

EFFECTIVENESS OF ESSENTIAL OIL COMBINATIONS AS REPELLENTS

Prepared on:

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Prepared By:

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Address of Test Site:

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Name of Sponsor:

Natural Environmental Solutions, Inc.

Animal Requirement: Rodentia

Significance:

To demonstrate effectiveness of formulated repellent with high percentage by weight active ingredients.

IDENTIFICATION OF THE STUDY, THE TEST ITEM AND REFERENCE ITEM

1) A Descriptive Title:

- a. Effectiveness of Essential Oil Combinations Being Used as Repellents

2) A Statement Which Reveals the Nature and Purpose of the Study:

- a. Study is being used to provide evidence and efficacy through the use of scat counting in compartments being treated with various Morgan's Repellent Formulations.
- b. EPA FIFRA Minimum Risk Pesticides – 25(b) Product Efficacy Data Guidance
 - 1) d greater than or equal to 80% more scat in compartment SC than found in compartments G, PC, SS and S&R, individually, e.g. 160 total scat droppings found in SC and G, would not expect to see more than 32 scat droppings in G and not less than 128 scat droppings in compartment SC, to be considered significant public health importance.
- c. EPA FIFRA Minimum Risk Pesticides – 25(b) Product Efficacy Data Guidance 1)
 - e greater than or equal to 60% more scat in compartment SC than found in compartments G, PC, SS and S&R, individually, e.g. 160 total scat droppings found in SC and G, would not expect to see more than 64 scat droppings in G and not less than 96 scat droppings in compartment SC, would be considered effective, but not significant for public health importance

3) Identification Of the Test Item.:

- a. Morgan's Repellent Mice & Rats: G
 - i. *Identified in this document as **G***

- b.** Morgan's Repellent Mice & Rats: PC
 - i.** *Identified in this document as PC*
- c.** Morgan's Repellent Mice & Rats: SS
 - i.** *Identified in this document as SS*
- d.** Morgan's Repellent Birds & Rodents: Pro (study identified as S&R)
 - i.** *Identified in this document as S&R*

REFERENCES & PRIOR ART

- Information was used to determine most favorable approaches as well as weakness of hypothesis and theories while in development of formulas and product process.

1) References and Journals That Support Using Oils as Repellents: (Information used to determine feasibility as well as recognizing areas of weakness. Many other references and journals reviewed during development and after but are not listed within this document.)

a. Like or dislike: Response of rodents to the odor of plant secondary metabolites

ii. Inter Zool. 2017 Sept;12(5):428-436. Doi: 10.1111/1749-4877.12245

iii. PMID: 27992117

iv. <https://pubmed.ncbi.nlm.nih.gov/27992117/>

b. Deterring rodent seed-predation using seed-coating technologies

i. Year 2020

ii. DOI: <https://doi.org/10.1111/rec.13158>

iii. <https://www.fs.usda.gov/research/treesearch/61381>

c. The effort of odors on the feeding behavior of female rodents

i. Crop Protection. Volume 78, 2015, Pages 270-276

ii. ISSN 0261-2194

iii. <https://doi.org/10.1016/j.cropro.2015.09.019>

d. Comparing behavior in wild and laboratory strains of the house mouse: Levels of comparison and functional inference

- i. 1994 June, Epub 2002 May 28
 - ii. PMID: 24925115 DOI: 10.1016/0376-6357(94)900029-9
 - iii. <https://pubmed.ncbi.nlm.nih.gov/24925115/>
- e.
- f. Making sense of strengths and weaknesses observed in adolescent lab rodents
 - i. <https://doi.org/10.1016/j.copsyc.2021.12.009>
 - ii. <https://www.sciencedirect.com/science/article/abs/pii/S2352250X21002499>
- 9
- g. A systematic review and meta-analysis of the inhibitory effects of plant-derived sterilant on rodent population abundance.
 - i. Toxins (Basel) 2022 Jul; 14(7): 487
 - ii. PMIC 35878225, PMCID: PMC9319076, DOI: 10.3390/toxins14070487
 - iii. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9319076/>
- h. Herbal rodent repellent: a dependable and dynamic approach in defiance of synthetic repellent
 - i. Published: 09 June 2023
 - ii. Bulletin of the National Research Centre
 - iii. <https://bnrc.springeropen.com/articles/10.1186/s42269-023-01055-4>
- i. Potential of eucalyptus oil as repellent against house rat, *Rattus rattus*.
 - i. 2014 Jan 12;2014:249284
 - ii. Doi: 10.1155/2014/2492284 PMID: 24523633; PMCID: ONC3913499

- iii. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3913499/#:~:text=Percent%20repellency%20in%20both%20male,for%20longer%20period%20of%20time.>
 - j. Secretagogen expression in the mouse olfactory bulb under sensory impairments
 - i. 2020 Dec 9;10(1):21533
 - ii. Doi: 10.1038/s41598-020-78499-5. PMID: 33299042; PMCID: PMC7726155
 - iii. <https://pubmed.ncbi.nlm.nih.gov/33299042/>
 - k. Differences between adult and adolescent male mice approach/avoidance and expression of hippocampal NPY in response to acute footshock.
 - i. Pages 965-977 | 30 Aug 2020
 - ii. <https://doi.org/10.1080/10253890.2021.1976139>
 - iii. <https://www.tandfonline.com/doi/full/10.1080/10253890.2021.1976139>
 - l. REVIEW Open Access Herbal rodent repellent: a dependable and dynamic approach to defiance of synthetic repellent
 - i. June 2023 – Bulletin of the National Research Centre 47(82): 1-13
 - ii. DOI: 10.1186/s42269-023-01055-4
 - iii. <https://pubs.acs.org/doi/abs/10.1021/jf60138a003>
- 2) Marketed Products Investigated: (Some products were tested, while others were used for information regarding active ingredients, percentage of active ingredients, longevity, directions for use, to determine common weaknesses seen from a scientific approach.)
 - a. Grandpa Gus

- b. Tomcat Ready to Use Rodent Repellent
- c. All-Natural Mice & Rat Repellent
- d. Rodent Repellent Spray
- e. Rodent Stopper
- f. Rodent Repellent
- g. Bella's Barrier Mouse Repellent
- h. Deer Out Mouse & Rat Repellent
- i. Nature's MACE Mouse, Rat and Rodent Repellent
- j. Critter Out
- k. Fresh Cab Rodent Repellent
- l. Victor Rat & Mouse Repellent
- m. Stay Away Natural Rodent Repellent
- n. SEEKBIT Rodent Repellent
- o. EarthKind Stay Away Rodent Repellent

TEST METHODS

- 1) Justification for selection of the test system.
 - a. Justification and selection of the test system based on Study Director's review of References and Prior Art.
 - b. Working with domestic white mice it was found that although they reacted positively regarding the scented repellent formulations, white mice do not have the instinct and determination that wild rodents presented, in regards to escape, individualization and curiosity.
 - c. Six compartments with positive air pressure in control areas seem most logical as the same approach is often used in industrial clean room production environments as well as critical health care facilities.



CHARACTERIZATION OF THE TEST SYSTEM

1) Species

- a. Mice caught in the wild in Miami County Kansas: Wood Mice or Field Mice
- b. Note mice were not sexed due to wishing not to stress, but was later informed they need to be and could have been completed after the study.

2) Source of Supply

- a. Live trapped in garages and feed storage areas

3) Number

- a. Placed two full grown rodents in SIX COMPARTMENT TESTING MODULE: A
- b. Placed two adolescent rodents in SIX COMPARTMENT TESTING MODULE: B

4) Approximate Age

- a. SIX COMPARTMENT TESTING MODULE: A, adult though to be older than four-month-old.
- b. SIX COMPARTMENT TESTING MODULE: B, thought to be one to two-months-old.

5) Type of Cage

- a. Cage is floor is .75" plywood with linoleum, while the compartment walls are .75" melamine shelving boards to lower surrounding sounds and block visual appearance when approaching. The top is .093 plexiglass as well are the segregation walls that are spaced out .5" from the 1.75" diameter holes so that the rodent could see the hole but not necessarily realize the scent inside until entering.

6) Diet and its Source

- a. Full access to water was provided by a one-liter rodent water.

- b. Food is a commercial mixture of meal worms, Blueberries and Dried Rose Pedals, provided by Zoo Med Laboratories.

7) Products Being Tested:

- a. **Morgan's Repellent Mice & Rats: G, 25(b) Formula:** Active Ingredients:

Garlic Oil (CAS # 8000-78-0) 6.26%, Peppermint Oil (CAS # 8006-90-4) 6.26%, Rosemary Oil (CAS # 8000-25-7) 6.25%, Clove Oil (CAS # 8000-34-8) 3.75%, Cinnamon Oil (CAS # 8015-91-6) 1.25%, Cedarwood Oil - Texas (CAS # 68990-83-0) 1.25%, Inert: *Pumice Stone (CAS # 1332-09-8) 75.0% by weight.

- b. **Morgan's Repellent Mice & Rats: PC, 25(b) Formula:** Peppermint Oil (CAS # 8006-90-4) 10.0%, Cinnamon Oil (CAS # 8015-91-6) 10.0%, Clove Oil (CAS # 8000-34-8) 1.875%, Cedarwood Texas (CAS #) 1.875%, Garlic Oil (CAS # 8000-78-0) 0.625%, Rosemary Oil (CAS # 8000-25-7) 0.625%, Inert: *Pumice Stone (CAS # 1332-09-8) 75.0% by weight.

- c. **Morgan's Repellent Mice & Rats: SS, 25(b) Formula:** Active Ingredients:

Peppermint Oil (CAS # 8006-90-4) 7.50%, Cinnamon Oil (CAS # 8015-91-6) 7.50%, Clove Oil (CAS # 8000-34-8) 7.5%, Cedarwood Oil - Texas (CAS # 68990-83-0) 1.875%, Garlic Oil (CAS # 8000-78-0) 0.3125%, Rosemary Oil (CAS # 8000-25-7) 0.3125%, Inert: *Pumice Stone 75.0% by weight.

- d. **Morgan's Repellent Birds & Rodents: S&R, 25(b) Formula:** Active

Ingredients: : Peppermint Oil (CAS # 8006-90-4) 12%, Garlic Oil (CAS # 8000-78-0) 8.0%, Thyme Oil – (CAS # 8007-46-3) 4.0%, Cinnamon Oil (CAS # 8015-91-6) 2.0%, Clove Oil (CAS # 8000-34-8) 2.0%, Rosemary Oil (CAS # 8000-25-7) 2.0%, Inert: **Pumice Stone 80.0% by weight.

**Pumice Stone: Grey/Red, 850-1200 (Target average 1025) kilograms per cubic meter, to obtain 25% active ingredients.*

***Pumice Stone: White, 650-850 (Target average 750) kilograms per cubic meter, to obtain 30% active ingredients.*

8) How the test system is identified

a. SIX COMPARTMENT TESTING MODULE: A (Adults)

- i. Compartment identified by G, PC, SS, S&R, LC and SC written on the floors.

b. SIX COMPARTMENT TESTING MODULE: B (Adolescents)

- i. Compartment identified by G, PC, SS, S&R, LC and SC written on the floors.

ADMINISTRATION

1) Method of administration.

- a. Placement of saturated pumice stone in each treatment module, in proportion of directions 2.5 ounces per 20' x 20' x 8' area or .312 grains per cubic feet.

2) Reason for the choice of method of administration

- a. To represent the actual use of the product in real life, eliminating influences of periodic observation to determine time of rodents spent in each compartment, but rather use scat droppings over 5 days in lieu of determining efficacy over a few minutes or hours.

3) Dose Levels and/or Concentrations

- a. Calculated the cubic feet area to find 2.6 cubic feet in each compartment treating area, multiplied by directions .321 grains per cubic feet to place .812 gain of product in each treatment compartment of G, PC, SS and S&R.

4) Method of preparation of the dose concentrations

- a. To assure end life consideration of the treatment time used opened containers of products for G, PC and SS from September 2024 tradeshow. Crushed to infused stones to obtain appropriate weighted stones for each formulation to scent the test compartments, stones were still found to contain visual oil and left residue on surfaces when crushed, after five months opening.
- b. The formula S&R is a newly formulated product, so only new produced product was available at the time of this study. Crushed an infused stone to obtain an appropriate weighted stone to scent the test compartment.

c. B

5) Dosing Route

- a. Secured a L-Bracket on the testing compartment walls across from the 1.75” opening at 8” above the test compartment floor, where the size weighted stones **G**, **PC**, **SS** and **S&R** were placed to nearly duplicate the product directions.

6) Frequency

- a. Dosed one time.

7) Duration

- a. Five days.

EFFICACY STUDY DESIGN

1) Description of the chronological procedure of the study

- a. Obtain test module
- b. Supply test module with bedding, water and food
- c. Place rodents in test module
- d. Follow process found in tables labeled SIX COMPARTMENT TESTING
MODULE: A and SIX COMPARTMENT TESTING MODULE: B
- e. Document conclusion with findings and observations.

2) Methods (including those for the control of bias)

- a. Create a positive air pressure in the control area **SC**, providing slight air flow through 1.75” diameter holes to each test compartment **G**, **PC**, **SS** and **S&R**, assuring no contamination of scents between test compartments and control area.

3) Material and conditions

- a. Six compartment testing modules kept in an inside room with the temperature at 70°F - 75°F, with florescent lights turned on between 4:00am – 5:00am and turned off between 8:30pm – 9:30pm.

4) Type and frequency of analysis:

- a. Scat dropping count at the end of five days.

5) Measurement of outcomes by.

- a. Percentage of scat dropping counts, when comparing **G/SC**, **PC/SC**, **SS/SC** and **S&R/SC**

6) Observations and examinations performed.

- a. Photographs of significant occurrences.

- b. Scat dropping count and calculations to determine efficacy.
- 7) List of records to be retained.
 - a. Resume, Photographs and this report.

TEST PLAN & RECORD

| TABLE: SIX COMPARTMENT TESTING MODULE: A (QTY 2, ADULTS) | | |
|---|-------------|-----------|
| ACTIVITY | DATE | BY |
| Prepare module and stock with bedding, water, food | 2/24/24 | cMorgan |
| Stock module with rodents, Qty 2 | 2/24/24 | cMorgan |
| Photograph module initially | 2/24/24 | cMorgan |
| Day 1 feed (Dried Mealworms, Blueberries and Dried Rose Flower Pedals) | 2/24/24 | cMorgan |
| Day 2 feed (Dried Mealworms, Blueberries and Dried Rose Flower Pedals) | 2/25/24 | cMorgan |
| Day 3 feed (Dried Mealworms, Blueberries and Dried Rose Flower Pedals) | 2/26/24 | cMorgan |
| Day 4 feed (Dried Mealworms, Blueberries and Dried Rose Flower Pedals) | 2/27/24 | cMorgan |
| Day 5 feed (Dried Mealworms, Blueberries and Dried Rose Flower Pedals) | 2/28/24 | cMorgan |
| | | |
| Photo Rodents in place | 2/24/24 | cMorgan |
| Photo Scat and count, no scat found in 4-treated areas | 2/29/24 | cMorgan |
| Photo Module compartment & scat dropping observation, while waiting On additional modules to be built, note 5-day study ended earlier. | 3/26/24 | cMorgan |
| COUNT SCAT ON DAY 5 | | |
| Gather and count scat SC – Scat Count: 468 - SC/(T) = 100 % Time Spent | 2/29/24 | cMorgan |
| Gather and count scat G – Scat Count: 0 - G/(T) = 0 % Time Spent | 2/29/24 | cMorgan |
| Gather and count scat PC – Scat Count: 0 - PC/(T) = 0 % Time Spent | 2/29/24 | cMorgan |
| Gather and count scat SS – Scat Count: 0 - SS/(T) = 0 % Time Spent | 2/29/24 | cMorgan |
| Gather and count scat S&R – Scat Count: 0 - S&R/(T) = 0 % Time Spent | 2/29/24 | cMorgan |
| TOTAL SCAT (T) = 468 | 2/29/24 | cMorgan |
| Release test specimens & disinfect testing module. | | |
| NOTE: Time Spent in Treated Area Was Less Than 0 % Considered as An Acceptable Repellent. | 2/29/24 | cMorgan |

| TABLE: SIX COMPARTMENT TESTING MODULE: B (QT2, ADOLESCENTS) | | |
|--|-------------|-----------|
| ACTIVITY | DATE | BY |
| Prepare module and stock with bedding, water, food | 3/27/24 | cMorgan |
| Stock module with rodents, Qty 2 | 3/27/24 | cMorgan |
| Photograph module initially | 3/27/24 | cMorgan |
| Day 1 feed (Dried Mealworms, Blueberries and Dried Rose Flower Pedals) | 3/27/24 | cMorgan |
| Day 2 feed (Dried Mealworms, Blueberries and Dried Rose Flower Pedals) | 3/28/24 | cMorgan |
| Day 3 feed (Dried Mealworms, Blueberries and Dried Rose Flower Pedals) | 3/29/24 | cMorgan |
| Day 4 feed (Dried Mealworms, Blueberries and Dried Rose Flower Pedals) | 3/30/24 | cMorgan |
| Day 5 feed (Dried Mealworms, Blueberries and Dried Rose Flower Pedals) | 3/31/24 | cMorgan |
| | | |
| Photo of module | 3/27/24 | cMorgan |
| Photo: Placed rodent in module | 3/27/24 | cMorgan |
| Photo: Rodents scattered bedding in 4-Treated Area | 3/28/24 | cMorgan |
| Photo: Vacuum bedding and scat droppings & Count scat droppings | 4/1/2024 | cMorgan |
| COUNT SCAT ON DAY 5 | | |
| Gather and count scat SC – Scat Count: 537 SC/(T) = 92.5 % Time Spent | 4/1/2024 | cMorgan |
| Gather and count scat G – Scat Count: 23 G/(T) = 4 % Time Spent | 4/1/2024 | cMorgan |
| Gather and count scat PC – Scat Count: 6 PC/(T) = 1 % Time Spent | 4/1/2024 | cMorgan |
| Gather and count scat SS – Scat Count: 6 SS/(T) = 1 % Time Spent | 4/1/2024 | cMorgan |
| Gather and count scat S&R – Scat Count: 9 - S&R/(T) = 1.5 % Time Spent | 4/1/2024 | cMorgan |
| TOTAL SCAT (T) = 581 | 4/1/2024 | cMorgan |
| Release test specimens & disinfect testing module. | | |
| NOTE: Time Spent in Treated Area Was Less Than 60 % Considered as An Acceptable Repellent. | 4/1/2024 | cMorgan |

CONCLUSION

- 1) Study using Six compartment Testing Modules A & B, took place over a 5-day period, to give rodent ample time to investigate escaping, bedding and other food sources. Using scat dropping as a device to determine compartment occupancy.
- 2) Study outcome reflected references and prior art in that adolescents proved to be more instinctively curious and active than adults in that adults did not enter into any of the treated areas that could be visually indicated with photographs of nesting areas where adolescents dug out the bedding within 48 hours, even though both adolescents and adults made effort to enter SC (Small Control) compartment through .5” gaps between the compartment wall and plastic sheeting to enter through a 1.75” diameter hold.
- 3) Both Six Compartment Testing Module A (Qty 2, Adults) and Six Compartment Testing Module A (Qty 2, Adults) demonstrated olfactory sensory repellent activity because of essential oil formulations used in regards to Morgan’s Repellent Mice & Rats: G, Morgan’s Repellent Mice & Rats: PC, Morgan’s Repellent Mice & Rats: SS and Morgan’s Repellent Birds & Rodents: Pro (aka S&R).
- 4) Investigator makes note that Morgan’s Repellent Mice & Rats: G did not perform as well as Morgan’s Repellent Mice & Rats: PC, SS or S&R, in that adolescents averaged 30% more time in Morgan’s Repellent Mice & Rats: G. Even at that adolescent only spent 4% of their total time as determined by scat dropping over 5 days, within the compartment containing Morgan’s Repellent Mice & Rats: G.
- 5) Six Compartment Testing Module A (Adults), were found crawling on top of the .5” opening between the areas of Morgan’s Repellent Mice & Rats: G, PC, SS and S&R, but

were not observed to have entered. Bedding was not disturbed and no scat dropping were found within the treated areas after 5-days of containment.

- 6) Use of previously opened formulation, opened and used September 2024, regarding Morgan's Repellent Mice & Rats: G, PC and SS, brought forward awareness of the value of using a vesicle non absorbent material in regards to longer preservation time attributed to slow release and protection from UV as well as oxygen.
- 7) The ability to store oils in lieu of absorption or dilution provided a more positive outcome in scent intensity. To substantiate further studies in regards to other repellent sources and formulations.
- 8) Using scat dropping as an indication of inhabiting compartment the repelling action documented through scat dropping count and photograph indicates the following:

| Table A: | | |
|--|---------------------|--|
| FORMULATION USE DURING TESTING | ADULT ADOLESCENT | PERCENTAGE OF TIME REPELLING ACTION ACCRUED |
| Morgan's Repellent Mice & Rats: G | Adults | 100% |
| Morgan's Repellent Mice & Rats: G | Adolescents | 96% |
| Morgan's Repellent Mice & Rats: PC | Adults | 100% |
| Morgan's Repellent Mice & Rats: PC | Adolescents | 99% |
| Morgan's Repellent Mice & Rats: SS | Adults | 100% |
| Morgan's Repellent Mice & Rats: SS | Adolescents | 99% |
| Morgan's Repellent Birds & Rodents: Pro* | Adults | 100% |
| Morgan's Repellent Birds & Rodents: Pro* | Adolescents | 98.5% |

* This is only rodent repellent portion of study, birds to be studied separately at a later time.

PHOTOGRAPHS



| | | | |
|---|----------------------------------|---|--|
| Rodent Travel Between Plastic and Wall Box -1 | Control Rooms 2/29/2024 Box-1 | Control Rooms Start 2/24/2024 Box-1 | Study Box 2/24/2024 Placed Rodents in Box-1 on 2/24/2024 |
| SIX COMPARTMETN TESTING MODUEL A (QTY-2 ADULTS) 2/24/2024 2-29-2024 | | | |
| 5-Day Results 2/24/2024 – 2/29/2024 | | | |

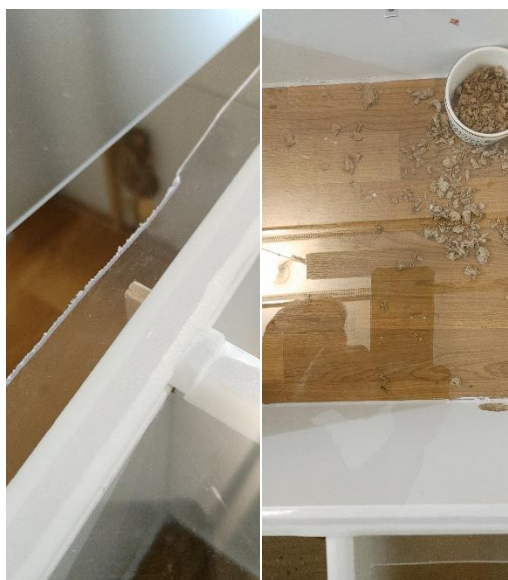


| Separated Control Rooms | S&R Formula | G Formula | SS Formula | PC Formula |
|---|-------------|-----------|------------|------------|
| SIX COMPARTMENT TESTING MODULE A (QTY-2 ADULTS) | | | | |
| 21-Day Result 2/24/2024 – 3/26/2024 (To determine if changes occur 14-days, past 5-day study) | | | | |



SIX COMPARTMENT TESTING MODULE B (QTY-2 ADOLESCENTS)

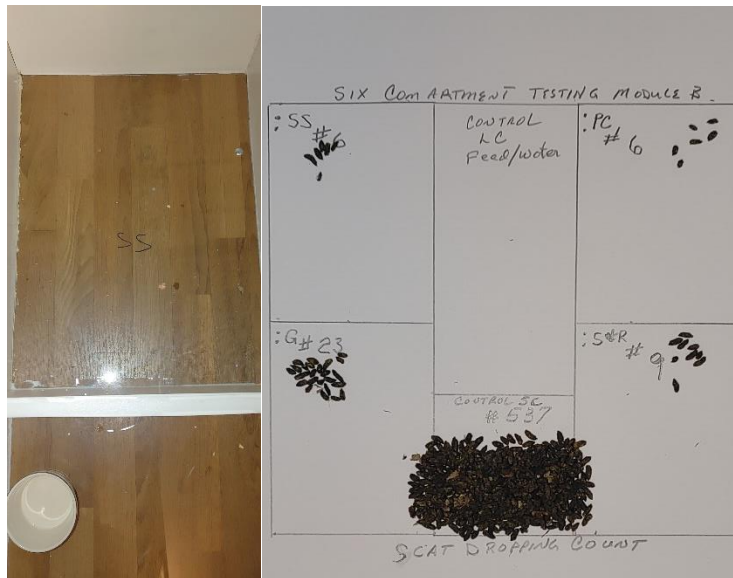
2/24/2024, Right Pic demonstrating placing double foam tape down to seal off compartments from one another.



SIX COMPARTMENT TESTING MODULE B (QTY-2 ADOLESCENTS)

(Left Pic), Adolescent Going into Compartment SC When Placed with Compartment LC on 3/27/2024

(Right Pic) Bedding Disturbed in 4-Treated Compartments on 3/28/2024



| |
|--|
| SIX COMPARTMENT TESTING MODULE B (QTY-2 ADOLESCENTS) |
| (Left Pic), Vacuumed Bedding & Scat Dropping to Perform Count 4/1/2024 |
| (Right Pic), Scat Count 4/1/2024 |



| |
|---|
| SIX COMPARTMENT TESTING MODULE MEASUREMENTS |
|---|

STUDY MATERIALS AND SETUP INFORMATION

ANIMAL REQUIREMENTS

GENUS: Rodentia ***** Test Species: The house mouse is distributed throughout Kansas. The subspecific status of this rodent in the state cannot be determined because of repeated introductions and cross-breeding. (Reference Fort Hays State University) ***** Test Species
Common Name: Wood Mice or Field Mice (Caught in Miami County, Kansas)

Age: Adolescent > Adult Sex: M & F Quantity of Rodentia: 4

Source: Farm Buildings & Grain Bins (Found white mice too serene, losing instinct behavior seen of field mice.)

Acquired Using: Wanqueen, Catch & Release Mouse Trap

EQUIPMENT & SUPPLIES:

- 1) Wanqueen, Catch & Release Mouse Trap [<https://www.amazon.com/stores/Wanqueen>], Qty. 10
- 2) Standard, five-gallon plastic buckets with lids for transportation, Qty 2
- 3) Health Pet, Carefresh small pet bedding [www.healthy-pet.com], Qty 14 Liter
- 4) Zoo Med Laboratories, Inc., Gourmet Bearded Dragon Food (Dried Mealworms, Blueberries and Dried Rose Flower Petals. [www.zoomed.com], Qty 8.25 ounces
- 5) PetSmart, Full Cheeks Large Water Bottle, [Item 5318501], Qty 2
- 6) Two cup ceramic saucers, Qty 10
- 7) Aquarium Air Pump 245, with air hose and 4 branch outlet control valve, Qty 2

- 8) .093" x 48" x 48" Plexiglass Sheet, (used for top cover of compartments), Qty 2
- 9) .093" x 8.5" x 12" Plexiglass Sheet, (used to provide ½" spacing in front to 1.75" diameter holes on LC Side), Qty 6
- 10) .093" x 48" x 48" Plexiglass Sheet, (used as closure on top sheet for access), Qty 2
- 11) Weigh Scale: Topweigh, Readability .1 grain, calibration weight, up to 3086 grains.
- 12) Disposable respiratory mask: N95
- 13) Eye Protection
- 14) Nitrile long sleeved gloves: Cleaning
- 15) Isopropyl Alcohol, 91%: Cleaning
- 16) Clorox Disinfecting Mist: Cleaning
- 17) Paper Towels: Cleaning
- 18) Camera
- 19) Calculation: Direction of use is (2.5 ounces (1,093.75 grain) / (20'x20'x8') or .312 grain per cubic foot. Treating compartments measure 22.75" x 17" x 11.5" or 4,447.625 cubic inches or 2.6 cubic feet. Morgan's Repellent Formulations .312 grain x 2.6 cubic feet = .812 grains in weight.
- 20) Morgan's Repellent Mice & Rats: G, PC and SS was opened September 2023 during a tradeshow event. Each formula of pumice stone and oil was broken to obtain .812 grain +/- 10% in weight for study uses.
- 21) Morgan's Repellent Birds & Rodents: S&R was a newly opened product on February 2024. Pumice stone and oil formula was broken to obtain .812 grain +/- 10% in weight for study use.
- 22) Hyper Tough, 3 gallon vacuum with liner to catch scat droppings and bedding.

- 23) **Morgan's Repellent Mice & Rats: G, 25(b) Formula:** Active Ingredients: Garlic Oil (CAS # 8000-78-0) 6.26%, Peppermint Oil (CAS # 8006-90-4) 6.26%, Rosemary Oil (CAS # 8000-25-7) 6.25%, Clove Oil (CAS # 8000-34-8) 3.75%, Cinnamon Oil (CAS # 8015-91-6) 1.25%, Cedarwood Oil - Texas (CAS # 68990-83-0) 1.25%, Inert: *Pumice Stone (CAS # 1332-09-8) 75.0% by weight.
- 24) **Morgan's Repellent Mice & Rats: PC Formula:** Peppermint Oil (CAS # 8006-90-4) 10.0%, Cinnamon Oil (CAS # 8015-91-6) 10.0%, Clove Oil (CAS # 8000-34-8) 1.875%, Cedarwood Texas (CAS #) 1.875%, Garlic Oil (CAS # 8000-78-0) 0.625%, Rosemary Oil (CAS # 8000-25-7) 0.625%, Inert: *Pumice Stone (CAS # 1332-09-8) 75.0% by weight.
- 25) **Morgan's Repellent Mice & Rats: SS, 25(b) Formula:** Active Ingredients: Peppermint Oil (CAS # 8006-90-4) 7.50%, Cinnamon Oil (CAS # 8015-91-6) 7.50%, Clove Oil (CAS # 8000-34-8) 7.5%, Cedarwood Oil - Texas (CAS # 68990-83-0) 1.875%, Garlic Oil (CAS # 8000-78-0) 0.3125%, Rosemary Oil (CAS # 8000-25-7) 0.3125%, Inert: *Pumice Stone 75.0% by weight.
- 26) **Morgan's Repellent Birds & Rodents: S&R, 25(b) Formula:** Active Ingredients: : Peppermint Oil (CAS # 8006-90-4) 12%, Garlic Oil (CAS # 8000-78-0) 8.0%, Thyme Oil – (CAS # 8007-46-3) 4.0%, Cinnamon Oil (CAS # 8015-91-6) 2.0%, Clove Oil (CAS # 8000-34-8) 2.0%, Rosemary Oil (CAS # 8000-25-7) 2.0%, Inert: **Pumice Stone 80.0% by weight.
- *Pumice Stone: Grey/Red, 850-1200 (Target average 1025) kilograms per cubic meter, to obtain 25% active ingredients.*

***Pumice Stone: White, 650-850 (Target average 750) kilograms per cubic meter, to obtain 30% active ingredients.*

| FORMULATION | LETTER DESIGNATION |
|---|-----------------------|
| Morgan's Repellent Mice & Rats: G (Garlic) | <u>G</u> |
| Morgan's Repellent Mice & Rats: PC (Peppermint/Cinnamon) | <u>PC</u> |
| Morgan's Repellent Mice & Rats: SS (Sweet Scent) | <u>SS</u> |
| Morgan's Repellent Birds & Rodents: PRO (Designated as S&R) | <u>S&R</u> |

27) Six compartment test chamber measurement / description: All compartments are 11.5" tall. Four compartments, known as **G**, **PC**, **SS** and **S&R** measuring 22.75" x 17", two control areas in between two, separating two of the four compartments measured 10.5" x 31", known as **LC** compartment and 10.5" x 14.5", known as **SC** compartment. Compartment **LC** was supplied with water, 2-cup ceramic saucer w/ ½ cup of pet bedding. Compartment SC was supplied with 2-cup ceramic saucer w/ ½ cup of pet bedding. Treating compartments **G**, **PC**, **SS** and **S&R** were supplied with 2-cup ceramic saucers w/ ½ cup of pet bedding. Compartments **G**, **PC**, **SS**, **S&R** and **SC** have a 1.75-inch diameter hole connecting into compartment **LC**, with a plastic cover spaced .5" away from the compartment wall on the **LC** side, to allow Rodentia to crawl up and into the compartments if they wish to investigate or use as a habitat. All compartment walls caulked on floor and vertical corners. One-pound double sided foam tape was applied to the compartment walls except between **LC** & **SC**. **SC** is the entry point to provide air to

create a positive pressure environment, to keep scents from drifting into compartment **LC** & **SC**. Within compartments **G**, **PC**, **SS**, and **S&R**, screwed a 1" x 1" x .3125", L-bracket on the wall to support the formula stones, approximately 8" from the floor of the compartments. Compartments **G**, **PC**, **SS**, and **S&R** instinctually had small air gaps along the outside walls between the double-sided foam tape to allow air flow, from .5" gap area around holes to the exterior to retain scents in one area.

28) After study completed, release mice to the wild and disinfect test chambers.

SIGNATURE PAGE & CERTIFICATION

I, Dr. Clyde Morgan Jr., hereby state that all information above is true and believed to be repeatable by those of common knowledge and resources.

X

Dr. Clyde Morgan, DC
Study Director / Investigator

4/1/2024