Vitis Propulsion: Theory and Practice

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Abstract

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Abstract

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1. Introduction and Theory of Vitis Propulsion

This paper reports experimental results supporting a new theory of vitis vinifera self-propulsion. The fruit of the family *Vitaceae*, genus *Vitis*, species *vinifera* (the grape), when situated on a lubricated planar surface with uniform gravitational field and subjected to microwaves, will show sudden translocation due to propulsion from the stem end of the fruit. The hypothesis tested is that the degree of pigmentation of the epithelial layer of the fruit affects its capacity for propulsion. The experiment measured average radial distances traveled by vitis fruits subjected to such electromagnetic radiation in a closed environment. Both red and green vitis fruits were tested, as were control groups of skinless subjects of both varieties. Results support the hypothesis that a darker-skinned vitis fruit travels further under these experimental conditions.

2. Related Work

Our experiments are but the latest in a fascinating tradition of research on bio-ingestible ingredients subjected to various forms of energy.

The work most closely related to ours is [Michaud 94], which purports to be an important new discovery in the field of "culinary entertainment." The author claims that the common seedless grape will "flare" (i.e. combust spectacularly) when given a five to ten second burst of electromagnetic radiation in the centimeter wavelength range. We question their findings, however, since we did not detect a single grape-flare during our experiments. The difference may be that we used whole fruit, while [Michaud 94] used half slices.

The most comprehensive work in organic electroluminescence devices is [Hamburgen 89], which determined that energizing a dill pickle with an alternating current causes the subject to glow. The authors also report data for experiments using kosher pickles, cornichon pickles, bok choy, and Mandarin orange segments. The authors' work can be considered as building upon a tradition of previous experiments with Life Savers® [Garfinkel 89].

The pioneering work on computer simulation of dessert foods is [Heckbert 87], wherein the author presents new technology for ray tracing Jell-O® Brand Gelatin. Prior to the author's controversial Dessert Realism Project, nobody had ray traced any food.

Finally, [Anonymous 96] is an inspiring work in the area of confectionery genetics. The author's on-going dedication to locating the strongest M&Ms® for breeding purposes will help continue the robustness of this candy as a species. While this study of Darwinian selection processes amongst M&Ms® may seem far removed from our work, it is still totally cool.

3. Experimental Protocol

This section describes the experimental procedure we developed and employed for testing our hypothesis. We first describe the selection and grouping of subjects and tests. We then list our laboratory apparatus and describe the method used for each experimental run.

3.1 Experimental Subjects

The test subjects consisted of the fruits of the family *Vitaceae*, genus *Vitis*, species *vinifera*. These fruits are true berries, unlike the aggregate drupes of the composite fruits of members of the genus *Rubus* (raspberries), or the pulpy receptacles bearing multiple achenes of the genus *Fragaria* (strawberries). The fruits were washed (in water previously subjected to a NaCl bath and Sodium Hydrosulfate and Sodium Bisulfate baths to remove iron) and then inspected to ensure no portion of the stem remained attached to the berry. During the experiment, the subjects were stored in clean ceramic bowls.

We employed two cultivars of vitis fruits. The first consisted of vitis vinifera berries of the variety Thompson and were observed to be without seeds. These grapes are “Nile green” [Webster 39], henceforth referred to as “green.” The second type consisted of vitis vinifera berries of the Red Flame cultivar, also seedless. These grapes are “hollyhock red,” henceforth referred to as red. It was important that all subjects deployed be seedless, to avoid any disturbance to the results due to seed/energy reaction.

We used four groups of vitis fruits for the experiment. Group 1 consisted of seven green vitis berries with epithelial layers (i.e. skins) intact. Group 2 consisted of seven red vitis berries with epithelial layers intact. Group 3 consisted of seven green vitis berries with epithelial layers removed. Group 4 consisted of seven red vitis berries with epithelial layers removed. Table 1 shows summarizes this information about the groups of berries.

Group Number	Subject Color	Number of Subjects	Total Weight	Epithelial Status
1	green	7	25g	intact
2	red	7	25g	intact
3	green	7	25g	removed
4	red	7	25g	removed

TABLE 1. Description of subject groups.

Groups 3 and 4 (skinless) were intended to be control groups to eliminate the effect of the epithelial layer itself (rather than its color) from our results. However, it turns out to be very difficult to flense a berry completely without removing tiny bits of its flesh. To tackle this problem we had two possible solutions; neither were ideal. The first solution was to test entirely skinless but lumpy vitis fruits. The second solution was to remove as much of the skins as possible without damaging the subjects. We employed the second solution, although we believe it is important to perform further experiments using the first solution. As seen in our results, the remaining skin bits affect our results (naturally, further reinforcing our hypothesis).

Groups 1 and 2 each collectively weighed 25±2 grams. Groups 3 and 4 (the control groups) each collectively weighed 25±2 grams. We chose subjects of the same total combined weight to control for the effect of total grape weight on propulsion characteristics.

We chose seven subjects for each group to provide seven distinct trials for each group, because seven is always a statistically significant number of trials.

3.2 Experimental Apparatus

All experiments were conducted using a JES1500T, 164ID2488P201 General Electric 900 Watt, 1.5 cubic foot kitchen microwave as the energy source. The apparatus manufacturer specifically addresses the issue of vitis propulsion in its warning [GE 92]: “Foods with unbroken outer skin such as potatoes, sausages, tomatoes, apples, chicken livers and other giblets and egg yolks should be pierced to allow steam to escape during cooking.” Fortunately, our removal of the vitis stem creates a proper steam outlet.

The experimental planar surface on which the subjects were placed was a glass microwave plate 13” in diameter.

We used a non-reactive polyethylene linear measurement device (ruler) to determine the radial distances traveled. The device was accurate to ±0.06 inches.

All subject weights were measured using a kitchen scale with a range of 0 to 454 grams, accurate to within ±2 grams for the weights considered in this experiment.

We used Dawn® household liquid dish soap for washing the microwave plate.

We used Stop and Shop® “pure vegetable oil” to lubricate the microwave plate.

We used K. Bostic’s margaritas to lubricate the research scientists.

3.3 Procedure

Before beginning the data gathering trials, we experimentally determined the optimal duration for which to apply the radiation source to our subjects. Several trials indicated that the amount of translocation increases with energy application intervals of up to 90 seconds, but that longer intervals induce no further propulsive activity and result in complete breakdown of the subjects. These observations were consistent across our data gathering trials.

The experimental procedure was designed to control for time-related effects on vitis propulsion. We first tested Groups 1 and 2 (epithelial layers intact). We alternated between testing a fruit of Group 1 (green) and a fruit of Group 2 (red) to control for potential aging effects on the experimental subjects. We then tested subjects of Groups 3 and 4, again alternating between the groups. There were thus a total of 28 experimental runs.

For each trial we proceeded as follows. We first coated the microwave plate with a thin (sub-millimeter) layer of oil and centered it inside the radiation appliance. We placed the subject 0.5 (±0.06) inches away from the raised edge of the plate and gently closed the appliance door to minimize vibratory effects. We then set the Time Cook option of our energy source to ninety seconds and initiated the experiment by triggering the microwave source (we pressed the START button). We then recorded the radial distance in inches traveled by the subject from the edge of the plate towards its center. We removed what was left of the subject and washed the plate with the liquid dish soap in preparation for the next run. Including the seven trial runs, B. Kercheval oiled and washed this plate meticulously 35 times. It's amazing what a couple of margaritas will do to some people.

It should be noted that our results do not include motion through other degrees of freedom traveled by the subjects, in that we measure only the radial offset of a subject from its starting position, rather than the length of the path it travels. This shortcoming in our measurement apparatus could significantly affect our results, as several subjects moved towards the center of the plate and then back towards its edge. Finally, several subjects went into an amazing tail spin, which our techniques did not record. Future work should attempt to capture these results as well. Motion in the vertical direction was not observed in any of the subjects.

4. Results and Analysis

Table 2 displays the results of our experiments. The red subjects show 16.2% more radial movement than their lighter skinned relatives. However, we believe that the results may be even more significant, because one of the Group 2 grapes was a dud. It displayed no movement at all and, unlike all other subjects in our trials, deflated immediately into a nasty pulpy thing. When we compute a 14.3%-trimmed mean, we observe 29.9% more movement from the red group than from the green group!

Trial	Group 1 (green)	Group 2 (red)	Group 3 (green, skinless)	Group 4 (red, skinless)
1	0.50	3.75	0.00	0.69
2	3.78	1.00	0.00	0.06
3	1.78	3.50	0.06	0.81
4	2.43	0.00	0.00	1.25
5	2.78	1.31	0.13	0.00
6	0.81	2.75	0.50	0.75
7	1.06	2.94	0.00	0.56
Average	1.88	2.18	0.10	0.59
Std. Dev.	1.10	1.13	0.16	0.41

TABLE 2. Radial distance traveled by vitis fruits subjected to microwaves.

Amongst the control groups we see 500% more movement from the red subjects than the green subjects. As explained previously, we believe this further supports our results, since we were unable to remove the skins completely. Further research is needed to confirm this result.

5. Future Work

Our work reveals several areas of research demanding further attention (and funding). First, we need to address the problem concerning skinless subjects. From our results, some might consider that the behavior of control Groups 3 and 4 indicates that pigmentation of the entire fruit, rather than merely its skin, dictates its propulsion capacity. We're sure that's not true, but we're not sure why we're sure. This question could be decided by experimentation with truly skinless (although lumpy) fruits. We would then need to control for their lumpiness.

One methodological flaw in our experiment is that we were only able to measure the radial offset of the end resting point of the subject with respect to its starting position. Better results would be obtained by measuring the length of the path traveled by the subject during its subjection to microwaves. This would most certainly require the application of time-lapse digital photography techniques and advanced computer image enhancement apparatus.

A final possible problem with our results is that vitis fruits grown in different hemispheres may respond differently to microwaves, perhaps due to Coriolis effects. We believe the red subjects in our experiments may have been from Chile, while the green ones were North American. Further work is needed to determine whether the native hemisphere of the grape affects our results.

6. Conclusions

The results of our experiments support our hypothesis that epithelial pigmentation affects vitis propulsion. This important result may go far in explaining such phenomena as slightly spritzy red wines.

Resolving the intriguing open questions revealed by our work requires further experimentation and thus further funding. Such funding would significantly improve our laboratory environment if used to hire an assistant (a graduate student to peel grapes for us) or to upgrade our laboratory apparatus (we could purchase one of those really expensive tequilas for our next batch of margaritas).

7. Acknowledgements

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