The Attractiveness of Common Liquid Solution in Life to Blatta lateralis (Turkestan Cockroach)

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I.

I. ABSTRACT

i. Context of research

Its' growth environment limited less than other species, wider distributes, and stronger vitality. That's why cockroaches are also known as "the strongest creature on the planet". The cockroach is not only a resolute species but another great pointer of "Whether the environment clean or not?" However, in the human society, cockroach is an injurious insect in cities that people always fear. included mess up your kitchen in the mid of the night.

ii. Research questions

If cockroaches have specific favor or FAVORITE of its' food? According to some online posts viewpoint: "Food which exotic odors assail the nostrils and greasy IS THE LOVE OF COCKROACH." That's why we decided to start up this research to confirm the viewpoint IS or ISN'T correct?

iii. Objectives set

Investigate "The Attractiveness of Common Liquid Solution in Life for Turkestan Cockroach" and the experiment of "How Many Oatmeal with Different Concentration of Artificial Soy Sauce Can Turkestan Cockroach Can Eat Per Day", "Different Ingredient of Soy Sauce (Artificial/Brewing)" to realize the behavior pattern of cockroaches, confirm the correct/incorrect of the posts online. Also, it could prevent setting the flavorings they are fond of. Avoid using insecticides which harmful to the environment, without that, still could keep the place clean, accomplish the sustainable spirit in purpose.

iv. Brief methods description

By doing some research going through documents, referring some biology books found in library and discussing with out biology teachers and talking to an expert who is works at local pet shop. We will also conduct experiments then analyze the results, to collate data to make charts for the experiment project (more details in P.3)

II. Research Questions

i. Research Questions

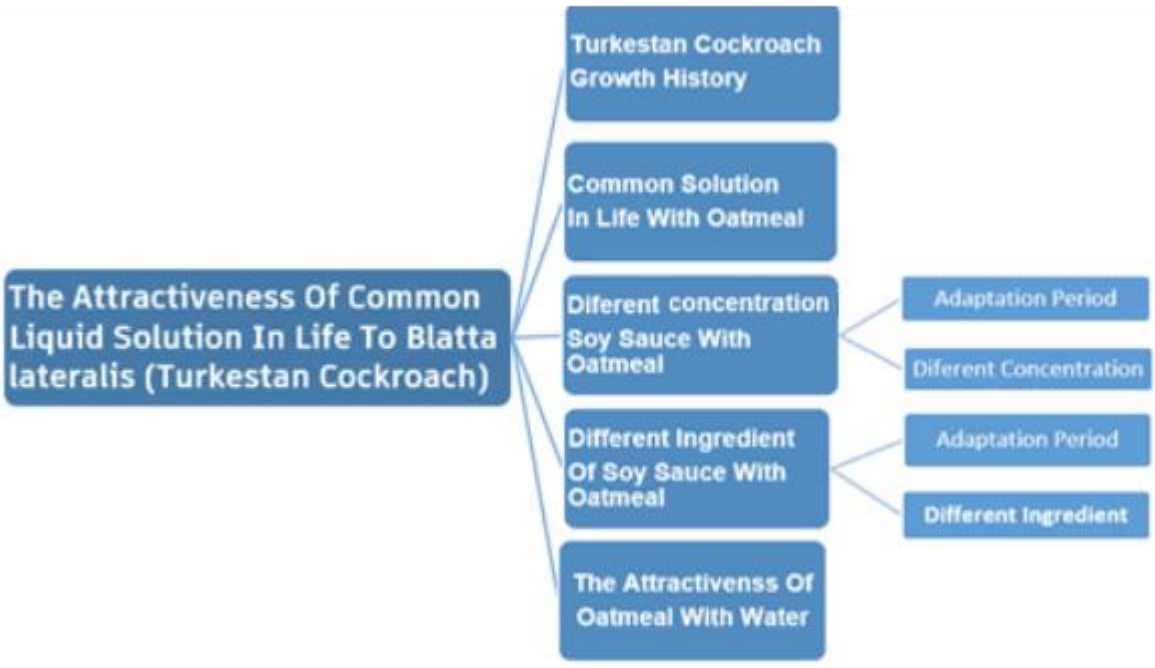
There's too much harmful chemicals around our life, in curse of time, that kind of stuff may become another fetal factor which threat the life lives on this planet.

Despite cockroaches are injurious insect, we shouldn't easily use insecticide anyplace where they appear. Cause using deadly material to provide the effect of bugs are high-efficiency way for create another more comfortable place for human, but for the whole environment and ecosphere exactly AREN'T. Yes, insecticide is cheap and high equality, but never mean it won't bring about pollution.

So, the best win-win situation to mother nature with human is avoid using syntheses material which made from nature object or avoid exposing the attractiveness favor to cockroaches and other insects in our places.

We tried 12 different common liquid solution in life, after that, we even testing 4 different concentrations and 4 different ingredient soy sauce.

ii. System Architecture



Pic.1: System Architecture
(Resource: Researcher)

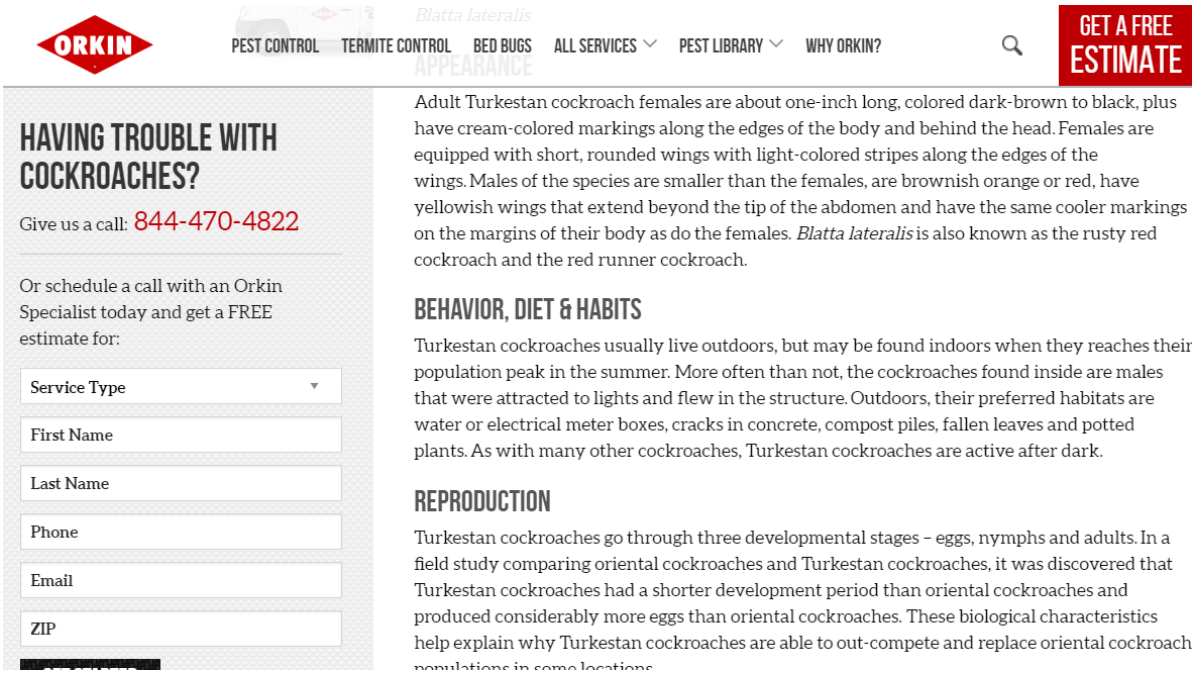
III. Introduction and review of the literature

i. Turkestan Cockroaches

Turkestan Cockroaches were chosen for this experiment due to it is easy to feeding and they active at the shade. So, except testing time, we'll put they beside the corner of lab.

"Turkestan cockroaches usually live outdoors, but may be found indoors when they reach their population peak in the summer. More often than not, the cockroaches found inside are males that were attracted to lights and flew in the structure." (ORKIN)

"Turkestan cockroaches are active after dark." (ORKIN)



(https://www.orkin.com/cockroaches/turkestan-cockroach)

ii. Turkestan Cockroach Brief Introduction

Turkestan Cockroach *(Blatta lateralis)*, it's the kind of cockroach that belongs to the order *Blattodea*, it is native to North Africa and Middle Asia. "Is a primarily outdoor-dwelling cockroach native to an area from northern Africa to Central Asia." (Tina Kim & Rust Michael, 2013).Its imago length is about2,3 cm。when it is in the stage of larva it's neither male nor female, its carapace is brown，developed male cockroach its carapace is reddish-brown, the female one is black(cerise).

iii. Turkestan Cockroach Growth History

Turkestan Cockroach, stink bug and katydid are Incomplete– metamorphosis –Progressive metamorphosis , this kind of metamorphosis doesn't go through the stage of cocoon ， it's morphology of larva and adult is almost the alike, even the living environment is also the same, the growth process : ovum →larva →developed.

The color of its egg pod is black, the length is about 1cm ；when it's in the stage of larva the color of the carapace is brown, the length is 1cm ； cockroaches shed through growing because of exoskeleton growth, (pic 2). They turn white after shedding, after a few days its exoskeleton (carapace) turns into different color due to its gender, male cockroach turns into reddish-brown, the length is about 2.5cm ；female cockroach turns into black (cerise); length is about 2.5cm (pic 2).

Turkestan Cockroach growth picture:

Pic.2: Turkestan Cockroach larva grow history

(Resource: Researcher)

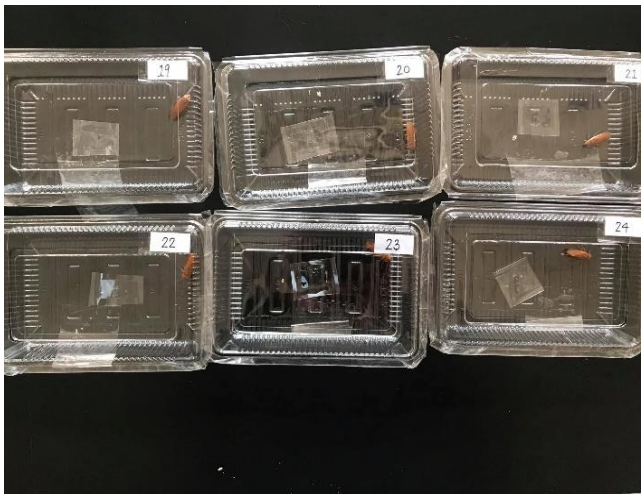
IV. Research Methods

i. Experimental Method Description(preparation)

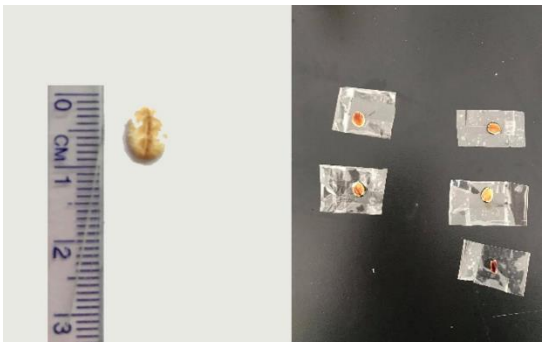
The Turkestan Cockroach is brought from the pet shop (pic.4) and placed it in different boxes (pic.5), we gave it 3 days of the adaptation period, during the 3 days we gave nothing but a piece 1 cm symmetry oatmeal (pic.6), after the adaptation period, we used the oatmeal as the food source to add to the liquid which we are testing on, below is the experimental method steps:

1. We used a plastic case to place the Turkestan cockroach and made some small holes to give them fresh air.
2. Considering that the cockroaches are gyrophototaxis insects, so besides the experiment time, we place it in the shade.
3. Each experiment we use the pipette to adulterate solution for controlling its volume on oatmeal, make them just cover the surface of the oatmeal.
4. The recording cycle is once per day, the experiment set costs 7 days In total
5. We recorded the amount of consumed oatmeal and the amount of defecation (Pic.7).

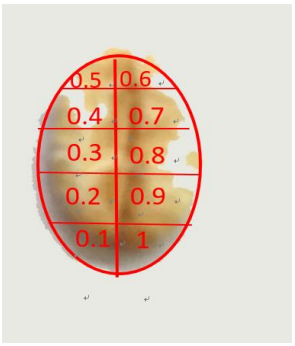
Pic.4: Turkestan Cockroach in pet shop
(Resource: Researcher)



Pic.5 Turkestan Cockroach placed in plastic case
(Resource: Researcher)



Pic 6: Left, Oatmeal, Right, Oatmeal with soy sauce
(Resource: Researcher)



Pic 7: The Definition of amount of oatmeal
(Resource: Researcher)

ii. Ingredients Of Ingredients Solution

TESTING SOLUTION	IMAGE	INGREDIENTS	TESTING SOLUTION	IMAGE	INGREDIENTS
Mirin		Fructose, Water, Glutinous Rice, Rice Yeast, Sugar, Vinegar, Salt, Seasoning agent (Glycine, Sodium Citrate, DL-Alanine, Sodium 5'-Inosinate, Sodium 5'-Guanylate)	Hair Conditioner		Vitamin E, Carotene, Squalene, Unsaturated Fat (Oleic acid、Linoleic acid)、α- Tocopherol, Phytosterol
Vinegar		Water, Vinegar, Sugar, Salt, Onion, Concentrated Orange Juice, Tomato Puree, Concentrated Carrot Juice, Celery seed	Bleach		Sodium hypochlorite Bleach
Cooking Alcohol		Rice, Ethyl Alcohol(19.5%)	Washing Machine Detergent		Orange Aroma, Hypochlorite, Sodium Hydroxide, Sodium Lauretha Sulphate
Soy Sauce		Water, Defatted soy（non-GMO）, Salt, Wheat, Invert Sugar(Cane Sugar, Water), Seasoning agent(Glycine, Sodium 5'-Inosinate, Sodium 5' -Guanylate)	Toilet Cleaner		Acidic Cleaner, Bactericide, Surfactant
Water		Water	Window Cleaner		Surfactant, Water
Mouthwash		Aqua, Glycerin, Sorbitol, Potassium Nitrate, PEG-60 Hydrogenated Castor Oil, Poloxamer 407, Sodium Benzoate, Aroma, Disodium Phosphate, Methyl paraben, Propyl paraben, Sodium Phosphate, Sodium Saccharin, CI 42090.	Toner		Water, triethanolamine

Form.1 Ingredients of Ingredients solution
(Resource: Researcher)

iii. Different soy sauce type and ingredient description

According to EXP.2, we discovered that the Turkestan Cockroach prefers the 25% concentration soy sauce than the others, so we used the 25% concentration soy sauce throughout the experiment.

The form below is the different type of soy sauce and their ingredient. We chose in this experiment

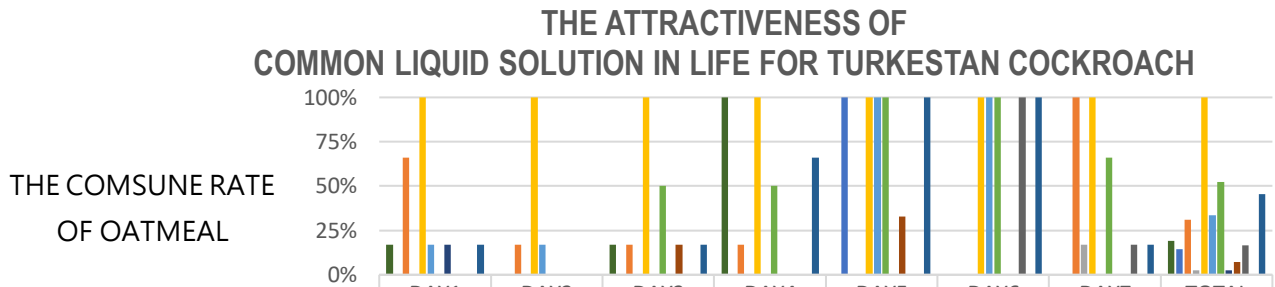
THE NAME OF SOY SAUCE	INGREDIENT
SI-ZI Brand Artificial Soy Sauce	Water, Defatted soy(non-GMO), Salt, Wheat, Invert Sugar(Cane Sugar, Water), Seasoning agent (Glycine, Sodium 5'-Inosinate, Sodium 5'-Guanylate).
JIN-LAN Artificial Soy Sauce	Water, defatted soybean(non-GMO), Wheat, Salt, Invert Sugar(Cane Sugar, Water), Alcohol, Yeast Extract, Monascus Colors(Within Alcohol), edulcorant(Licorice Extracts(Dextrin, Sodium, Citrate),flavoring agent(DL-acid of apples).
Black Bean Brewing Soy Sauce	Water, Black Soybean, Miso(Defatted soy(non-GMO), Rice), Unrefined Sugar, Crude Salt From Australia, Sorghum Bicolor, Glycyrrhiza Uralensis
WAN-JA-SHAN Brand Vintage Brewing Soy Sauce	Water, Invert Syrup, defatted soybean(non-GMO), Wheal, Alcohol, Yeast Extract.

Form.2: Soy sauce type and ingredient description
(Resource: Researcher)

V. RESEARCH RESULTS

i. Experiment resulis

EXP.1 THE ATTRACTIVENESS OF COMMON LIQUID SOLUTION IN LIFE FOR TURKESTAN COCKROACH



	DAY1	DAY2	DAY3	DAY4	DAY5	DAY6	DAY7	TOTAL
Mirin	17%	0	17%	100%	0	0	0	19%
Vinegar	0	0	0	0	100%	0	0	14%
Cooking alchol	66%	17%	17%	17%	0	0	100%	31%
Soy Sauce	0	0	0	0	0	0	17%	2%
Water	100%	100%	100%	100%	100%	100%	100%	100%
Mouthwash	17%	17%	0	0	100%	100%	0	33%
Toner	0	0	50%	50%	100%	100%	66%	52%
Hair Conditioner	17%	0	0	0	0	0	0	2%
Bleach	0	0	17%	0	33%	0	0	7%
Washing Machine Detergent	0	0	0	0	0	100%	17%	17%
Toilet Detergent	0	0	0	0	0	0	0	0%
Window Cleaner	17%	0	17%	66%	100%	100%	17%	45%

Picture 3: The attractiveness of common liquid solution in life for Turkestan Cockroach (Resource: Researcher)

This chart showing that water is more attractive than others in this experimental set. Turkestan Cockroaches take 21 pieces in 7 days (100%). The second high is toner (52.42%), and the third of cockroaches' favorite flavor is window cleaner (45.28%). However, when it comes to soy sauce, the result shows that soy sauce can't have attracted the cockroaches (2.42%).

However, we still curious about the result of "soy sauce can't have attracted the Turkestan Cockroaches so well as others." Weather DIFFERENT CONCENTRATION of artificial soy sauce is another factor the effect the Turkestan Cockroaches?" or "DIFFERENT INGREDIENT (ARTIFICIAL/NATURAL) of soy sauce ganna make a different result?

“The character of this smell is best discovered by experience for description can only reveal it as an ominous, awful fetid odor which might be approximated to a fecal soy sauce. It is produced both by the roaches’ waste and by various sexual and functionary secretions.” (Harry Hurt III, 1976) points out Dr. Christopher Durden discovered in his researching presses that the scent is painful for cockroaches. Due to its’ waste and various sexual and functionary secretions.

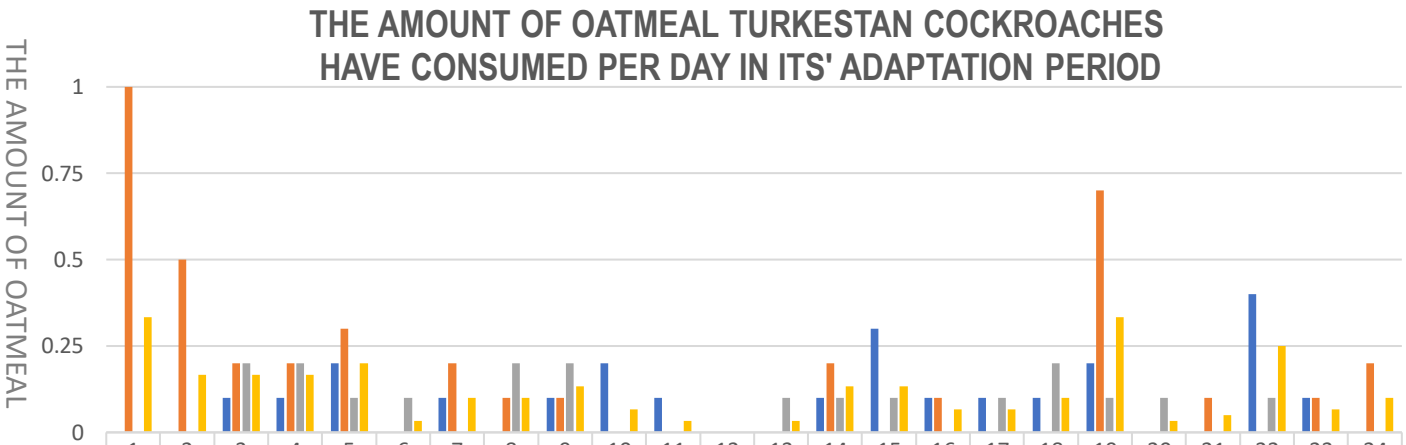
Japanese entomologist Noboru Aoki (青木 皐) say in his book: “They can get their mandibles on, including but not limited to dandruff, hair, wood, paper, grease, dead insects, and fabrics. But they wouldnot eat salt nor soy sauce.” (青木 皐,2002)

EXP.2 HOW MANY OATMEAL WITH DIFFERENT CONCENTRATION OF ARTIFICIAL SOY SAUCE (SI-ZI BRAND) CAN TURKESTAN COCKROACH EAT PER DAY.

ii. Experimental Method Description:

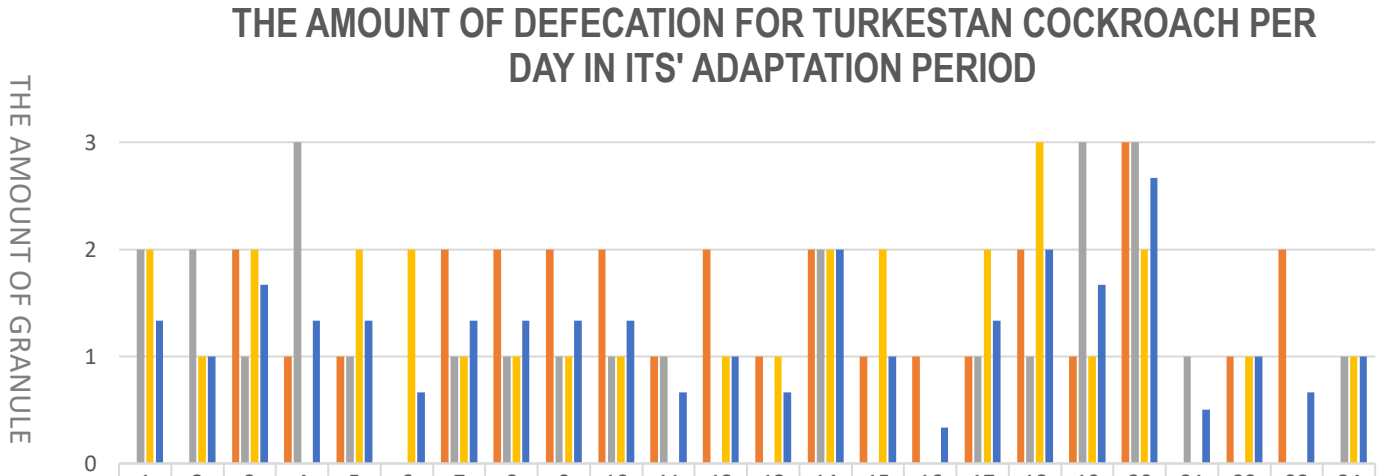
1. This experiment takes four different concentration of artificial soy sauce (SI-ZI BRAND):100%、75%、50%、25%.During the dilutee process, each equipment is clean.
2. Each experiment we use a pipette to adulterate solution for controlling its volume on oatmeal, make them just cover the surface of the oatmeal.
3. The recording cycle is once per day, the experiment set costs 7 days in total. The amount of consumed oatmeal and amount of defecation. (Pic.7 & Chart.1)
4. We gave three-day-adaptation period for each Turkestan Cockroach (more detail in EXP2-1). And observe its' CONSUMED AMOUNT OF OATMEAL PER DAY, THEAMOUNT OF DETHCATION PER DAY."

1. Adaptation Period Experiment Result (Use for compare)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
DAY1	0	0	0.1	0.1	0.2	0	0.1	0	0.1	0.2	0.1	0	0	0.1	0.3	0.1	0.1	0.1	0.2	0	0	0.4	0.1	
DAY2	1	0.5	0.2	0.2	0.3	0	0.2	0.1	0.1	0	0	0	0	0.2	0	0.1	0	0	0.7	0	0.1		0.1	0.2
DAY3	0	0	0.2	0.2	0.1	0.1	0	0.2	0.2	0	0	0	0.1	0.1	0.1	0	0.1	0.2	0.1	0.1		0.1	0	0
AVG	0.33	0.17	0.17	0.17	0.2	0.03	0.1	0.1	0.13	0.07	0.03	0	0.03	0.13	0.13	0.07	0.07	0.1	0.33	0.03	0.05	0.25	0.07	0.1

Pic.9: The amount of oatmeal Turkestan Cockroaches have consumed per day in its' adaptation period (Resource: Researcher)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
DAY 1	0	0	2	1	1	0	2	2	2	2	1	2	1	2	1	1	1	2	1	3	0	1	2	
DAY 2	2	2	1	3	1	0	1	1	1	1	1	0	0	2	0	0	1	1	3	3	1		0	1
DAY 3	2	1	2	0	2	2	1	1	1	1	0	1	1	2	2	0	2	3	1	2		1	0	1
AVG	1.33	1	1.67	1.33	1.33	0.67	1.33	1.33	1.33	1.33	0.67	1	0.67	2	1	0.33	1.33	2	1.67	2.67	0.5	1	0.67	1

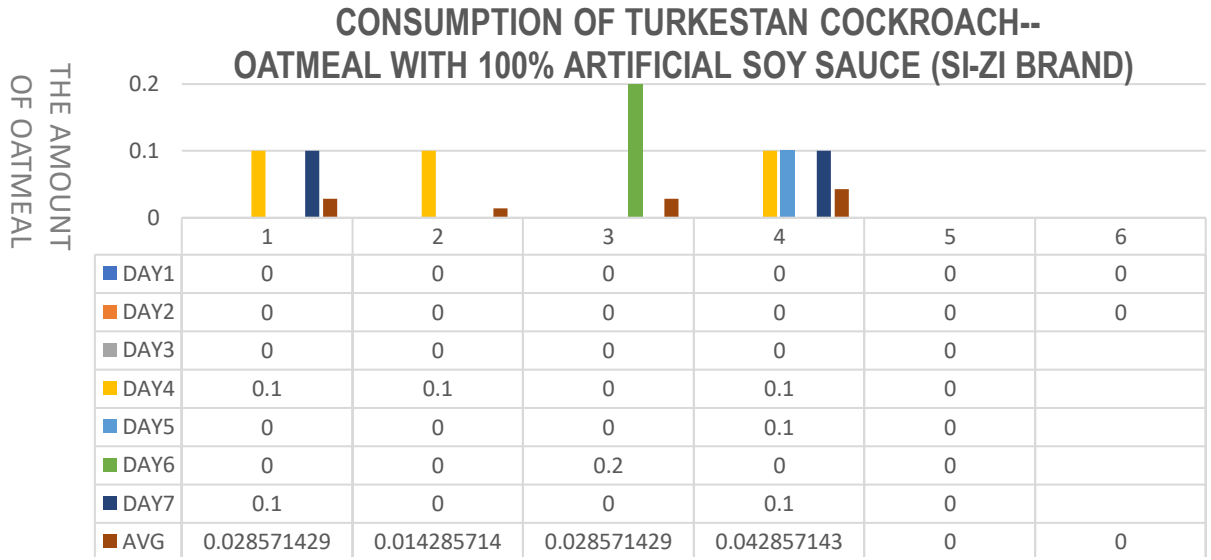
Pic.10: the amount of defecation for Turkestan Cockroach per day in its' adaptation period (Resource: Researcher)

2. 100%Artificial Soy Sauce (SI-ZI Brand)

Pic.11 is the record chart of how much each Turkestan Cockroach consumed the 100% concentration artificial soy sauce per day. The result data shows that is same with the **EXP.1**, soy sauce can't really attracted cockroach will. the highest average amount of which consumes the most is No.4 (0.04pces/day), the highest the average amount of granule is No.2(0.57/day).

The highest amount of consumption in a day record records by No.3(0.2 pces)

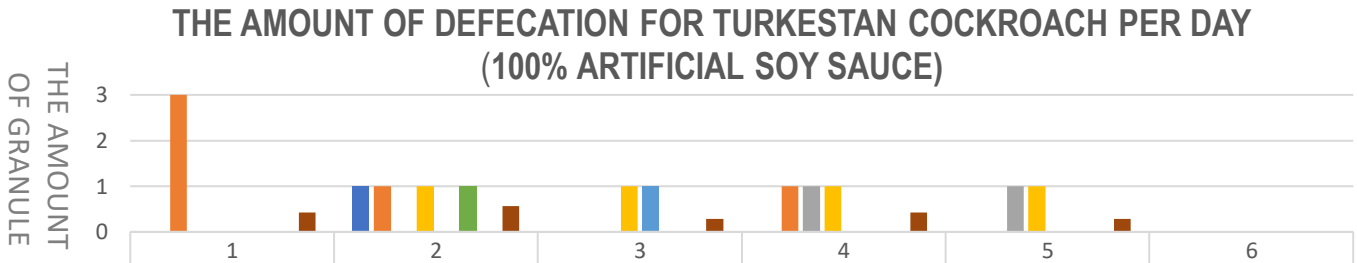
And compare with the data of adaptation period (0.1pces/day; 1.2 granule/day), all of average amount are lower.



	1	2	3	4	5	6
DAY1	0	0	0	0	0	0
DAY2	0	0	0	0	0	0
DAY3	0	0	0	0	0	
DAY4	0.1	0.1	0	0.1	0	
DAY5	0	0	0	0.1	0	
DAY6	0	0	0.2	0	0	
DAY7	0.1	0	0	0.1	0	
AVG	0.028571429	0.014285714	0.028571429	0.042857143	0	0

Pic.11 Consumption of Turkestan Cockroach-- oatmeal with 100% artificial soy sauce (SI-ZI brand)

(Resource: Researcher)



	1	2	3	4	5	6
DAY1	0	1	0	0	0	0
DAY2	3	1	0	1	0	0
DAY3	0	0	0	1	1	
DAY4	0	1	1	1	1	
DAY5	0	0	1	0	0	
DAY6	0	1	0	0	0	
DAY7	0	0	0	0	0	
AVG	0.428571429	0.571428571	0.285714286	0.428571429	0.285714286	0

Pic:12: The amount of defecation for Turkestan Cockroach per day (100% artificial soy sauce)

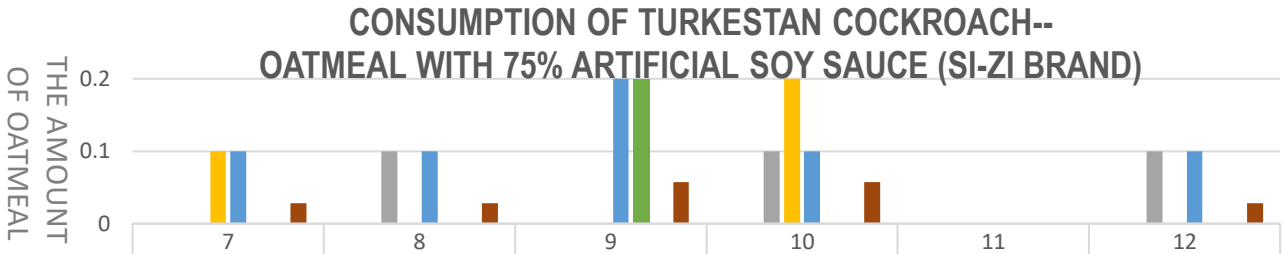
(Resource: Researcher

3. 75%Artificial Soy Sauce (SI-ZI Brand):

Pic.13 is the record chart of how much each Turkestan Cockroach consumed the 75% concentration artificial soy sauce per day, this experiment shows that the highest average amount of which consumes the most is no.9 & No.10 (about 0.06 pces/day), they had the record of average amount of consumed record the highest data in total.

Something interesting happened, despite they are highest average in consumption; but the highest average amount of granule are No.8 & No.12 (about 0.8 granule/day)

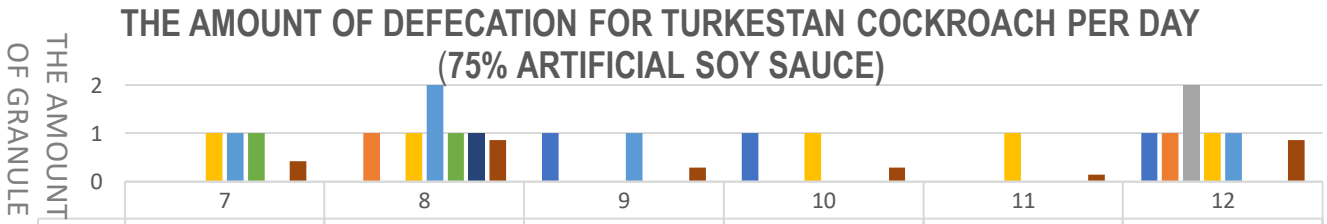
Compare with adaptation period, all of the data are lower than.



	7	8	9	10	11	12
DAY1	0	0	0	0	0	0
DAY2	0	0	0	0	0	0
DAY3	0	0.1	0	0.1	0	0.1
DAY4	0.1	0	0	0.2	0	0
DAY5	0.1	0.1	0.2	0.1	0	0.1
DAY6	0	0	0.2	0	0	0
DAY7	0	0	0	0	0	0
AVG	0.028571429	0.028571429	0.057142857	0.057142857	0	0.028571429

Pic.13 Consumption of Turkestan Cockroach-- oatmeal with 75% artificial soy sauce (SI-ZI brand)

(Resource: Researcher)



	7	8	9	10	11	12
DAY1	0	0	1	1	0	1
DAY2	0	1	0	0	0	1
DAY3	0	0	0	0	0	2
DAY4	1	1	0	1	1	1
DAY5	1	2	1	0	0	1
DAY6	1	1	0	0	0	0
DAY7	0	1	0	0	0	0
AVG	0.428571429	0.857142857	0.285714286	0.285714286	0.142857143	0.857142857

Pic:14: The amount of defecation for Turkestan Cockroach per day (75% artificial soy sauce)

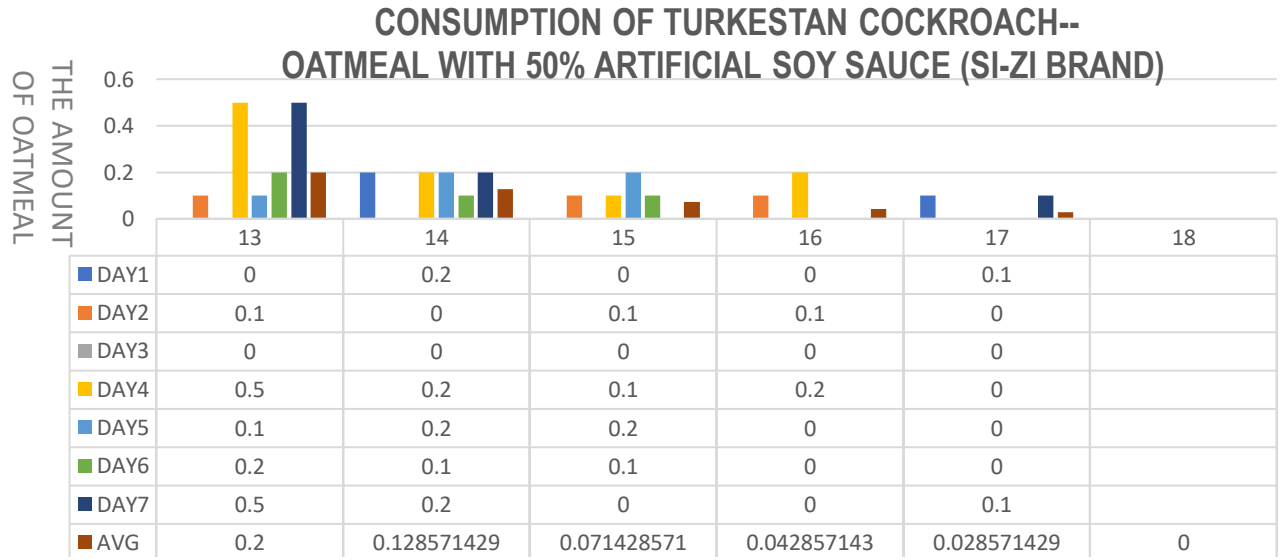
(Resource: Researcher)

4. 50%Artificial Soy Sauce (SI-ZI Brand):

Pic.15 is the record chart of how much each Turkestan Cockroach consumed the 50% artificial soy sauce per day, this experiment shows that the highest average amount of which consumes the most is No.13 (0.2pces/day), while No.13 and No.14 shows the highest interest to the 50% concentration artificial soy sauce during the 7 days experiment (No.13: 0.2pces/day), (No.14 0.12pces/day)

In this experiment set, not only average consumption but average defecation (0.08pces,0.52 granule/day), both of them higher than set of 100% & 75% (0.19pces,0.33 granule/day) & (0.33,0.47 granule/day).

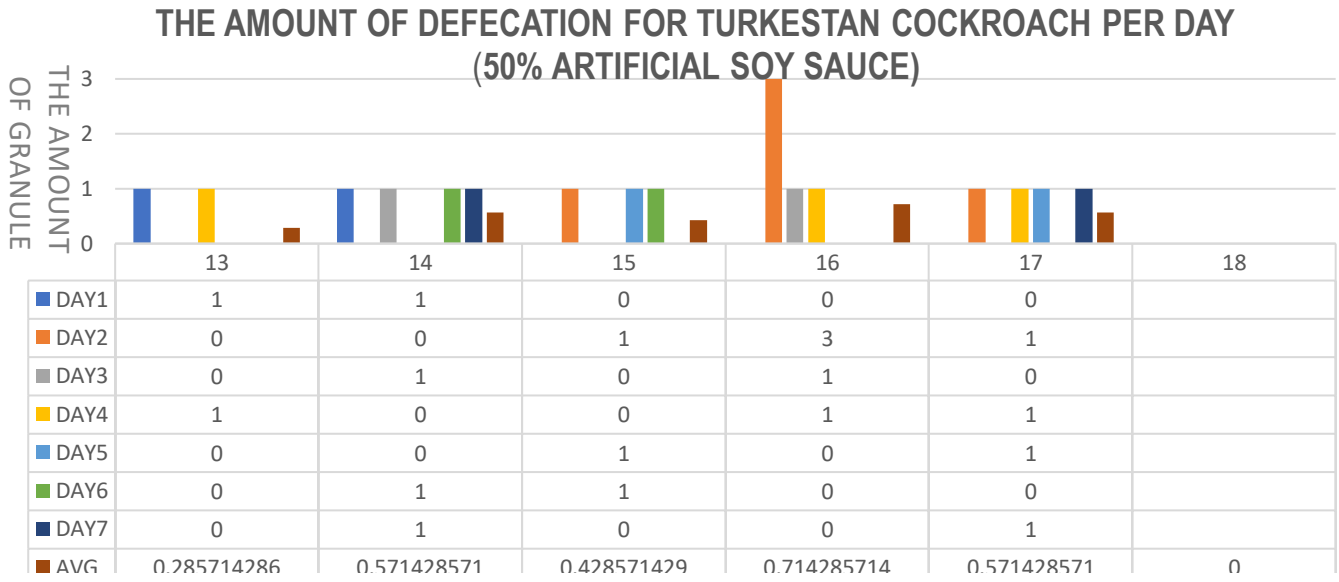
Despite lower than the same cockroach in adaptation period (1.2pces.0.08 granule/day).



	13	14	15	16	17	18
DAY1	0	0.2	0	0	0.1	
DAY2	0.1	0	0.1	0.1	0	
DAY3	0	0	0	0	0	
DAY4	0.5	0.2	0.1	0.2	0	
DAY5	0.1	0.2	0.2	0	0	
DAY6	0.2	0.1	0.1	0	0	
DAY7	0.5	0.2	0	0	0.1	
AVG	0.2	0.128571429	0.071428571	0.042857143	0.028571429	0

Pic.15: Consumption of Turkestan Cockroach--oatmeal with 75% artificial soy sauce (SI-ZI BRAND)

(Resource: Researcher)



	13	14	15	16	17	18
DAY1	1	1	0	0	0	
DAY2	0	0	1	3	1	
DAY3	0	1	0	1	0	
DAY4	1	0	0	1	1	
DAY5	0	0	1	0	1	
DAY6	0	1	1	0	0	
DAY7	0	1	0	0	1	
AVG	0.285714286	0.571428571	0.428571429	0.714285714	0.571428571	0

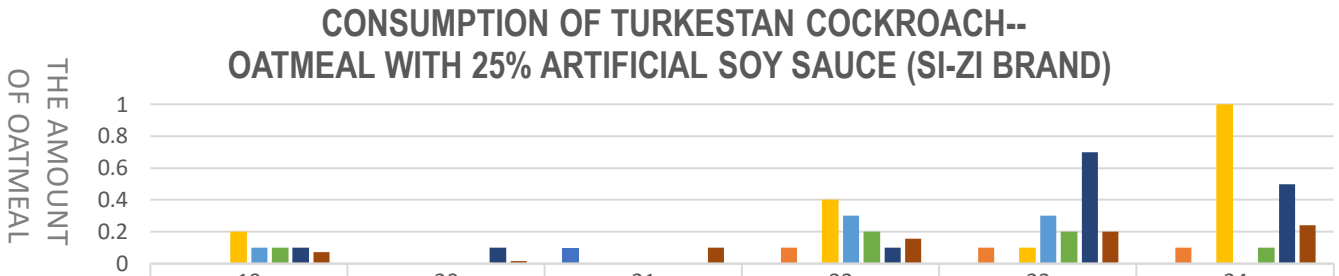
Pic.16: The amount of defecation for Turkestan Cockroach per day (75% artificial soy sauce)

(Resource: Researcher)

5. 25%Artificial Soy Sauce (SI-ZI Brand):

Pic.17 is the record chart of how much each Turkestan Cockroach consumed the 25% artificial soy sauce per day, in this experiment the Turkestan Cockroach shows higher interest than other set. The highest average amount of which consumes the most is No.24(0.25pces/day), but it is not the highest average amount of defecation too (0.57 granule/day). The highest is No.22 (1 granule/day).

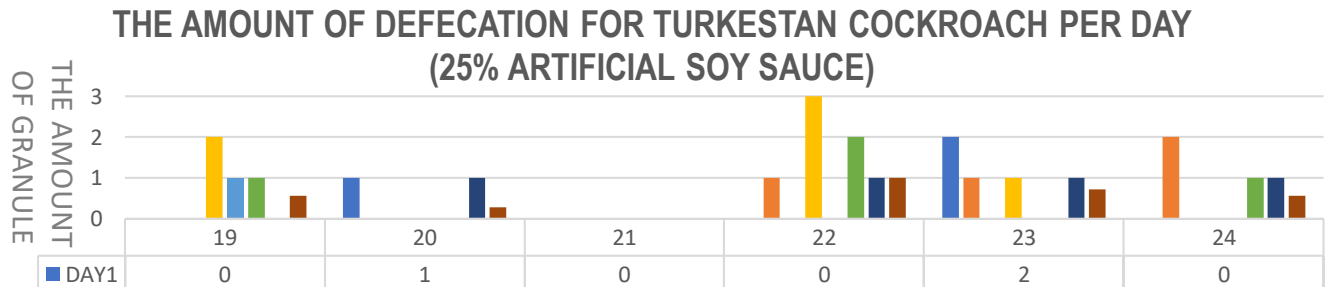
In this experiment set, not only average consumption but average defecation (0.13pces,0.52 granule/day), both of them higher than set of 100%, 75% & 50%(0.19pces,0.33 granule/day), (0.33pces,0.47 granule/day). In spite of its' data higher than others, but the fact of it still lower then adaptation period's.



	19	20	21	22	23	24
DAY1	0	0	0.1	0	0	0
DAY2	0	0		0.1	0.1	0.1
DAY3	0	0		0	0	0
DAY4	0.2	0		0.4	0.1	1
DAY5	0.1	0		0.3	0.3	0
DAY6	0.1	0		0.2	0.2	0.1
DAY7	0.1	0.1		0.1	0.7	0.5
AVG	0.071428571	0.014285714	0.1	0.157142857	0.2	0.242857143

Pic.17: Consumption Of Turkestan Cockroach-- Oatmeal With 25% Artificial Soy Sauce (SI-ZI Brand)

(Resource: Researcher)

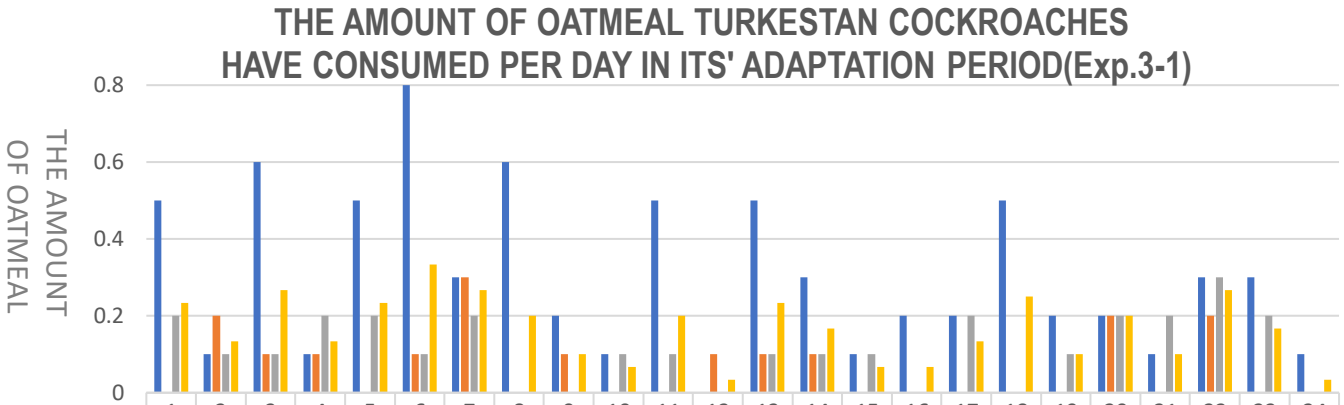


	19	20	21	22	23	24
DAY1	0	1	0	0	2	0
DAY2	0	0		1	1	2
DAY3	0	0		0	0	0
DAY4	2	0		3	1	0
DAY5	1	0		0	0	0
DAY6	1	0		2	0	1
DAY7	0	1		1	1	1
AVG	0.571428571	0.285714286	0	1	0.714285714	0.571428571

Pic.18: The amount of defecation for Turkestan Cockroach per day (25% artificial soy sauce)

(Resource: Researcher)

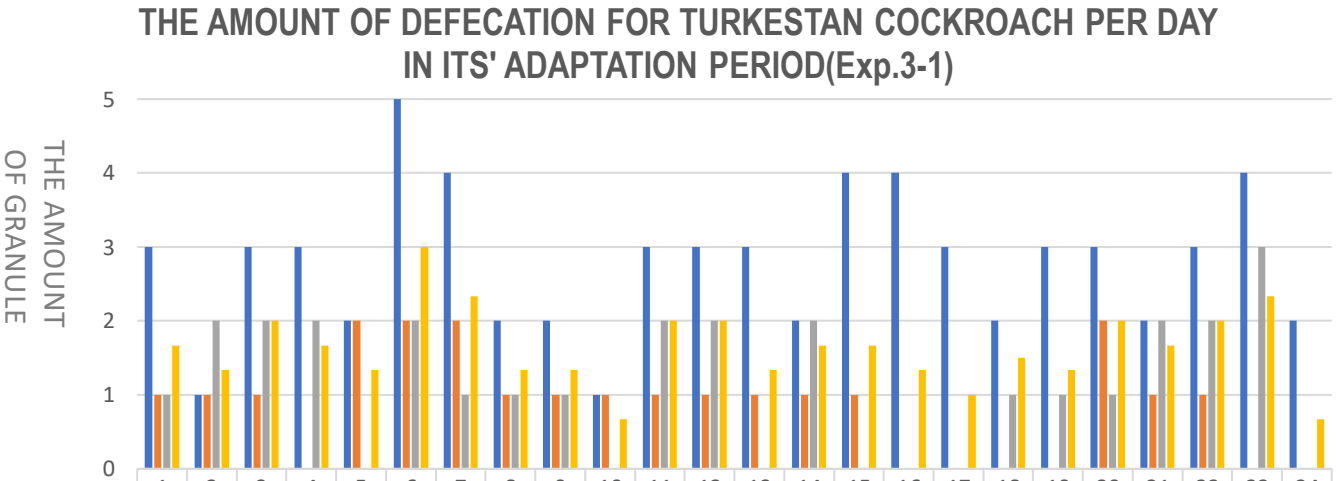
6. Adaptation Period Experiment Result(Use for compare)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
DAY 1	0.5	0.1	0.6	0.1	0.5	0.8	0.3	0.6	0.2	0.1	0.5	0	0.5	0.3	0.1	0.2	0.2	0.5	0.2	0.2	0.1	0.3	0.3	0.1
DAY 2	0	0.2	0.1	0.1	0	0.1	0.3	0	0.1	0	0	0.1	0.1	0.1	0	0	0		0	0.2	0	0.2	0	0
DAY 3	0.2	0.1	0.1	0.2	0.2	0.1	0.2	0	0	0.1	0.1	0	0.1	0.1	0.1	0	0.2	0	0.1	0.2	0.2	0.3	0.2	0
AVG	0.23	0.13	0.27	0.13	0.23	0.33	0.27	0.2	0.1	0.07	0.2	0.03	0.23	0.17	0.07	0.07	0.13	0.25	0.1	0.2	0.1	0.27	0.17	0.03

Pic.23: The amount of oatmeal Turkestan Cockroaches have consumed per day in its' adaptation period

(Resource: Researcher)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
DAY 1	3	1	3	3	2	5	4	2	2	1	3	3	3	2	4	4	3	2	3	3	2	3	4	2
DAY 2	1	1	1	0	2	2	2	1	1	1	1	1	1	1	1	0	0		0	2	1	1	0	0
DAY 3	1	2	2	2	0	2	1	1	1	0	2	2	0	2	0	0	0	1	1	1	2	2	3	0
AVG	1.67	1.33	2	1.67	1.33	3	2.33	1.33	1.33	0.67	2	2	1.33	1.67	1.67	1.33	1	1.5	1.33	2	1.67	2	2.33	0.67

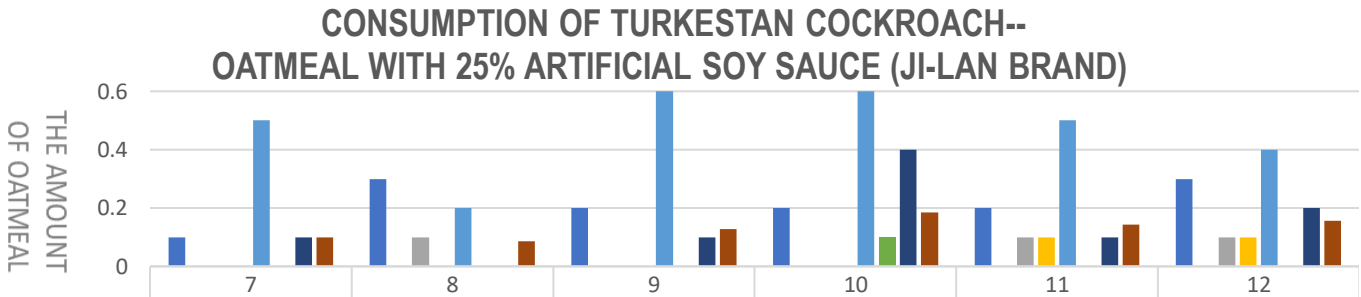
Pic.24: the amount of defecation for Turkestan Cockroach per day in its' adaptation period

(Resource: Researcher)

7. 25% JIN-LAN Artificial Soy Sauce

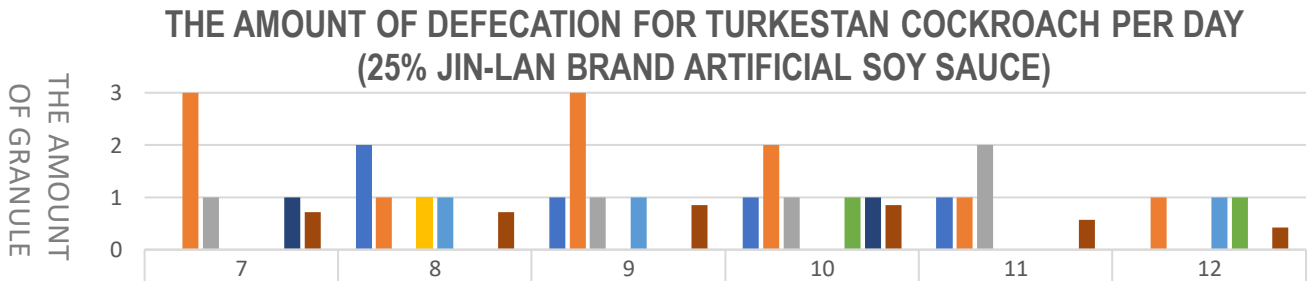
Pic.25 is the chart of how much each Turkestan Cockroach consumed the 25% artificial soy sauce (JIN-LAN) per day, the highest record is No.4(0.18pces/day). That's focus on DAY 5. Somehow, at the day cockroaches' consumption freaking high, and some data are others' 3 times!

As the same result, both of "amount of oatmeal", "amount of granule" (0.13 pces, 0.7 granule/day) lower the average data in adaptation period (0.4 pces, 0.7 granule/day).



	7	8	9	10	11	12
DAY1	0.1	0.3	0.2	0.2	0.2	0.3
DAY2	0	0	0	0	0	0
DAY3	0	0.1	0	0	0.1	0.1
DAY4	0	0	0	0	0.1	0.1
DAY5	0.5	0.2	0.6	0.6	0.5	0.4
DAY6	0	0	0	0.1	0	0
DAY7	0.1	0	0.1	0.4	0.1	0.2
AVG	0.1	0.085714286	0.128571429	0.185714286	0.142857143	0.157142857

Pic.25: Consumption of Turkestan Cockroach--oatmeal with 25% artificial soy sauce (JI-LAN BRAND) (Resource: Researcher)



	7	8	9	10	11	12
DAY1	0	2	1	1	1	0
DAY2	3	1	3	2	1	1
DAY3	1	0	1	1	2	0
DAY4	0	1	0	0	0	0
DAY5	0	1	1	0	0	1
DAY6	0	0	0	1	0	1
DAY7	1	0	0	1	0	0
AVG	0.714285714	0.714285714	0.857142857	0.857142857	0.571428571	0.428571429

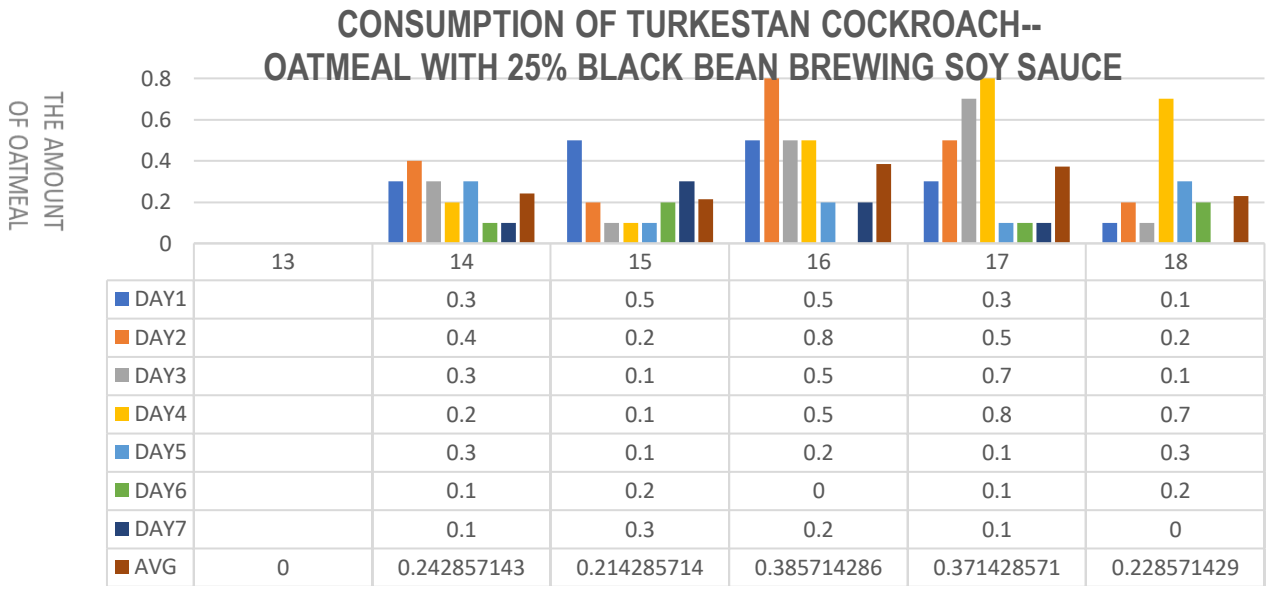
Pic.26: The amount of defecation for Turkestan Cockroach per day (25% JIN-LAN BRAND artificial soy sauce) (Resource: Researcher)

8. 25% Black Bean Brewing Soy Sauce

Pic.27 is the chart of how much each Turkestan Cockroach consumed the 25% Black Bean Brewing Soy Sauce. If brewing soy sauce can make more attractiveness to Turkestan Cockroach?

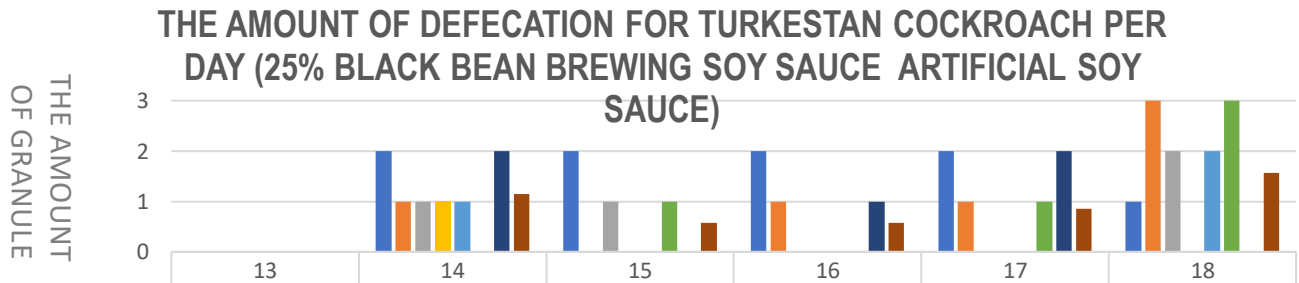
The answer of this result is yes, compare with Pic.25& Pic.27, the consumption rate way higher than both of them. Maybe cockroaches prefer natural sauce.

At the average of the amount of oatmeal, the highest data is No.16(0.38pces/day). The highest is number (1.57 granule/day)



	13	14	15	16	17	18
DAY1		0.3	0.5	0.5	0.3	0.1
DAY2		0.4	0.2	0.8	0.5	0.2
DAY3		0.3	0.1	0.5	0.7	0.1
DAY4		0.2	0.1	0.5	0.8	0.7
DAY5		0.3	0.1	0.2	0.1	0.3
DAY6		0.1	0.2	0	0.1	0.2
DAY7		0.1	0.3	0.2	0.1	0
AVG	0	0.242857143	0.214285714	0.385714286	0.371428571	0.228571429

Pic.27: Consumption of Turkestan Cockroach-- oatmeal with 25% black bean brewing soy sauce (Resource: Researcher)



	13	14	15	16	17	18
DAY1		2	2	2	2	1
DAY2		1	0	1	1	3
DAY3		1	1	0	0	2
DAY4		1	0	0	0	0
DAY5		1	0	0	0	2
DAY6		0	1	0	1	3
DAY7		2	0	1	2	0
AVG	0	1.142857143	0.571428571	0.571428571	0.857142857	1.571428571

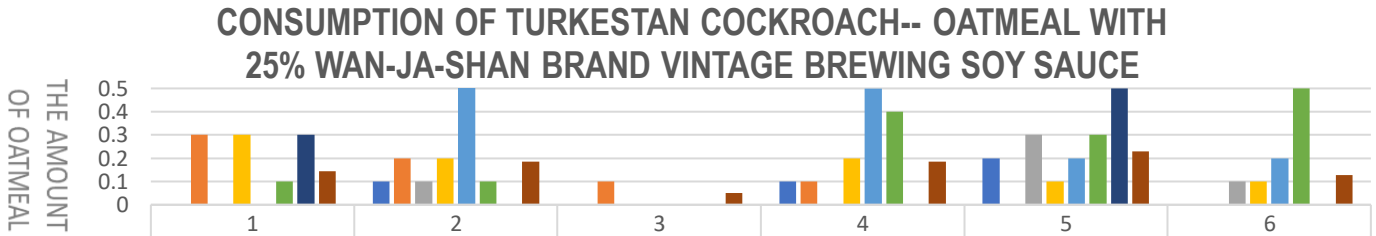
Pic.28: The amount of defecation for Turkestan Cockroach per day (25% BLACK BEAN BREWING soy sauce) (Resource: Researcher)

9. 25% WAN-JA-SHAN Brand Vintage Brewing Soy Sauce

Pic.29, shows another interesting truth. The total average of this set is (0.15pces/day, 0.28granule/day). Somehow, the average amount of defecation is ridiculous low.

Though the chart, the highest average amount of oatmeal per day is No.5(0.23pces/day),it also is the highest average of amount of defecation(0.8granule/day),and that is different than other set. In the experiment before, we knew the highest average amount of oatmeal per day usually won't be the highest average defecation. For No.5 both of data are the highest in this case.

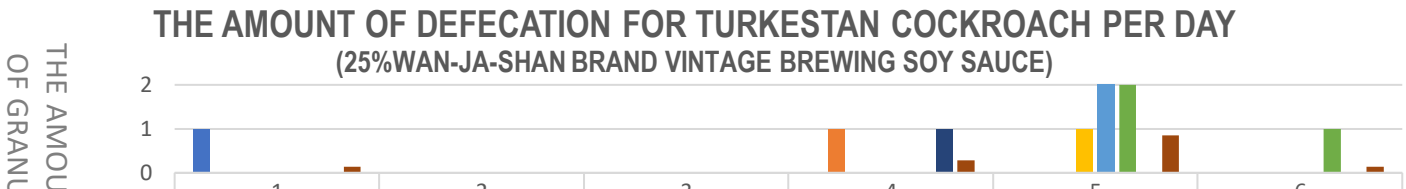
If we compare with adaptation period (0.22pces/day, 1.83 granule/day), the average amount of oatmeal, get closer (deference with adaptation period: 0.07) than JIN-LAN one's (deference with adaptation period: 0.07). It is the prove that cockroaches favor low concentration brewing soy sauce than low concentration artificial soy sauce.



	1	2	3	4	5	6
DAY1	0	0.1	0	0.1	0.2	0
DAY2	0.3	0.2	0.1	0.1	0	0
DAY3	0	0.1		0	0.3	0.1
DAY4	0.3	0.2		0.2	0.1	0.1
DAY5	0	0.6		0.5	0.2	0.2
DAY6	0.1	0.1		0.4	0.3	0.5
DAY7	0.3	0		0	0.5	0
AVG	0.142857143	0.185714286	0.05	0.185714286	0.228571429	0.128571429

Pic.29 : Consumption of Turkestan Cockroach-- oatmeal with 25% WAN-JA-SHAN brand vintage brewing soy sauce

(Resource: Researcher)



	1	2	3	4	5	6
DAY1	1	0	0	0	0	0
DAY2	0	0	0	1	0	0
DAY3	0	0		0	0	0
DAY4	0	0		0	1	0
DAY5	0	0		0	3	0
DAY6	0	0		0	2	1
DAY7	0	0		1	0	0
AVG	0.142857143	0		0.285714286	0.857142857	0.142857143

Pic.30: The amount of defecation for Turkestan Cockroach per day

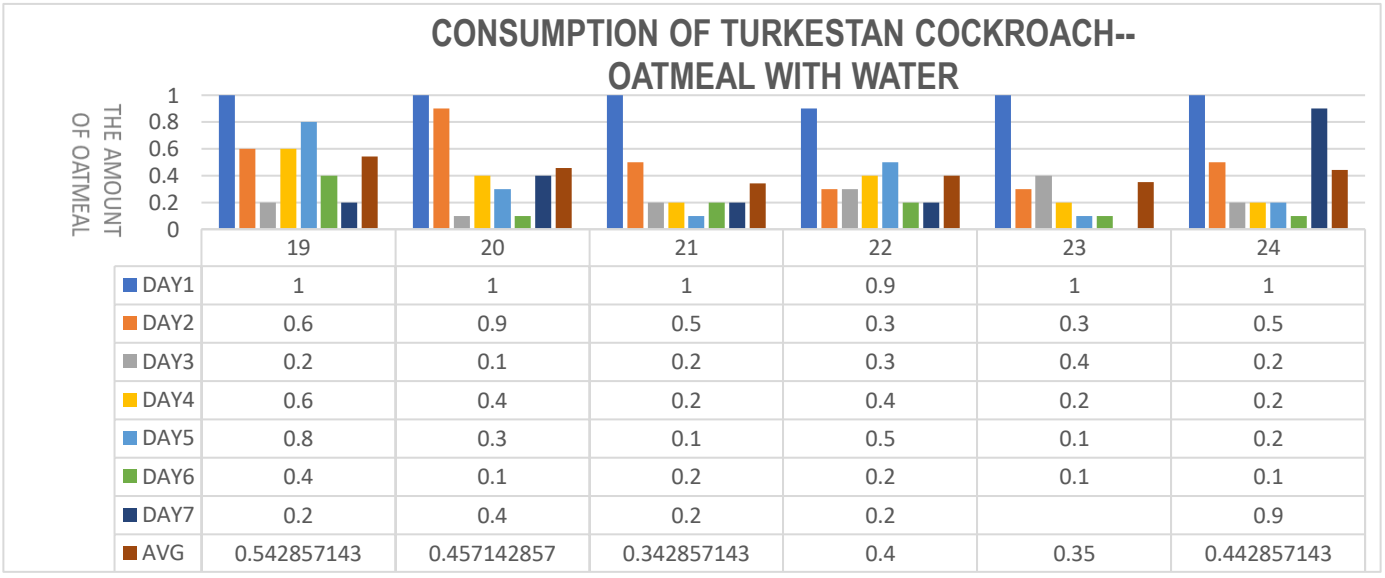
(Resource: Researcher)

10. Oatmeal With Water(Control Group)

Pic .31 is the record chart of Control Group, data here is the highest group of whole experiment. The highest average amount of oatmeal consumed is No.19, it consumed 0.54 pieces per day. It is almost a half of a piece oatmeal.

When it comes to the highest average amount of defecation, the highest is No.20(2 granule/day)

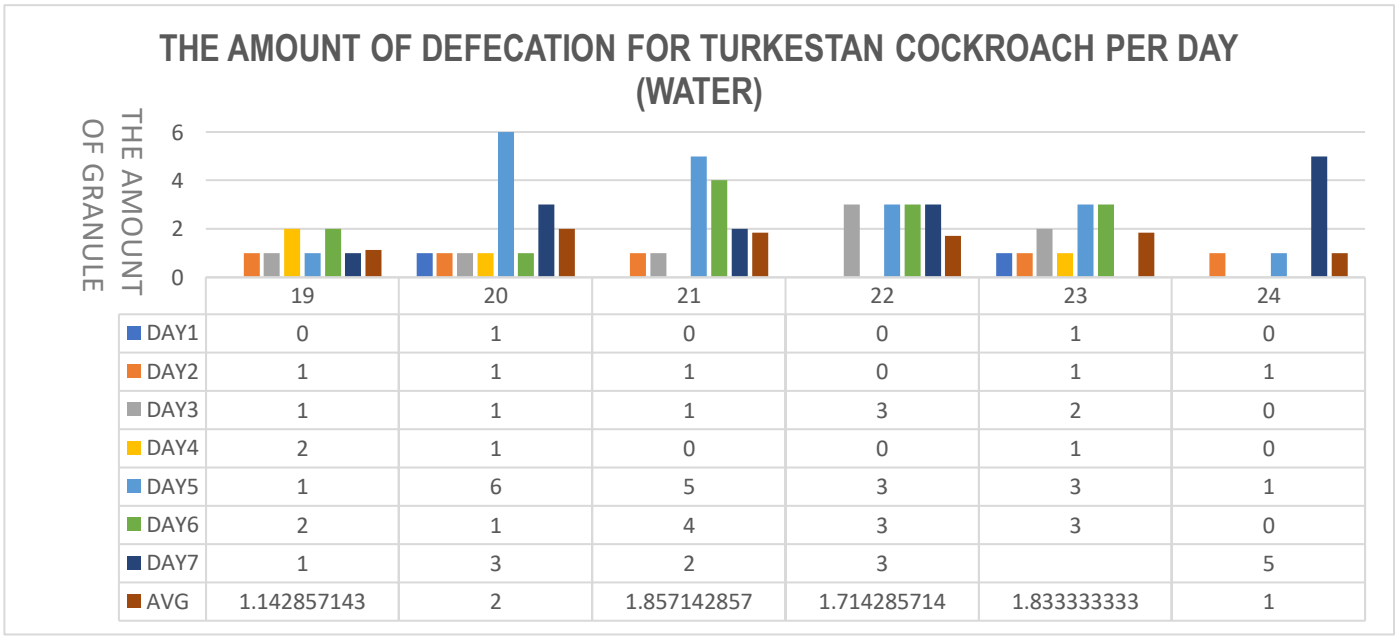
In control group, The average of both is (0.4pces/day,1.6 granule/day),the average amount of oatmeal consumed higher than adaptation period(0.14pces/day,1.6 granule/day).



	19	20	21	22	23	24
DAY1	1	1	1	0.9	1	1
DAY2	0.6	0.9	0.5	0.3	0.3	0.5
DAY3	0.2	0.1	0.2	0.3	0.4	0.2
DAY4	0.6	0.4	0.2	0.4	0.2	0.2
DAY5	0.8	0.3	0.1	0.5	0.1	0.2
DAY6	0.4	0.1	0.2	0.2	0.1	0.1
DAY7	0.2	0.4	0.2	0.2		0.9
AVG	0.542857143	0.457142857	0.342857143	0.4	0.35	0.442857143

Pic.31: Consumption of Turkestan Cockroach (Control Grourp)

(Resource: Researcher)



	19	20	21	22	23	24
DAY1	0	1	0	0	1	0
DAY2	1	1	1	0	1	1
DAY3	1	1	1	3	2	0
DAY4	2	1	0	0	1	0
DAY5	1	6	5	3	3	1
DAY6	2	1	4	3	3	0
DAY7	1	3	2	3		5
AVG	1.142857143	2	1.857142857	1.714285714	1.833333333	1

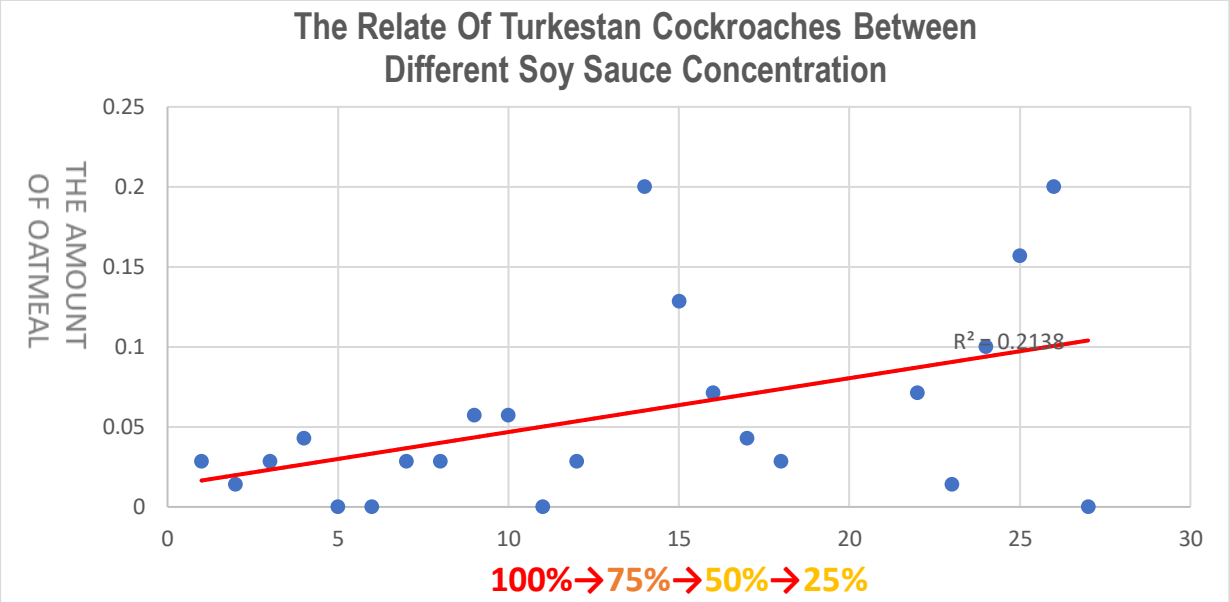
Pic.32: The amount of defecation for Turkestan Cockroach per day (Control Group)

(Resource: Researcher)

VI. CONCLUSION

After three major experiments, the results show that Turkestan Cockroaches love water and solution ingredient with water over 50% the most. Take this research for example(Exp.1), the favorite of Turkestan Cockroaches is toner(80%water) except water. This is the first of three evidence in total.

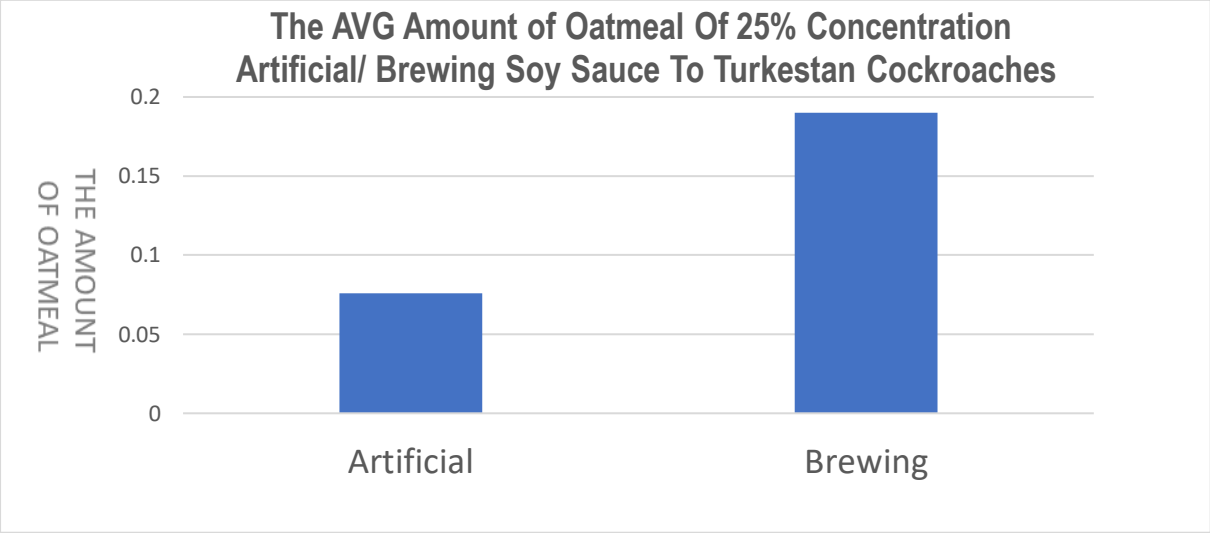
In the experiment of “The attractiveness to different soy sauce concentration”, though the relate of Turkestan Cockroaches between different soy sauce concentration(Pic.33) to get completely information. We discovered that Turkestan Cockroaches prefer low concentration soy sauce than pure one. And that is the second of three advance in total to prove Cockroaches prefer Water than other solution.



Pic.32: The relate of Turkestan Cockroaches between different soy sauce concentration (Resource: Researcher)

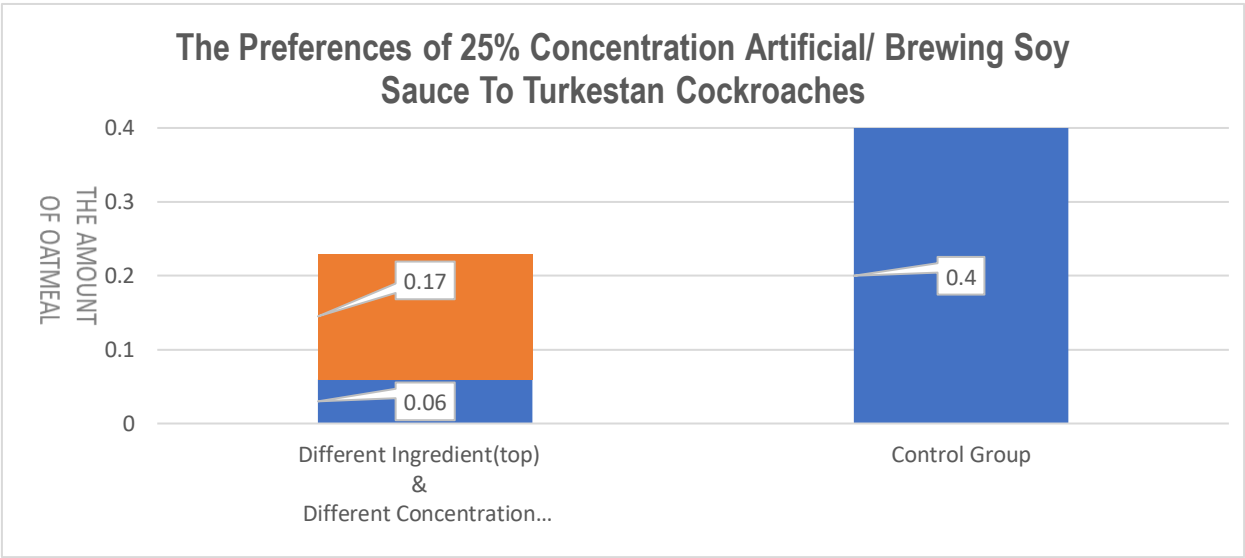
According to the picture(Pic.32), it shows cockroaches favor brewing soy sauce exactly.
In the experiment of “The attractiveness to different type/ingredient soy”. The picture below is “The preferences of 25% concentration artificial/ brewing soy sauce to Turkestan Cockroaches” (Pic.32)

Pic.32 shows the result clearly. Turkestan Cockroaches like brewing soy sauce more than artificial.



Pic33: The AVG of consumed amount of oatmeal-- 25% concentration artificial/ brewing soy sauce (Resource: Researcher)

The three of third evidence is the experience of Control Group (oatmeal with water only). The average amount of consumed higher than each set of oatmeal with soy sauce. (Pic.34)



Pic.34: The preferences of 25% concentration artificial/ brewing soy sauce to Turkestan Cockroaches (Resource: Researcher)

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