**Super-pest: the evolution if insecticide resistance**

This is a simple dice game that can be used to understand the concept of natural selection and genetic drift. It is intended for K-5 students as a short hands-on activity.

Definitions: **Natural selection** occurs when individuals are favored over others in a population due to greater fitness (survival and reproduction). **Genetic drift** occurs when small populations lose individuals due to chance mortality events.

**Equipment**:

- 100 green, 100 red and 100 blue dice.
- Plastic bins to roll the dice in (ours have a photo of a potato field on the bottom).
- Plastic cup to contain the dice prior to a roll.
- Optional: Poster describing background information
- Optional: Live potato beetles and potato plants

**Conceptual overview**:

Student will participate in two to three different dice rolling experiments. In the first experiment, they will learn how populations go extinct during the process of natural selection. They will use only blue dice (the normal beetles that are susceptible to insecticides). Dice are rolled, the insecticide is sprayed, and beetles live or die. In this round, beetles will gradually decline and eventually go extinct, as the beetles only rarely survive when a 6 is rolled.

In the second experiment, students will learn how more fit individuals (mutants) survive selection events and rise in frequency over time. They will use a mix of blue, green and red dice (susceptible, moderately resistant and highly resistant beetles that survive insecticides, respectively). Dice are rolled, the insecticide is sprayed, and beetles live or die. In this round, blue beetles will gradually go extinct, whereas green and red will increase in frequency. In most situations, only red will remain if enough rounds of dice-rolling occur.

In the third experiment, students will learn about genetic drift. No selection occurs in this experiment (all dice survive if they obtain values of 4, 5, or 6). Students track the change in blue, green and red individuals, which will shift randomly across multiple rounds of dice-rolling.

**Experiment 1 (Natural selection)**: A total of 10-15 blue dice are given out in a cup, and students roll them in the bin.

**Experiment 2 (Survival of the fittest)**: A total of 10 blue dice, 4 green dice, and 2 red dice are given out in a cup, and students roll them in the bin.

**Experiment 3 (Genetic Drift)**: A total of 10 blue dice, 10 green dice, and 10 red dice are given out in a cup, and students roll them in the bin.

**Dice Key:** This table shows the dice fitness values used in Experiments 1 & 2 of this activity.

| Dice description | Represents | Fitness | |
|---|---|---|---|
| | | Beetles survive and reproduce if roll = | Beetles die if roll = |
| Blue dice | Normal beetles | 6 | 1, 2, 3, 4, or 5 |
| Green dice | Moderately resistant beetles | 4, 5, or 6 | 1, 2, or 3 |
| Red dice | Super-resistant beetles | 2, 3, 4, 5, or 6 | 1 |

- If they survive, a dice stays in the game and is duplicated in the next round.