



Which Berries are Most Genetically Similar to Roses?

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Abstract

In our experiment we sequenced *rbcl* gene of the chloroplast DNA of strawberries, blackberries, and raspberries to find which was most genetically similar to the rose. We specifically compared the rose to berries since these berries are in the same subfamily and have high Vitamin C like the rose. Although roses have many benefits, they have negative side effects and therefore our goal was to find which berry could potentially be used as an alternative to roses with the benefits of a rose but without the negative side effects based on chloroplast DNA sequencing results. We hypothesized that the strawberry would be most genetically similar. In our experiment, we went through a series of steps and methods to extract and barcode the chloroplast DNA of each specimen. We compared the results of the berries and roses and found that our hypothesis was correct. Since the strawberry was found to be most genetically similar, further research should be done to test if they can be used as an alternative for roses in the medical field, for beauty products and so much more.

Introduction

Roses are an integral part of our lives for medical purposes, hygienic benefits, and beauty products. They're also an important part of Chinese culture and traditional medicine. New York City is home to the highest Chinese-American population in the US, with an estimated 573,388 Chinese-Americans. Rose oils are used in acne products, moisturizers, perfumes, and aromatherapy. However, there are also possible negative side effects to roses including nausea, diarrhea, heartburn, stomach cramps, fatigue, headache, and more. Rogosin E is a chemical found in rose hips which might slow blood clotting and so taking rose hip might increase the risk of bleeding in people with bleeding disorders. Therefore, we wanted to find a plant that can be used as an alternative to the rose with all of its benefits. We used DNA sequencing to compare the *rbcl* gene of the chloroplast DNA of the roses and berries. We specifically chose to compare strawberries, blackberries, and raspberries to roses because they are all part of the subfamily *Rosoideae* from The Rosaceae Family and are also all rich sources of Vitamin C. Our hypothesis was that the strawberry would be most genetically similar to the rose. Many rose species produce edible hips which are a rich source of Vitamin C. Rose hips are considered to be the "accessory fruit" of the rose. Botanically, the strawberry fruit is considered an "accessory fruit" which means in addition to a mature ovary and seeds it also contains tissue and is not a true berry. We thought the strawberry was most similar to the rose hips of the rose since they are both considered accessory fruits and are high in Vitamin C.

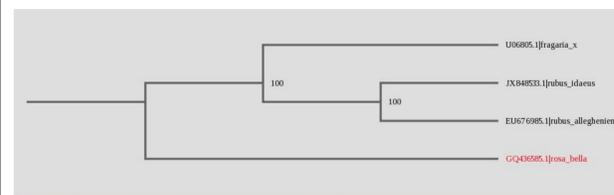
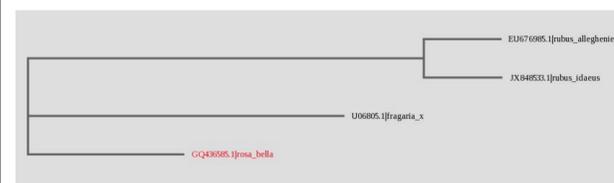
Materials & Methods

Our project involved a lot of natural produce that needed to be fresh, so we collected all the samples a day before we conducted the experiment. The samples that we collected were strawberries, raspberries, blackberries and roses. We collected two of each sample in order to increase the accuracy of our experiment. When extracting the DNA we used chloroplast DNA because we were working with all plants and the genetic information on plants can be found in the chloroplasts. There were many materials that were used in the lab each with their own unique task. The micropipette was one of the instruments used and we used three different sizes. We began by preparing the samples, in order to get the sample we used scissors to cut a piece, we then added it to the tube. We added 100 µL of the nuclei lysis solution into each sample. The pestles helped to grind each of our samples creating a liquid. The remaining 500 µL of the nuclei lysis solution was added and the samples went into the heating block. Once incubated for 15 minutes at 65 degrees we added the RNase solution which contains RNase enzyme. The purpose of this enzyme is to break down majority of the RNA that is present in the solution. We took the P10 micropipette and took up 3 µL of the RNase solution, and added it to each of the tubes. After that we shook the tubes and placed them at 37 degrees in a heating block for another 15 minutes. After the incubation we added 200 µL of a protein precipitation solution to each tube which took out the proteins that are soluble in the liquid. Making it easier to extract the DNA and it caused a change in color. We then took the samples and put them through the centrifuge. Once it was finished spinning, the cellular detritus lodged itself on the side of the wall and we extracted 600 µL of the supernatant liquid into a freshly labeled tube. We then added 600 µL of isopropanol (alcohol) to each one of our tubes. We inverted the tubes and then placed them to spin for a minute. After we had our DNA amplified using the *rbcl* primer we set up the PCR. We poured the agarose solution into the tray and let it completely solidify. The buffer was added to fill in the wells and cover the gel, 5 µL of each PCR product was placed in a microcentrifuge tube with SYBR Green DNA stain. The DNA was loaded into the wells and ran 30 minutes at 130V. We did this process twice for each sample and we made no modifications to the original protocol.

Results

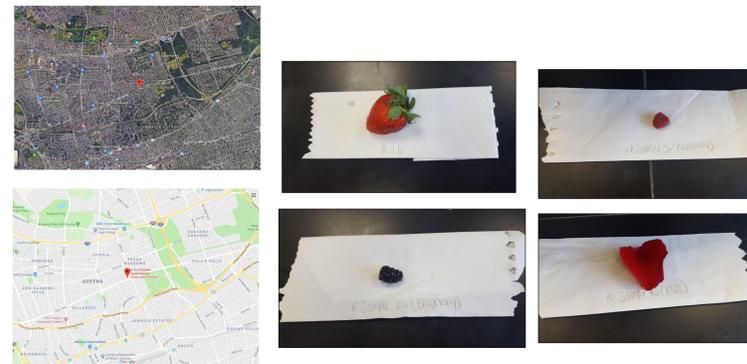
As we hypothesized, the strawberry was most closely related to the rose. The raspberry and blackberry were the least related to the rose.

Tables & Figures



• Blasts:

Sample ID	Plant	BLAST
BSJ-001 & BSJ-005	Strawberry	Fragaria x ananassa
BSJ-002 & BSJ-007	Raspberry	Rubus idaeus
BSJ-003 & BSJ-008	Blackberry	Rubus allegheniensis
BSJ-004 & BSJ-006	Rose	Rosa bella



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Discussion

The diagrams show the relationship between the berries and the rose (*Rosa bella*). The Strawberry (*Fragaria x ananassa*) was most closely related based on the tree. The Raspberry (*Rubus idaeus*) and blackberry (*Rubus allegheniensis*) were most closely related to each other but the least related to the rose. These results proved our hypothesis to be correct. With further research we could potentially use strawberries as an alternative to the rose and its multiple benefits. Roses, despite their many medical and hygienic benefits, have many side effects that are dangerous to certain people. Since the strawberry is most genetically similar it may be possible that it could be utilized for many of the same benefits as the rose but without the negative side effects. Strawberries are also very rich in Vitamin C can give all the positive benefits such as protection against immune system deficiencies, cardiovascular disease, prenatal health problems, eye disease, and even skin wrinkling. Those who were not able to use rose hips because of it's side effects can use strawberries as an alternative.

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