CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Alissa M. Arroyo

Project Number
S2101

Project Title
How Toxic Is Your Nail Polish?

Abstract

Objectives/Goals
Based on what research I have conducted, I believe by using nail polishes that contain one of the three chemicals, known as the "toxic-trio", and comparing the results to that of toxin free labeled nail polish, there will be a distinct similarity.

Methods/Materials
When it came to choosing what nail polishes would fit best for the experiment I decided to pick nail polishes that had at least one of the three chemicals from the "toxic-trio." The first nail polish was a Maybelline brand that contained dibutyl phthalate in which I used as the dependent variable. I then placed 1 drop of the Maybelline, Express Finish, nail polish on a square piece of tin foil and set it down in a mason jar along with 3 crickets. I used a cellular device to time the rate at which all crickets died. I repeated each of the following procedures 3 times making sure to wash the Mason jar with soap after every test run. After recording all results and observations, I then proceeded onto the first variable.

Results
The non toxic labeled nail polish ended up being the variable that had the fastest death rate and the concentration variable had the slowest death rate. To test the concentration variable I took general nail polish and added 1 ml of water to test if that would alter the toxicity of the polish.

Conclusions/Discussion
My hypothesis was refuted by my results.
As the experiment was in progress, I began comparing the results between trial 1 and trial 2 and noticed the outcomes were not matching up what so ever. I focused on the concentration variable where the results for trial 1 came out to be 15 minutes with 36 seconds and trial 2 came out to be 1 hour 30 minutes and 11 seconds. This huge gap in time tells me that there must have been an error in either my procedure or the materials I used.
I used Mason jars as the object in which I would enclose the model organisms. After every variable that was tested, I would wash the Mason jar with soap and water so I can reuse it to test the same variable for a second round. I noted in my observations that some of the crickets that would run to the corners of the glass would get stuck and die. As I was reviewing my results it occurred to me that it#s a possibility the crickets were drowning from the water left in the corners of the Mason jar. Because the crickets drown in any amount of water that is present, the cause of death was drowning and not suffocation of toxins.

Summary Statement
My experiment is about testing whether the use of non-toxic nail polish would have the same toxicity effect as using general nail polish.

Help Received
My cousin helped tranfer crickets into mason jar.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Haripriya Bellam; Suchitra Dara; Sumanth Dara

Project Number

S2102

Project Title

Promoting Sustainable Pest Management with a Beneficial Fungus

Abstract

Objectives/Goals

The major objective of this experiment was to discourage the use of chemical pesticides and increase the use of fungal biopesticides which will improve the enviornmental health. The two goals of this experiment were to:

1. Evaluate the compatibility between an entomopathogenic fungus (Beauveria bassiana) based biopesticide and one fungicide from each of the eight different mode of action groups.
2. Evaluate the potential of increasing the compatibility between the fungicides and the biopesticide by increasing the application intervals.

Methods/Materials

Mealworms were exposed to paper towels treated with B. bassiana and the eight fungicides (Captan, Merivon, Microthiol Disperss, Pristine, Rally, Rovral, Switch, and Thiram) applied from 0-6 day intervals. B. bassiana and the fungicides were applied alone along with an untreated control which was used for comparison. The mortality was observed and recorded everyday for seven days. The assay was repeated for a total of three times, and the results were averaged. The data was analyzed using various statistical procedures, and the impact of time intervals was assessed.

Results

Very few mealworms from the last treatments, the fungicides alone, died. There were only 6 deaths out of a total of 560 mealworms per assay. Because of this negligible amount, we can safely assume that the fungicides had no effect or impact on the mealworms. None of the untreated mealworms died, while all of the Botanigard treated mealworms died. Captan and Thiram had a negative effect on the B. bassiana with a 43% and a 57% average mortality rate, respectively. The other six fungicides had a 96% to 100% mortality in the mealworms.

Conclusions/Discussion

The usage of Captan and Thiram is discouraged as they had the least compatibility with the biopesticide, Botanigard (B. bassiana). Also, the time interval between application of the biopesticide and the fungicide had no affect on the compatibility of the two.

Summary Statement

Investigating the interaction between eight fungicides and a fungus based biopesticide in an effort to promote sustainable pest management.

Help Received

Two other students helped us with this project as well as the supervisor from the UC system.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Alexa Camacho-Sanchez; Lorena Camacho-Sanchez

Project Number
S2103

Project Title
Are Vegetables Safe to Eat?

Abstract

Objectives/Goals
The objective is to see the effect that pesticides have on plant growth.

Methods/Materials
10 organic garlic, 10 conventionally-grown garlic, 10 organic potatoes, 10 conventionally-grown potatoes, and 10 organic avocado seeds and 10 conventionally-grown were bought from a local supermarket, planted, measured and observed during a 9-week period.

Results
Although the potato plant died within a week, both the garlic and avocado were able to grow. The organic garlic was taller and grew faster than the conventionally-grown garlic, and looked greener and healthier as well. 4 out of the 10 sprouted within the 9-week period reaching a height of 7.04cm, while only 1 conventionally-grown avocado grew, only reaching an average height of .82cm.

Conclusions/Discussion
Many state that using pesticides on vegetables does not harm the food. With this in mind, we decided to compare organic vs. conventionally-grown vegetables, which are found in the local supermarket and sprayed with pesticides while growing them. If indeed pesticides did no harm to the vegetable, then they would grow at about the same height and rate as an organic plant, a statement not supported by the experiment.

Summary Statement
With many stating that the use of pesticides does not harm vegetables, we decided to compare organic and non-organic vegetables, which, if indeed pesticides do no harm to the plant, should have grown around the same height and rate.

Help Received
Mom bought all the materials needed.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Talie L. Cloud

Project Number

S2104

Project Title

The Effects of Momordica charantia on the Reproductive Rate of Drosophila melanogaster

Abstract

Objectives/Goals

The purpose of the science fair project is to investigate the long term effects of bitter melon seed on the Reproductive rate of the Drosophila melanogaster. The hypotheses stated that as the concentration of bitter melon seed increased, the reproductive rate of the Drosophila melanogaster would decrease. The third generation of bitter melon fruit flies, when placed in control food, would yield a similar fecundity to the same concentration of bitter melon fruit flies that continued to receive bitter melon food for the fourth generation.

Methods/Materials

In order to harvest the bitter melon seed, scoop the seeds out of the melons and grind them into a paste using a mortar and pestle. Create the concentration solutions by creating a control, a 2.5%, and a 5% concentration group. To create the medium, add equal parts of the concentration mixture of water and bitter melon to the instant Drosophila medium. After creating the food, placing it into marked vials, and adding 5-7 grains of yeast, anesthetize and sex 360 fruit flies. Place 3 males and 3 females in each vial. Repeat these step for three generations of 14 days each before creating the final generation groups where half of the fruit flies with a history of bitter melon are placed in bitter melon concentration once again and half are placed in control food for the final generation.Count the fecundity after the 14 day final generation and conduct statistical analysis to find results.

Results

The 5% concentration group had the smallest average fecundity of 14.1 fruit flies whereas the control had the greatest reproductive fecundity of 95.95 fruit flies. The 2.5% bitter melon group had a fecundity of 27.8. After statistical analysis, there was no significant difference in the reproductive rates of the fruit flies that received bitter melon for the final generation and those that received control food for the fourth generation.

Conclusions/Discussion

As the concentration of bitter melon increases, the reproductive rate of the Drosophila melanogaster decreased. As for the different food mediums within each concentration group, there was no significance between the the reproductive rate of those placed in control and those placed in the concentration group for the final generation. This fact is important because it indicates that Momordica charantia effects the genetic sterility of the fruit fly and leads to the evolution of the population.

Summary Statement

This project is a study on the effects of bitter melon on the reproductive rate of the fruit fly after four generations of exposure.

Help Received

Teacher helped supply materials, Parent helped Purchase Board

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Hunter C. Crawford-Shelmadine

Project Number
S2105

Project Title
Sunscreen: Friend or Foe? The Effect of Coppertone and Reef Safe Biodegradable Sunscreen on Ghost Shrimp

Abstract

Objectives/Goals
The objective is to determine the safety of sunscreen containing Oxybenzone as compared to reef safe biodegradable sunscreen on marine life by testing how each sunscreen affects the activity level of Ghost Shrimp.

Methods/Materials
Ten environments, 5 with Coppertone (5) & biodegradable Badger (5) sunscreen with varying percentages of sunscreen, were mixed in a pint size glass with a drawn grid. (control-no sunscreen, .001%, .005%, .01%, .05%). One Ghost Shrimp was placed in the Coppertone Control and a count of how many quadrants into which it swam during a 5 minute period was recorded. That same shrimp was moved into the other four Coppertone solutions recording the number of quadrants into which it swam during a 5 minute period. The same process was repeated with the Reef Safe sunscreen. Two independent trials were run.

Results
I ran two trials, collecting data on a total of 22 shrimp in the Coppertone and Reef Safe environments. The results of the two Coppertone trials were the same. As the % of sunscreen increased, the activity level for each shrimp decreased. In the Badger environments, there was random variation. As the shrimp moved into increasingly saturated solutions, the activity level alternated: increase, decrease, increase, decrease. When comparing the activity level between the Control and .05% solution, 82% of the shrimp showed a decrease in activity in the Coppertone as compared to the Badger environment, where only 45% of the shrimp showed a decrease in activity. When the ghost shrimp completed one cycle of testing, they were released into an aquarium to live out their natural lives.

Conclusions/Discussion
As the concentration of the Coppertone sunscreen increased, there was a linear correlation of decreased activity level in Ghost Shrimp. When the concentration of Badger Reef Safe sunscreen increased, it did not have a causal effect on the activity level of the Ghost Shrimp. In fact, my results suggest that the Reef Safe sunscreen did not have any effect on the activity level of the Ghost Shrimp, whereas the Coppertone solutions had a direct negative effect on the activity level of the Ghost Shrimp.

Summary Statement
This study compares the effects of Coppertone sunscreen containing Oxybenzone to Badger reef safe biodegradable sunscreen and how they each affect the activity level of Ghost shrimp.

Help Received
My mom helped with the logistics of aquiring supplies and setting the timer during the experiments.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Ivann U. De La Cruz

Project Number
S2106

Project Title
Return of Cacti's Worst Enemy: Combating Wild Grana Cochineal

Abstract

Objectives/Goals
Objective: To find an efficient mixture that can exterminate Wild Grana Cochineal then protect cacti from being plagued again for the longest amount of time. I think the alcohol and liquid soap mixture will be able to do this best due to their toxic properties if ingested, and because of last year#s results.

Methods/Materials
Procedure: I sprayed the insects directly with the mixtures in an effort to exterminate them with the mixture alone. Then I sprayed the entire plant every time new plague appeared to make sure the cacti had a coating that would theoretically protect it from new cochineal.

Results
I sprayed the insects directly with the mixtures in an effort to exterminate them with the mixture alone. Then I sprayed the entire plant every time new plague appeared to make sure the cacti had a coating that would theoretically protect it from new cochineal.

Conclusions/Discussion
Conclusion: The alcohol and liquid soap mixture was the mixture that exterminated the parasite efficiently constantly protected the cacti from being infected again for the longest amount of time. The mixture was all safe as they did not affect the cacti internally, did not alter growth, and the cacti was deemed safe to eat. They were also easy to use, effective, materials can be obtained at a reasonable cost, and with the shortage in water, it replaces well known (although less effective) mixtures.

Summary Statement
Creating a safe insecticide to combat Wild Grana Cochineal

Help Received
Mother helped me wash and maintain cacti.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Lekha Duvvoori

Project Number
S2107

Project Title
Chemical Detection Applied to Formaldehyde as a Marker for Wider Chemical Contamination

Abstract

Objectives/Goals
Formaldehyde is a known hazardous compound and a human carcinogen. Over the last few years, it has been found in household goods such as furniture and textiles. The harmful nature of formaldehyde will be demonstrated in the growth of bean plants.The potential levels of formaldehyde in food packaging may be high enough to be concerned about. Food packaging is made from a wide variety of papers and plastics as well as printing inks. If formaldehyde is found, it could be a marker for the presence of other chemicals.
Hypothesis
There will be a detectable amount of formaldehyde in the range of food packaging and textiles, domestic and imported, that are tested.

Methods/Materials
A variety of food packaging was tested to see of there was detectable presence of formaldehyde. Over fifty samples were collected from a large range of packaging, both from the USA and imported from multiple countries. A method involving a chemical detector was used to take a quantitative color reading. If any packaging tested positive for the presence of formaldehyde then it was retested. Bean seeds were exposed to formaldehyde and the growth of each bean plant was measured in centimeters.

Results
Positive samples showed a range of amounts of formaldehyde. Overall, 14.2% of samples tested were positive. None of the ten bean seeds given formaldehyde germinated.

Conclusions/Discussion
As was hypothesized, there was a detectable amount of formaldehyde in sampled food packaging. This quantitative, color based formaldehyde test can be used as a marker to determine the presence of other hazardous chemicals in food packaging and household items. Further testing could determine what level of formaldehyde is toxic, and whether formaldehyde leaches into foods. In the future, testing for formaldehyde can be broadened to a larger sample size and different household items. Since studying food packaging is a surprisingly new area, this work can be built upon, with testing for a range of other chemicals. More testing for the effects of chemicals at low levels, but in combination could also be done.

Summary Statement
A variety of food packaging and clothing was tested for the presence of the known carcinogen formaldehdye, demonstrating a new concern for food safety.

Help Received
Science Teacher Ms. Kiest for design and editing; Mother for assistance with board and obtaining testing materials.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Manjot Kaur; Sophia Lau

Project Number

S2108

Project Title

Effect of Metal Pollutants on Algal Growth under Oceanic Conditions Measured by the Resulting Chlorophyll Concentration

Abstract

Objectives/Goals

Oceanic metallic pollutants make it important to examine the effect on marine life. This project focuses on an essential building block in the aquatic food chain, algae, and explores effects of metal cations on marine algal growth and chlorophyll production.

Methods/Materials

The pollutants tested: chloride compounds of potassium, copper, zinc, cesium, and aluminum. 6 triplicates were created: 1 control with water and 5 with equal concentrations of the cations with algae. Potassium and zinc were hypothesized to be favorable because of their known presence and benefits in various lifeforms. Using spectrophotometry, transmittance readings were taken daily to measure growth. To measure chlorophyll, the triplicates were crushed and dissolved in acetone, and chlorophyll density was measured with a spectrophotometer.

Further zinc chloride tests were conducted at varied, smaller concentrations. The original molarity was diluted by 1/10s to create 9 new quadruplicates. Growth and chlorophyll production were evaluated with a spectrophotometer.

Results

Experiment 1: growth-wise, on average, copper chloride excelled (1.44%). However, aluminum chloride was lacking (1.12%). The test tube producing most chlorophyll was zinc chloride (94.60%). The solution with the least chlorophyll was cesium chloride (98.80%).

Experiment 2: growth-wise, on average, molarity 1 excelled (14.95%). Molarity 8 was the concentration at which the most chlorophyll was produced and had lowest transmittance reading of 52.00%

Conclusions/Discussion

Discrepancies where chlorophyll production differs from optical density imply that although the algae is multiplying, it#s unable to properly conduct photosynthesis and produce chlorophyll.

The heavy ratio of cations to algae were unfavorable towards growth and chlorophyll production. Control in experiment 1 excelled more than the polluted trials due to intracellular toxicity hindering growth/chlorophyll production. Although the zinc chloride trials indicate that heavy concentrations of zinc chloride don't allow for steady growth compared to the control, a small amount of the metal (molarity B) can benefit chlorophyll production. The investigations suggest high concentrations of heavy metals are detrimental to algae, but microconcentrations of these metals are essential for algal growth.

Summary Statement

This investigations measures the effects various metal pollutants have on the photosynthetic growth of marine chlorella algae under replicated oceanic conditions based on the resulting concentration of chlorophyll.

Help Received

Advise was given by our science teacher; Equipment from the science department were taken advantage of.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Samuel Z. Lang

Project Number
S2109

Project Title
Camelia sinensis Extracts: Potent Alternative Snail/Slug Repellents

Abstract

Objectives/Goals
This is my 6th year of ongoing annelid and mollusc science experiments. I previously discovered that high concentrated tea waste leave (TWL) is a potent toxin to worms/snails/slugs; TWL is more effective than conventional metaldehyde/carbamate baits and metallic copper. I have been developing repellent trays for local application of TWL as an environmentally friendly repellent. This project involves: 1) A final comparison of TWL with coffee afterbrew, beer, Diatomacous Earth, (DE), NaCl to find the most effective repellent; 2) Identification of the most effective dilution of TWL for practical economic application: 3) A systematic breakdown of possible toxic rmolecules / colligative properties of tea, including pH, caffeine, saponins, and possibly tannins.

Methods/Materials
Part 1: Repellent Tray is used for island effect tests - inverted pest-plant-barrier scenario with pests in a safe haven encircled by repellent zone (filled with a thin layer of tested substance), surrounded by seedlings.
Part 2: Prepare various dilution of TWL, then test pests in direct contact(dc).
Part 3: Analogous concentrations prepared with water, diluted, and tested in dc. Repellent efficacy evaluated by pest mortality, escape rate, and damaged plant ratio.

Results
TWL had most mortalities, nearly no escapes or plant damage. While NaCl caused rapid dehydration, some pests escaped and damaged plants, and some salt-damaged pests were revived in water. Although fresh beer caused some deaths, it lost potency as it became stale, allowing pests to ecape beer easily. Both coffee and DE have mild repellent effect. Pests could escape coffee with ease, but struggled while passing DE.
Part 2: as TWL dilution increased, pest escape rate increased.
Part 3: testing thus far has found no correlation between pH and lethality. Analogue solutions w/high concentrations of caffeine caused paralysis, vastly different from TWL reaction. Saponin analogue solutions display similar effects to those observed with TWL.

Conclusions/Discussion
1) TWL (red & green) were the most effective tested molluscicides, with higher mortality and lower escape/plant damage rates than any other substance tested.
2) The most effective dilution of TWL seems to be the 1/2 high concentrated TWL, to avoid escape.
3) Both pH and caffeine lack correlation with TWL lethality.

Summary Statement
This project compares the Camelia sinensis extract to other alternative repellents/molluscicides, evaluates possible active ingredients, and determines the lowest effective dilution.

Help Received
Advice from Professor Yan Xu of CSU Ohio, used some lab equipment under supervision of Dr. Sandusky in CSUB Chemistry department, parents aided in purchasing some equipment for home testing and providing moral support.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Henry G. Low

Project Number
S2110

Project Title
Assessing the Mutagenicities of Common Herbicides Using a Novel Reverse Mutation Assay

Abstract

Objectives/Goals
The purpose of this research project is to assess the mutagenicities of three major herbicides: 2,4-D, atrazine, and trifluralin, in an effort to determine if the substances are carcinogens. In the process, this project also aims to establish an efficient and novel assay that utilizes the bacterial strain, E. coli WP2 uvrA pKM101, to identify carcinogens.

Methods/Materials
This project incorporated a reverse mutation assay to quantitatively measure the mutagenicities of the herbicides. The utilized strain, E. coli WP2 uvrA pKM101, has a mutation in the trp operon and thus cannot grow or reproduce. When placed in a petri dish, the bacteria will only form colonies if they undergo reverse mutations in their trp operons. Mutagens increase the likelihood of these reverse mutations. Therefore, using this assay, I quantitatively assessed the mutagenic effects of the herbicides on the bacteria by analyzing the resulting bacterial growth. Three concentrations of each herbicide were tested, providing data to help determine whether the substances are carcinogenic. In addition, the assay was tested on two known carcinogens, 4NOP and MMS, to ensure that the procedures were functioning properly.

Results
2,4-D demonstrated no mutagenic effects on the E. coli WP2 bacteria, while atrazine and trifluralin both produced mildly mutagenic effects, with atrazine displaying the strongest evidence of mutagenicity. In addition, both trifluralin and atrazine revealed a positive correlation between substance concentration and average colony count, indicating that concentration has a role in mutagenicity. Atrazine, in particular, demonstrated a near linear positive correlation.

Conclusions/Discussion
The results indicated that 2,4-D has a low mutagenicity while atrazine and trifluralin both have mild mutagenicities. They possess the ability to increase the reverse mutation frequencies in E. coli WP2 bacteria and thus have potential to cause mutations in human cells. This data provides valuable insight into the nature of these herbicides. Furthermore, I established an efficient and safe assay for identifying mutagens in a standard laboratory environment. This assay can potentially be used to detect a broad range of mutagens that induce base-pair substitution mutations. It can also be used in conjunction with other protocols to comprehensively assess the mutagenic and carcinogenic effects of various substances.

Summary Statement
My research project assessed the mutagenicities of three major herbicides using a novel reverse mutation assay that I established as an improvement over existing protocols.

Help Received
Research was conducted in American River College under the supervision of Dr. Kenneth Kubo and in William Jessup University under the supervision of the lab technician, Mr. Paul DeCoux.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Zach Magidow; Lauren Waldman

Project Number

S2111

Project Title

Oxidative Stress Induced by Various Glutamic Acid Concentrations in Carassius auratus auratus

Abstract

Objectives/Goals

The objective of this experiment was to detect if prominent alcohol and drug use caused a change in cellular enzyme activity and oxidative stress in fish hippocampus tissue.

Methods/Materials

Feeder fish were subjected to various concentrations of glutamic acid, an excitatory neurotransmitter that is increased when illicit drugs and alcohol are used. Samples were taken out at 24, 48, and 72 hours and the brain tissue was weighed and homogenized. The tissue sample was then analyzed by using data from a catalase calibration curve and the units of catalase were determined by using a gas pressure sensor detecting the average change in kPA due to oxygen production from the catalase reaction.

Results

The brain tissue with the highest concentration of glutamic acid had the lowest concentration of catalase at 0.958 units after 72 hours, compared to the lowest concentration of glutamic acid, which had 15.536 units of catalase after 72 hours.

Conclusions/Discussion

Oxidative stress is defined as a disturbance in the balance between the production of reactive oxygen species, or free radicals, and the coinciding antioxidant defenses. Excess hydrogen peroxide and free radicals can cause damage to cellular lipids, proteins, and DNA without antioxidant enzymes, such as catalase. This free radical damage reflects the biological system#s inability to readily detoxify the reactive molecules and repair the resulting damage to cell organelles. Oxidative stress can be caused by catalase deficiency, as shown in this experiment. Catalase deficiency can cause a multitude of disorders, such as type II diabetes, aging, and vision loss. Additionally infantile lipoprotein oxidation is an effect of catalase deficiency and oxidative stress due to maternal use of drugs or alcohol, which can be lethal to babies and small children.

This experiment made a clear connection between alcohol and drug abuse and catalase deficiency. This is another reason to teach the general public about the dangers of substance abuse, because it can cause free radical damage due to low catalase activity in tissue and individual cells. Symptoms of free radical damage, such as the aforementioned diabetes, faster aging, and vision loss, and even diseases passed to offspring, can now potentially be symptoms of substance abuse.

Summary Statement

This project tests to see if alcohol and drug use cause changes in enzyme activity and oxidative stress.

Help Received

No help was used.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Zoe Marsh; Maxwell Menke

Project Number

S2112

Project Title

The Effects of Agricultural Runoff on Peifytic algae

Abstract

Objectives/Goals

The objective is to find if and at what concentration is algae affected by both pollutants.

Methods/Materials

We made a half series dilution for six different concentrations of both glyphosate and nitrogen fertilizer. There was six trials for each concentration. A small amount of algae was added to each concentration, and the results were observed.

Results

There was a significant difference in growth between the control and all concentrations of glyphosate indicating that it maybe dangerous to algae. The nitrogen fertilizer stimulated growth only in low concentrations, higher concentrations decreased the growth in algae.

Conclusions/Discussion

This suggests that Agrocultural runoff maybe harmful the the ecosystems of fresh water lakes and streams.

Summary Statement

We are testing the effects of agricultural run off on perifytic algae for its potentially harmful effects on an ecosystem.

Help Received

Our teacher Daisy Sharrock and our mentor Dr. Ed Parnell helped greatly with our project. Andrew Lerario and Jeff Lohman gave some donations of necessary supplies for the project including a Spectrophotometer, flasks and a grow light.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Macy Matsukawa; Edward Segura; Esmeralda Suarez

Project Number

S2113

Project Title

The Effect of Ascorbic Acid on Alcohol Exposed Bovine Biological Catalysts

Abstract

Objectives/Goals

Our experiment was to determine if different durations of ascorbic acid exposure positively affects a liver's enzymatic activity after being previously exposed to alcohol.

Methods/Materials

The materials used for the experiment were beef liver, isopropyl alcohol (50% concentration), hydrogen peroxide (3% concentration), water, round vial with a rubber stopper, filter paper discs, Vitamin C tablets and a graduated cylinder (100 milliliters). We carried out this experiment by forming a catalase solution in which the liver was macerated after it was submerged in the alcohol and then in the ascorbic acid solution. Then, we soaked the paper discs in the catalase solution and allowed the biological catalysts to react with the hydrogen peroxide within the reaction chamber. The reaction occurred under water. We determined the enzymatic activity based on the oxygen produced from the reaction.

Results

The longer the liver was exposed to ascorbic acid, the higher the oxygen volume the liver produced. According to the results, the liver that was exposed to vitamin C for 60 minutes reached an oxygen volume of 43 mL, while the liver that was exposed to vitamin C for 20 minutes reached an oxygen volume of 30 mL. In contrast the liver that was only exposed to alcohol for 60 minutes reached an oxygen volume of 22 mL, and the liver that was only exposed to alcohol for 20 minutes reached 26 mL. This showed that as the exposure to alcohol increased the oxygen volume decreased.

Conclusions/Discussion

The results of the experiment did support the hypothesis. The liver that had been previously introduced to alcohol and then exposed to ascorbic acid had an enzymatic activity that proceeded at a much higher rate, in comparison to a liver that was less exposed to the ascorbic acid. As the exposure of ascorbic acid increased, the more enzymatic activity the liver was able to perform. Metabolism of alcohol predominantly occurs within the liver and as a byproduct; free radicals are released. As these molecular fragments are released, they interfere with other molecules by denaturing proteins; thus inhibiting enzymes, and interfering with molecular bonds. From our data it was evident that the proteins that denatured due to free radicals had folded back into their native conformation based on the enzymatic activity of the bovine liver from the exposure of ascorbic acid.

Summary Statement

To determine if different durations of ascorbic acid exposure will affect a liver's enzymatic acitivty after it has been exposed to alochol.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Eveline S. Mayner

Project Number

S2114

Project Title

Is Sugar Killing You? The Effects of Sugar and Aspartame on the Longevity of C. elegans

Abstract

Objectives/Goals

Diabetes and obesity are affects millions of Americans each year. The objective of my experiment was to determine if Equal brand aspartame would be a viable dietary substitute for glucose by studying how it impacts the longevity of C. elegans.

Methods/Materials

C. elegans share key genetic traits with humans. The experiment varied concentrations of glucose and Equal brand aspartame to levels shown by previous studies to produce the intracellular concentration found in poorly managed diabetic patients of 40mmol/L (G40 and A40) and half of the diabetic patient level of 20mmol/L (G20 and A20)

Five groups of N2 strain C. elegans were stored at 20 degrees Celsius on Fluorodeoxyuridine (FUDR, an additive that prevents progeny) agar plates with different concentrations of glucose and aspartame. Each treatment had about 75 to 100 worms on five different plates. The groups were labeled and studied in longevity trials by checking for movement.

Results

The average lifespan of the C. elegans decreased with the increased concentration of glucose. Equal brand aspartame at the 20mmol/L concentration actually caused a more drastic mean lifespan that of the glucose at double the concentration (40 mmol/L). However, the aspartame 40mmol/L treated c. elegans had a lifespan that was similar to the control group and therefore was not considered significant (P=0.7491). This suggests that the Equal brand aspartame had detrimental effect but an inversely proportional relationship between concentration and decreases in lifespan, a counterintuitive relationship which should, and will, be investigated further.

Conclusions/Discussion

Glucose consumption was shown to decrease the lifespan of C. elegans and as concentration of glucose increased, longevity is decreased further. However, the Equal had more acute negative effects than glucose of the same level, but interestingly as concentration of aspartame was increased, the effect was less detrimental. This is an interesting relationship that I hope to explain in future studies involving the diffusion rate through the cuticle of the worm at different molarities. This data suggests that glucose should be consumed in moderation and that aspartame has un-interpreted health effects and should be consumed with awareness of possible repercussions.

Summary Statement

This project tested the impact of sugar and Equal brand aspartame on the longevity of C. elegans.

Help Received

Used lab equipment at UCSB under the supervision of Andrew Swafford and Dr. Joel Rothman.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Thomas McDonald; Sara Moss

Project Number

S2115

Project Title

The Effect of Nicotine on Tau Protein in Artemia salina

Abstract

Objectives/Goals

Due to the fact that Tau protein failure has been linked with the disease Alzheimer#s, and in-taking nicotine has become so prominent, this experiment has been designed to better understand if nicotine itself could make the Tau proteins become unstable leaving them without the ability to stabilize microtubules, therefore playing a role in the development of Alzheimer#s.

Methods/Materials

Brine Shrimp Grade A Eggs
Hatching Dish
NaCl
Nicotine 1000 ppm solution
Tubulin Green Fluorescent Protein
Incubation Station + Shaker
Microscope 400X Total Magnification
Microscope Photo Program

Artemia were grown in a standard medium in a hatching dish and were then kept at room temperature in a stable environment for later testing. Samples of the brine shrimp were exposed to different concentrations of nicotine in the range of 0 ppm (our control), 5 ppm, 10 ppm, 20 ppm, 50 ppm, 75 ppm and 100 ppm for different time periods. Nicotine treated samples and control were analyzed under a 10X microscope for microtubule destabilization signifying tau protein change with Tubulin Green Fluorescent Protein.

Results

The increase in nicotine concentration proved to cause the cells cytoskeleton to disintegrate, and seen in these disintegrated cells were green fluorescent spots. These fluorescent patches show that the microtubules had become unstable causing the cytoskeleton to break apart. This expression showed that the tau protein were no longer stabilizing microtubules.

Conclusions/Discussion

Tau proteins job is to stabilize microtubules therefore, the nicotine is preventing them from doing this job showing that nicotine has a negative effect on microtubule stabilization. This research relates to the disease Alzheimer's, when tau protein becomes abnormal they tangle and then fall apart which causes nutrients to no longer move throughout the brain cells causing death to these cells. In this research it was seen that tau protein had become abnormal (possibly causing them to fall apart), leaving the microtubules unstable therefore showing that nicotine could play a role in the development of Alzheimer's.

Summary Statement

This project's purpose is to understand the effects of nicotine on tau protein to determine if intake of nicotine over one's lifetime could potentially lead to the development of Alzheimer's disease.

Help Received

Parents helped purchase necessary materials; Advisor supported the group throughout the project by opening the labs on weekends and more.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Aditi Mittal

Project Number

S2116

Project Title

Coral Bleaching by Sunscreens: Effect of Sunscreen Chemicals on the Survival of Coral Symbiont Zooxanthellae Algae

Abstract

Objectives/Goals

Corals have a symbiotic relationship with the algae zooxanthellae, which carry out photosynthesis on the coral, providing the reef with essential sugars, lipids, and oxygen. Coral bleaching occurs when the zooxanthellae die, causing the reef to become white. The project was done to test if sunscreen chemicals have an effect on the viability of zooxanthellae, and if there is a difference in toxicity of active ingredients in mineral-based sunscreen and chemical-based sunscreen. I hypothesized that oxybenzone, an active ingredient in chemical-based sunscreens, is more toxic to zooxanthellae than zinc oxide, an active ingredient in mineral-based solutions. Higher concentrations of the solutions will lead to a higher mortality rate of the zooxanthellae.

Methods/Materials

Varying concentrations of sunscreen active ingredients were prepared in a 22 g/L saltwater stock solution. 1 mL of each sunscreen solution was combined with 1 mL of zooxanthellae in solution, and added to a well in a welled plate. After this dilution, the solution concentrations were: 10 mg/L, 25 mg/L, 50 mg/L oxybenzone; 50 mg/L, 125 mg/L, 250 mg/L zinc oxide. The experiments were done in triplicate. The welled plates were kept in a 25˚C room under a 12-hour/day timed lamp, for 0 to 3 days. A hemacytometer was used to count alive and dead algae at each time point.

Results

Normalized results showed that oxybenzone and zinc oxide had similar impacts on zooxanthellae mortality. Standard deviation in each concentration of both ingredients overlapped with or were very close to the other concentrations, indicating that higher concentration had no significant effect. Longer exposure to all sunscreen solutions showed increases in algae mortality. The sunscreen ingredients, regardless of type and concentration, activated dormant viruses in zooxanthellae by inducing the lytic viral cycle, killing the algal cells.

Conclusions/Discussion

My hypothesis was not supported, as both ingredients had similar toxicity, and higher concentrations had similar effects as lower concentrations. Although mineral-based sunscreens may be less harmful to humans, they are still harmful to zooxanthellae, and in turn, corals.

Summary Statement

I tested the effects of two sunscreen chemicals on the survival of zooxanthellae, an algal species symbiotic with coral, to see how sunscreen that leaches into the ocean affects coral bleaching.

Help Received

Teacher supervised; Presentation High School paid for materials; father helped with experimental setup

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Matthew S. Moser

Project Number

S2117

Project Title

The Metalloprotease Inhibitor, 1,10-Phenanthroline, as a Lead for Finding Drugs to Kill Brugia pahangi Worms

Abstract

Objectives/Goals

The objective of my project was to inhibit the proteolytic enzymes of adult and microfilariae Brugia pahangi using protease inhibitors to see if protease inhibitors could kill these parasites.

Methods/Materials

I tested various classes of protease inhibitors (serine, cysteine and metalloprotease) on the adult and microfilarial stage of Brugia pahangi as well as on the adult and larval states of Caenorhabditis elegans. The worms were incubated in 24-well plates with media (RPMI for Brugia and M9 for C. elegans). The inhibitors were added in high and low dosages. The survival of the adult Brugia worms was quantified using a #Worminator#, while the small worms (microfilariae and C. elegans) had their survival rate recorded visually using a microscope. I used a scale from 0 to 5, with 0 = dead and 5 = very active.

Results

The metalloprotease inhibitor, 1,10 Phenanthroline (1,10 P) caused the greatest mortality on the adult Brugia at high (120uM) and low (24uM) concentrations within the first 24-hours of the assay. The microfilariae were not only killed by 1,10 P drug but also with high concentrations of a cysteine protease inhibitor, K11777. The low concentration did not have any effect on the microfilariae. C. elegans adults and larvae were killed by high concentrations of 1,10 P.

Conclusions/Discussion

Overall the metalloprotease inhibitor 1,10P had the greatest effect on both the parasitic worm, Brugia and the free-living nematode, C. elegans. For a further study, I looked through the ZINC database for any drugs that a similar compound structure as 1,10 P. There was only one drug that had a similar chemical structure to 1,10 P and I would be interested in investigating this drug, as well as other metalloprotease inhibitors, on the worms to determine if they could be a potential anti-parasitic drug for lymphatic filariasis.

Summary Statement

My project tested different protease inhibitors on Brugia pahangi adult and microfilariae to see if these compounds could kill the parasite.

Help Received

Dr. Judy Sakanari at UC San Francisco helped mentor me; Used lab equipment in her lab under her supervision

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Cassandra E. Overney

Project Number

S2118

Project Title

Genotoxicity Investigation by Measuring the Effect of Metals on Garlic Bioassays by Observing Chromosomal Aberrations

Abstract

Objectives/Goals

The purpose of this experiment is to study how metal contamination impacts biological organisms at a cellular level and how the growth properties of cells are impacted. The biological organisms react to the negative metal stimulus by producing genetic mutations that could lead to cancer. My hypothesis states that certain concentrations of metal ions inside a bioassay cause genetically mutated cells, which detrimentally impact the health of an organism and could lead to cancer in animal tissue.

Methods/Materials

Genotoxic effects in garlic root tips are observed using a very direct method. First, garlic gloves need to be exposed to test chemicals for 72 hours. The test chemicals I used were copper sulfate and lead nitrate. Then, a squash preparation is made by placing garlic roots into fixation solution (9 parts 95% acetic acid and 1 part 1 M HCL) and staining them with Aceto-Orcein stain (1% aqueous solution). Lastly, the freshly created slides are investigated under a microscope and scored for chromosomal aberrations and micronuclei.

Results

As the concentration increases, the number of genotoxic effects increases for both copper sulfate and lead nitrate. Those genotoxic effects were already visible at 2.5% of the EC50 value for both copper sulfate and lead nitrate. The microscopic impact of lead and copper ions was observed by the increase of the number of genotoxic effects. The macroscopic impact was also observed by the descending trend in the macroscopic analysis graphs, which means that as the concentration rises the growth of the garlic roots are negatively impacted.

Conclusions/Discussion

A direct link between microscopic and macroscopic properties of a garlic bioassay were found, confirming the hypothesis. The genotoxic effects observed at a microscopic scale correspond to DNA damage, while the root growth inhibition observed at a macroscopic scale is possibly caused due to protein damage. More research is necessary in order to connect damages that happen in the genome with damages that occur in the proteome. Even at low concentrations, genotoxic effects were detected. Therefore the direct exposure to even small amounts of lead and copper should be kept at a minimum. These genotoxic effects could lead to cancer inside animal/human tissue if the impacted cells do not trigger programmed cell death (apoptosis).

Summary Statement

My project is about the genotoxicity of metal concentrations on garlic root bioassays measured by the observations of chromosomal aberrations, found in cells undergoing mitosis, that can lead to cancer in animal/human tissue.

Help Received

I am a member of the STEM research class from Lynbrook High School. I received equipment and knowledge from science teachers: Mr. Jason Lee and Mrs. Carol Fong. Professor Muhsin Konuk and Professor Ruth Sofield were kind enough to reply to my emails with answers to my questions.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Eunice Padilla

Project Number

S2119

Project Title

The Effects of Pseudoephedrine on the Cardiovascular System of the California Blackworms

Abstract

Objectives/Goals

Popular illegal street drug Crystal Meth, composed mainly of Pseudoephedrine, can cause physical and psychological effects. In addition, this addictive substance can increase the risk of cardiovascular disease. Since, heart disease is currently the leading cause of death according to the Centers of Disease Control and Prevention, 610,000 people die of cardiovascular diseases in the United States. Furthermore, the purpose of this experiment was to determine if exposing the California Blackworm to pseudoephedrine, an over the counter nasal decongestant would have an effect on the worm pulse rate.

Methods/Materials

A total of ten worms were exposed to pseudoephedrine, ten other worms were exposed to an induced cardiovascular injury, and ten other worms were exposed to both pseudoephedrine and induced cardiovascular injury. They were then observed under a microscope for pulse rate and were compared to the control.

Results

As a result the group from test A, which was the control, had an average of 6.8 pulse rates per 30 seconds. In addition, test A had a regular pulse rate and showed normal health behaviors. In test B, the worms were exposed to pseudoephedrine; they had an average 9.4 pulse rate per 30 seconds. However, they were less active then test A. In test C, the worms were induced with an injury in their dorsal blood vessel, and had a mean value of 11.8 pulse rate per 30 seconds; test C had a faster pulse rate then A and B. The worms in test D, exposed to both injury and pseudoephedrine, had an average of 11.8 pulse rate per 30 seconds. Although, test C and D did not have difference in average pulse rates; test D showed irregular pulse rates, several pulse rates were slower an others were faster.

Conclusions/Discussion

My hypothesis was that exposing pseudoephedrine and causing an injury on the main blood vessel (dorsal) of a California Blackworm would increase the pulse rate. As a result the data does support this hypothesis: pseudoephedrine and the injury did increase the heart rate. Therefore, I can concluded that having a cardiovascular injury or even just high blood pressure and taking over-the-counter cold medication that contain pseudoephedrine, can increase your chances of heart disease or arrhythmia

Summary Statement

The purpose of this experiment was to induce the Blackworms environment by exposing Pseudoephedrine in the water and inducing a cardiovascular injury, and observe their pulse rate.

Help Received

Parents helped with display bored; performed project and used lab equipment in Mrs. De La Cruz classroom.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Elizabeth M. Salmond

Project Number

S2120

Project Title

Livin' the Hydra Life: Hydra Regeneration as Affected by Different Chemical Compounds

Abstract

Objectives/Goals

I predict the compounds will have various effects on the Hydra#s regeneration which may include multiple budding, fast regeneration, retarded growth, extended tentacles, and tentacle paralysis. However, I do not know which compound will have which effect.

Methods/Materials

At least 50-60 Hydra without buds, Scalpel or Razor Blade for dissection, Digital Microscope Camera, 6 Trays, each tray contains 6 mini Petri dishes (wells), 5 compounds, each with their own chemical make-up, Eyedropper to transport Hydra, Brine Shrimp, A photograph depicting the six stages of head regeneration in Hydra

Results

Compound A after 36 hours had 0 Hydra regenerate to their full body. Compound B had 7Hydra that fully regenerated after 36 hours. Compound B had caused tentacle paralysis to the point where the Hydra had no visible reaction to me pinching their tentacles with a pair of tweezers. Compound C had a total of 9 fully regenerated Hydra. When I examined the 9 Hydra, I noticed that their basal disks (the foot of the Hydra) were much larger than the control group. Compound D regenerated almost twice as fast as the control group and the other compounds, and almost three times as fast as Compound A. These Hydra also exhibited an excessive amount of budding. Compound E had similar results to Compound B, but the dish contained more fully regenerated Hydra, with a total of 12. These Hydra had tentacle paralysis and longer tentacles as well.

Conclusions/Discussion

Of all regenerations, Compound D had the most full body regenerations with 17. Along with the most regeneration, Compound D also had sporadic budding. The control group had 14 Hydra that completely regenerated. There was no chemical compound added to this group so I was expecting to see at least half regenerate. Compound E regenerated the next highest, 12. After the 36 hours, I took the regenerated ones and saw that the Hydra that did regenerate had no sensation in their tentacles. Also, their tentacles were much longer than normal. Compound C is next with nine Hydra regenerations. When I examined these Hydra, I saw that they were much bigger and bloated than the rest of the Hydra that regenerated. Compound B had 7 total regenerations. And lastly, Compound A had zero regenerations.

Summary Statement

I tested the affects of different chemical compounds on the Hydra regeneration process and its resulting morphology.

Help Received

Used lab equipment at University of California Irvine under the supervision of Dr. Felix Grun

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Alana R. Tessman

Project Number
S2121

Project Title
Testing the Adhesive and Toxic Properties of Bioremediated Oil

Abstract

Objectives/Goals
My objective was to test which of 3 types of bioremediation agents,each with different mode of action and listed on NCP(Nat.Contingency Plan)NA(Nutrient Additive)MC(Microbial)EA(Enzyme Additive)performed best in reducing toxic & adhesive qualities of oil.

Methods/Materials
I performed 2 toxicity and 1 adhesive test. Adhesion Test: simulated a diving pelican used 'Dunk/Withdrawal' method, primary duck feathers trimmed to 7.62cm(10 per test).Feathers vertically dunked into 4/10gal.aerated river water aquariums(3 bio/1control),40ml oil,40ml bio.agent sprayed 4" above oil,feathers held 3 sec.,withdrawn,then hung vert.for 48hrs. Calculated total adhesion weight using analytical balance.Toxicity Test#1 VOC(volital organic compounds)& PAH(poly aromatic hydrocarbons):Duplicated same aquarium set up,application of bio.agent and oil,tested levels with miniRae3000 meter while measuring test parameters; temp,TDS,pH,DO at the following times: 3:30,5:30,8:30,12:30,17:30, 23:30,31:30,40:30,45:30,60:30 Toxicity Test#2 LC50 bioassay testing water column toxicity: Modified version EPA's LC50(Daphnia Magna)testing water column depths. Top:water-oil interface,Middle, Bottom:benthic layer.Duplicated same aquarium set up,application of bio.agent and oil over 48hrs.Extracted water each section placing samples in 40ml aerated beakers adding 6 adult Daphnia per beaker. Observed/recorded number dead/alive during: 1hr, 12hr, 24hr, 48hr.

Results
Toxicity Test #1: EA showed significant reduction. NA reduced(noted slight crude smell when applied) MC reduced but to lesser degree. Toxicity Test #2:Oil remained floating after application of all products in LC50 bioassy with no notable absorption of toxicity in water column thus eliminating secondary impact to aquatic life and benthic layer. Adhesion Test: Adhesion properties were significantly reduced when compared to control with EA agent showing greatest reduction in oil's adhesion.

Conclusions/Discussion
While bioremediation agents are typically overlooked as a 'First Response' tool in oil spills, I feel there is merit to using them in place of dispersants due to their immediate ability to reduce the oils toxic and adhesive properties and better protect waterfowl,other aquatic life and ecosystems.

Summary Statement
My project was testing to see if a bioremediation agent would be an effective 'First Response' tool in the event of an oil spill where waterfowl and predictably other aquatic life and ecosystems would be affected.

Help Received
HS Biology & Chemistry teachers reviewed project allowed use of lab equipment, GeoTech Engineering allowed me to use their VOC and PAH meters, Watson Bros. Balances allowed me to use analytical scale, Mr. Morrison donated the oil, Mom drove me, supported studies, purchased materials

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Perrin J.G. Turney

Project Number

S2122

Project Title

Death by Salt: An Experiment to Test the Salinity Tolerance of Microorganisms at the Arcata Marsh

Abstract

Objectives/Goals

The objective of this project was to determine the salinity tolerance of microorganisms at the Arcata Marsh.

Methods/Materials

Water, including substrate and floating plants, was collected from the Arcata Marsh. 100 mLs of sample were placed in each of 14 clean beakers to make 2 groups of 7 salinity concentrations. Sea salt was measured out at 0.1 gram increments from 0.1 grams to 0.7 grams and was placed in each 100 mL of sample until a range of salinity concentrations from 0.1% to 0.7% were obtained. The remaining sample water was used as the control. I observed the samples every 2 hours for the first 6 hours, then twice daily for a week, noting any changes in populations and health of Daphnia, Cyclops, Coleps, Euglena, diatoms, green algae, amoeba, green algal colony and Rotifers. After one week, I brought the samples back to freshwater concentrations by adding spring water. I observed them twice daily for an another week to determine if any protozoans had become dormant cysts under harsh environmental conditions and became active once freshwater was available again.

Results

Nearly all microorganisms died by the end of one week, even in a 0.1% salinity. Daphnia and Cyclops were relatively tolerant at lower concentrations, but beyond 0.3% died within the first day. Protozoans, Euglena and Coleps, were the most salt tolerant of the protozoans and green algae also survived for several days in up to 0.4% salinity. Diatoms were the most susceptible to salinity change. None of the microorganisms' populations replenished when returned to freshwater.

Conclusions/Discussion

My hypothesis was incorrect because I had thought the microorganisms would be tolerant to 0.6% salinity. In California's current drought, microorganisms, which play in integral role in water health, are at risk. The loss of microorganisms due to drought greatly affects the ecology by influencing food chains, bacterial populations, and the decomposition of waste material in water. I would like to continue this project by increasing salinity slowly, over a longer period of time, to make the change more like that of a natural drought.

Summary Statement

This experiment tests the salinity tolerance of freshwater microorganisms in the Arcata Marsh.

Help Received

Mother trained me how to use a microscope and helped me glue down my backboard.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Kayla L. Williams

Project Number
S2123

Project Title
Smokin' Spiders: An Investigation of Secondhand Smoke on Spider Webs

Abstract

Objectives/Goals
The objective of this project was to determine whether or not secondhand smoke exposure was detrimental to the average strength of spider webs. If Parasteatoda tepidariorum spiders are exposed to secondhand cigarette smoke, then over time, the strength of the webs will decrease.

Methods/Materials
12 Parasteatoda tepidariorum spiders were purchased online. Identical habitats were created to house the spiders. The spiders spun for one week. The web strength was then tested by hanging paperclips on the webs until the web snapped. After snapping, the weight of the paperclips, in grams, was measured on a scale. This process was repeated three times, to create a baseline, with one week of spinning in between each test. After the control testing, smoke was introduced to five spiders that had been selected at random to be the test group. One cigarette per habitat was lit every night for ten days, then placed on top of the habitat and underneath a glass container to contain the smoke. Both the control group and test group were tested every other night.

Results
Over time, the test group had a 43% averaged decrease in web strength.

Conclusions/Discussion
The data supported the hypothesis by showing that secondhand smoke did decrease the strength of spider webs over time.

Summary Statement
This project investigated the effects of secondhand smoke on living organisms.

Help Received
Mother took pictures; Father lit cigarettes and dealt with the cigarettes

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Gina Y. Yang

Project Number
S2124

Project Title
Investigating Colony Collapse Disorder: Effects of Agricultural Adjuvant on the Health of Honeybees Apis mellifera L.

Abstract

Objectives/Goals
Bee pollination accounts for about $15 billion in added crop value and 1/3 of the food consumed in the U.S. For almost ten years, Colony Collapse Disorder (CCD) has been responsible for unexplained large-scale bee losses. After almond pollination season recently, a large bee die-off resembling CCD implicated agrochemicals in the bee deaths. In almond crops, a surfactant, called an adjuvant, is often combined with pesticides to boost their efficacy. This project investigated the effects of Dyne-Amic, an adjuvant commonly used on almond crops, on the health of honeybees. It was hypothesized that bees orally exposed to Dyne-Amic would exhibit lower food consumption, higher mortality, and learning and memory impairment.

Methods/Materials
48 honeybees were divided into 3 groups of 16. A control group was fed with sucrose solution, while the two remaining groups were fed with different concentrations of Dyne-Amic (1% and 5%). All groups were triplicated. Bees were maintained in hoarding cages and allowed to feed ad libitum from feeders. Food consumption and mortality were recorded daily; after 3 days of feeding, proboscis extension reflex (PER) assays took place to assess olfactory associative learning and memory.

Results
No statistically significant differences in average food consumption between groups were observed, as confirmed by one-way ANOVA. According to Pearson chi-square test for independence, mortality in adjuvant-fed groups (1% adjuvant solution: 14.6%; 5% adjuvant solution: 16.7%) was not statistically different than mortality in control groups (10.4%). Another Pearson chi-square test was performed to examine the relationship between the learning performances of adjuvant-fed bees and controls; the number of PER responses elicited in adjuvant-fed groups was determined to be significantly lower than the number of responses in control groups, $p<0.05$.

Conclusions/Discussion
As shown by a lack of conditioned PER response, Dyne-Amic had a significant negative impact on bee learning and memory. Olfactory learning and memory association are vital to foraging and homing behavior, which are crucial to colony food supply. Learning impairment in workers would therefore have serious implications for the health of colonies. Thus, the negative effects of Dyne-Amic on bee learning and memory suggest that Dyne-Amic could have been a cause of the post-almond pollination bee die-off and have a link to CCD.

Summary Statement
The agricultural adjuvant Dyne-Amic was determined to cause significant learning and memory impairment in honeybees and therefore may be linked to the unexplained phenomenon Colony Collapse Disorder.

Help Received
My mentor, Ms. Fallon, provided advice and guidance. Beekeeper Alan Henninger donated live bees; my mother assisted in the purchase of materials and supervised experimentation.