative to using insecticides to protect grain that researchers and government agencies are exploring? _____
- 7) Many stored food pests have adapted to live in _____.
- 8) Did your group’s results and the class results support your group’s predictions? _____
Explain _____

- 9) What errors could have occurred in this experiment? _____

- 10) How could this experiment be altered to produce more accurate results? _____

