



Factors affecting the rate of photosynthesis of Sansevieria plant

Angel Lhi F. Dela Cruz

INTRODUCTION

Plants performed photosynthesis in a step by step process to make their food and release oxygen vital for animals and humans to sustain their lives. The main requirement is to collect light from the sun, convert, transfer an electron from water to produce NADP^+ , generate ATP, and perform a series of reactions like enzymatic activities that synthesize products such as carbohydrates and release oxygen as a product of its photosynthesis.

Some essential factors were affecting the photosynthesis of plants. Hence, have the same rate of photosynthesis. Thus, the environmental factor is a common significant factor affecting photosynthesis rate, light intensity, pH, carbon dioxide concentration, and temperature.

The Sansevieria, commonly named as mother-in-law's tongue, is also a resilient brief because it can grow anywhere from about 6 inches to more feet tall. Again, this plant is used almost by all plant growers in decorating at home because it provides a bit of ambiance, is pleasing to the eye, easy to grow, and requires a small amount of water and its health benefits.

S. triafasciata is also known for its ability to help purify toxins in the air, such as pollutants, and its potential characteristic to absorb and eliminate harmful toxins, and benefits as an effective defense to allergies possibly gotten from the perspective.

However, despite *S.trifasciata* advantage and benefits offered, this plant is mildly toxic if

eaten. Its leaves contained poisonous substances that would result in swelling and inability to feel in your tongue if taken and consumed in large amounts.

Research Questions:

1. What is the rate of photosynthesis in distance 10 cm, 20 cm, 30cm, 40cm and 50 cm?
2. What is the rate of photosynthesis in 10°C, 20°C, 30°C, 40°C and 50°C the rate of photosynthesis?
3. What is the rate of photosynthesis in pH level 4 +/- 0.02, 7 +/- 0.02 and 10 +/- 0.02?
4. What is the significant difference between the rate of photosynthesis in light-dark reaction?
5. What is the rate of photosynthesis in the concentration of carbon dioxide ten ppm, 20 ppm, 30 ppm, 40 ppm, and 50 ppm?
6. What is a significant difference in the rate of photosynthesis exposed to an antibiotic?
7. What is the significant difference in the factors distance, temperature, pH levels, concentration of carbon, and antibiotic as factors affecting the photosynthesis rate of *S. triafaciata*, *S. hyacintoides*, and *S. stukyi*?

Significance of the Study

This study's result may benefit all plant growers, especially the plantitas and plantitos who loved to collect Sansevieria plant with this kind of species *S. triafaciata*, *S. Hyacintoides*, and *S. Stukyi*. The result shows might be a useful reference for properly selecting indoor plants placed inside-home to release oxygen.

The result of this study may encourage every people to grow and place *S. triafaciata*, *S. hyacintoides*, and *S. Stukyi* to help surroundings cleaned and safe from all impurities

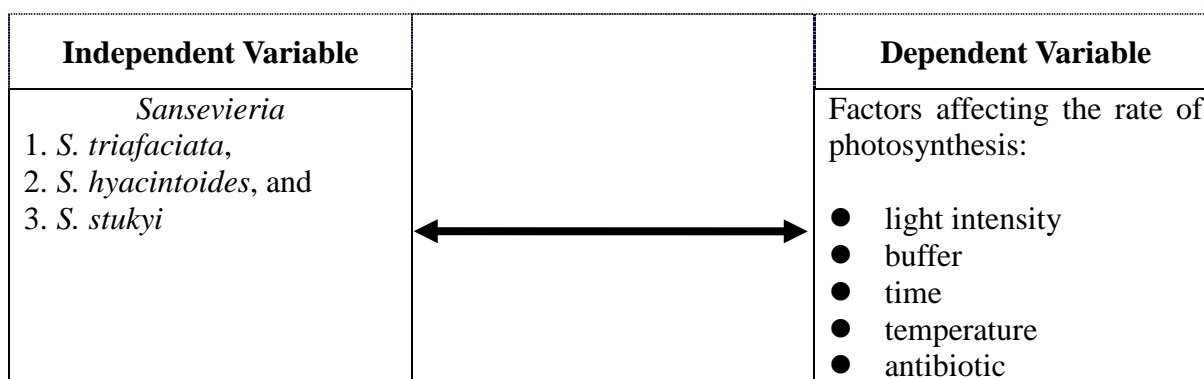
outside the home or inside the house.

To all designers, hotels, and restaurants who used managed to used plant as an interior design. The result might be an appropriate reference in decorating and promote a suitable ambiance for animals and humans to stay inside or outside establishments.

Scope and Limitation

The experiment was done and focused only on *S. triafaciata*, *S. hyacintoides*, and *S. stuky*. The Sansevieria planted in the third-floor building as outdoor decoration. The plants were less maintained, not watered every day, but they are fully grown for three years up on the third floor; the plants received proper light from the sun and exposes to an atmosphere full of impurities and human or animal disturbances.

Conceptual Framework



MATERIALS AND METHODS

The *S. triafaciata*, *S. hyacintoides*, and *S. stuky* were tested and measured the rate of photosynthesis in the fume hood to experiment by trying the accurately: (1) distance of light source measuring the distance in 10 cm, 20 cm, 30 cm, 40 cm, and 50 cm in 2 watts light bulb in low carbon dioxide; (2) effects of buffer 4, 7, and 10 measuring the release of oxygen gas as a by-product of photosynthesis in 10 mins, 20, mins, 30 mins, 40 mins, and 50 mins; (3) carbon concentration using the sodium bicarbonate in 10 ppm, 20 ppm, 30 ppm, 40 ppm, and 50 ppm; (4) measuring the rate of photosynthesis in 10°C, 20°C,

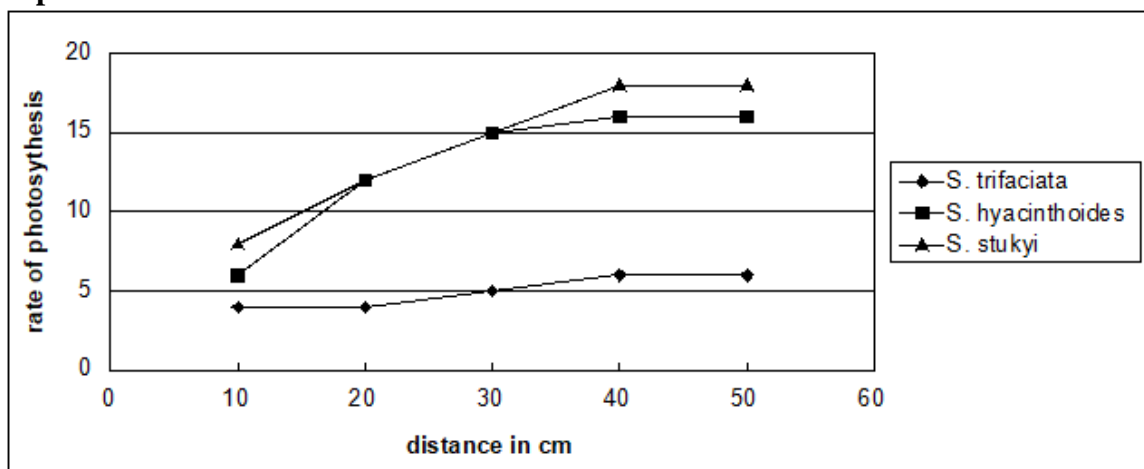
30°C, 40°C and 50°C; and (5) exposing the plants 20 ppm antibiotic in a test tube for one hour and measure the rate of photosynthesis in low concentration of sodium bicarbonate.

Testing the light source's distance 10 cm, 20 cm, 30 cm, 40 cm, and 50 cm, buffers' effects in pH 4, 7, and 10, carbon concentration, temperature, and antibiotic tested in light and dark reaction seeing differences in photosynthesis rate.

The materials used are *Sansevieria trifasciata*, light source (two watts), test tube, beaker, meter stick, timer, UV light, sodium bicarbonate, water bath, hot plate, thermometer, iron stand, and iron clamp.

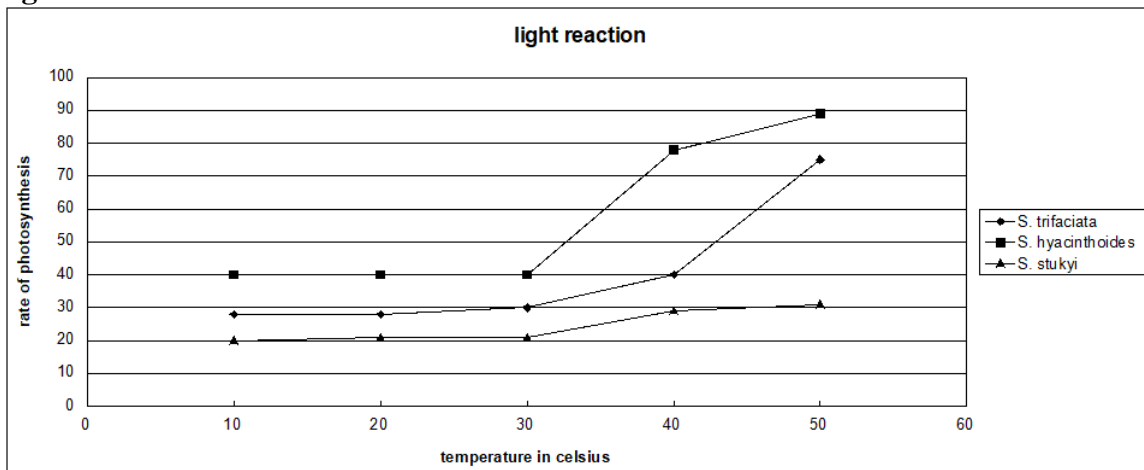
Results and Discussion

Figure 1. The *S.triafasciata* indoor plant's photosynthesis rate to the distance as a dependent variable in low carbon dioxide concentration.



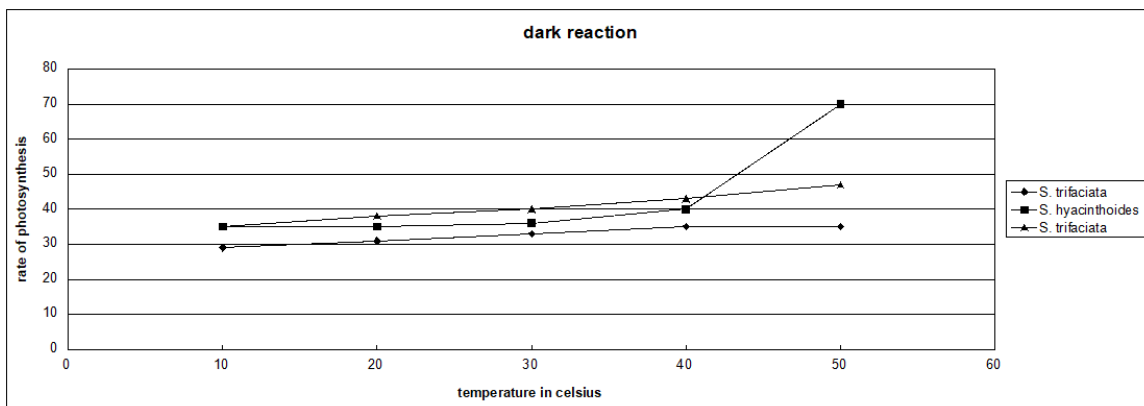
The figure shows an increase in photosynthesis rate despite the distance of the light source. It implies that *S. Hyacinthoides* and *S.stuckyi* have a higher rate of photosynthesis. While *S. triafasciata* shows a low rate but still changed its photosynthesis rate a minimal amount. It means the plant can absorb light even the light source is far and will continue to do photosynthesis in its stable condition. It also shows that these plants have the same potential to do photosynthesis. However, the low supply of energy sources is a good indication for being a potential plant to synthesize oxygen as a yield of photosynthesis production.

Figure 2. Rate of photosynthesis of *S.trafaciata*, *S. hyacinthoides*, and *S. stuky* in light reaction.



The figure shows an increased rate of photosynthesis in light reaction among all *Sensivieria* plants. Both *S. stuky* and *S. hyacinthoides* improve the quality of photosynthesis than *S.trafaciata* that takes in minimum rate.

Figure 3. Rate of photosynthesis of *S.trafaciata*, *S. hyacinthoides*, and *S. stuky* in dark reaction.



The figure shows that *S.trafaciata*, *S. hyacinthoides*, and *S. stuky* plants performed photosynthesis during nighttime and released oxygen as a product. Simultaneously, the *S.trafaciata* offers a high increase in the rate of photosynthesis in dark reactions at 40°C.

Table 1. The t-test result on the rate of photosynthesis in light and dark reaction

Variable	n	Mean	SD	t-value	p-value
light reaction	15	40.67	483.95	0.30	.76
dark reaction	15	38.80	95.17		

The *t*-value is 0.30. The *p*-value is .76. The result is *not* significant at $p < .05$.

The table shows that there is no difference in the rate of photosynthesis on light and dark reactions. It is a good indication that *S.trafaciata*, *S. hyacinthoides*, and *S. Stukyi* are plants potentially to be placed inside-home as home decor that produced oxygen and maintain the give and take relationship of plants and animals inside the home. The result also implies no differences in the rate of photosynthesis in the light and dark reactions.

Table 2. Differences in pH level in *S. triafaciata*, *S. hyacintoides*, and *S. Stukyi* using One Way Analysis of Variance.

	<i>SS</i>	<i>df</i>	<i>MS</i>	
Between-treatments	10606.43	2	5303.21	$F = 44.3117$
Within-treatments	6821.75	57	119.67	
Total	17428.18	59		

*The *f*-ratio is 44.31. The *p*-value is $<.0001$. The result is significant at $p < .05$.

Table 3: Post Hoc Analysis Using Tukey on the effects of buffer with pH 4 +/- 0.02, pH 7 +/- 0.02, and pH 10 +/- 0.02.

Pairwise Comparison		HSD _{.05} = 8.32 HSD _{.01} = 10.49	Q _{.05} = 3.40	Q _{.01} = 4.29
T ₁ :T ₂	M ₁ = 20.60 M ₂ = 29.00	8.49	Q = 3.43 ($p = .04751$)	
T ₁ :T ₃	M ₁ = 20.60 M ₃ = 52.05	31.45	Q = 12.86 ($p = .0000$)	
T ₂ :T ₃	M ₂ = 29.00 M ₃ = 52.05	23.05	Q = 9.42 ($p = .0000$)	

The table shows a significant difference in the treatments to photosynthesis rate in *S.trafaciata*, *S. hyacinthoides*, and *S. stukyi*. It merely indicates that exposing these three Sansevieria plants to higher pH levels increases the rate of photosynthesis. Hence, pH level affects the quality of photosynthesis.

Table 4. The test result of ANOVA using One Way Analysis of Variance on the concentration of carbon of *S. triafaciata*, *S. hyacintoides*, and *S. stukyi*.

	<i>SS</i>	<i>df</i>	<i>MS</i>	
Between-treatments	1983.71	4	495.92	$F = 1.15194$

Within-treatments	32719.34	76	430.51
Total	34703.06	80	

The *f*-ratio is 1.15194. The *p*-value is .33881. The result is not significant at $p < .05$.

The result implies that despite the high concentration or intake of carbon dioxide in a room and outside the home atmosphere the *S. triafaciata*, *S. hyacintoides*, and *S. Sukyi* plants continuously to absorb the carbon in the air. The test result shows that these plants can clean impurities in the atmosphere because there is a significant difference in the test result.

Table 5. The *t*-test of the control group against the experimental group treated with an antibiotic.

Variable	n	<i>S. triafaciata</i>		<i>t</i> -value	<i>p</i> -value
		Mean	SD		
control group	5	28	167.5	4.87	0.0012
experimental group	5	0	0		

*The *t*-value is 4.83. The *p*-value is .0012. The result is significant at $p < .05$.

The test result shows that there is no rate of photosynthesis in *S. Triafaciata* exposed to the antibiotic. It will hinder the release of oxygen as an essential product for photosynthesis.

Table 6. Test result affecting rate of photosynthesis of *S. triafaciata*, *S. hyacintoides*, and *S. Stuky*.

	<i>SS</i>	<i>df</i>	<i>MS</i>	
Between-treatments	32780	4	8195.07	$F = 53.84617$
Within-treatments	14458	95	152.1942	
Total	47238.75	99		

*The *f*-ratio is 53.84. The *p*-value is <.00001. The result is significant at $p < .05$.

The table shows that temperature, the distance of the light source, pH level, and antibiotic concentration of carbon have a significant effect on the Sansevieria plant.

Conclusion

Temperature, carbon concentration, light and dark reactions, pH levels do not affect the rate of photosynthesis of *S. triafaciata*, *S. hyacintoides*, and *S. stuky*. However, antibiotic

disrupts the rate of photosynthesis.

Recommendations

Some recommendations formulated after the experiment:

1. For further studies on Sansevieria, also test on different varieties.
2. The cells must be viewed in the microscope and conduct a thorough investigation on light and dark reactions of the Sansevieria.
3. Must also be explored using other factors affecting the rate of photosynthesis.
5. Must be tested on some indoor plants.