# NATURE'S DEFENSE ORGANIC MOUSE AND RAT REPELLENT POWDER REDUCES MOUSE PRESENCE AND DAMAGE IN HOMES.

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## ABSTRACT

Mice in homes contaminate food with droppings and urine. They are vectors for Hanta virus and Lyme's disease. Non-toxic spice-based scent repellents offer a new potential method for discouraging mice from entry to homes and living quarters. One such repellent is "Nature's Defense Organic Mouse and Rat Repellent," Made by Weiser Group, Zelienople, PA., and marketed by Bird-X Inc. of Chicago, IL. Efficacy of this repellent was assessed using direct evidence of mice presence (being caught in traps) or absence of mice trapped or droppings present. Tests compared mouse trapping/dropping count data from my farm house, Marquette County, Wisconsin from 5 August 2010 to 19 January 2011, a pretrial control period, to test period 19 January to 21 April 2011 with Nature's Defense Mouse and Rat Repellent Powder being used, and followup post test study from 21 April- 20 July 2011. First application of repellent powder was done 19 January on four lowest basement stairs and in a 1 m X 1 m area in the entry hall from the basement and backdoor to the kitchen area. Powder was reapplied weekly for the first four weeks, then biweekly for a second month as per container directions and finally not replenished for 4 full months to test duration of efficacy if not replenished.

There were 45 mice trapped during the study, 43 White-footed Deer Mice, *Peromyscus leucopus*, and 2 House Mouse, *Mus musculus*. Only two mice were trapped during the 90 day test period when the powder was in use, one during the first week and one at the end of the final week, for an overall average of 0.022 mice caught per day. For the 167 day pretest control period, 39 mice were trapped for an average of 0.234 mice per day, slightly more than 10.5 times the rate for the test period. No differences other than the use of the repellent granules were present between these test periods. Only 4 mice were captured in the 3 month post test study period, or .044 mice/day, double that of the test period but only one fifth that of the original pretest capture rate. Mice evidenced a strong avoidance of the areas of repellent use, and since trapping rates remained well below baseline for more than 90 days after the tests were complete, it suggests a long lingering mouse discouraging effect from the treatment. Efficacy of the granules was reflected in the 94.1 % reduction in mice trapped/day when in use. Since the product claims it takes 2-3 weeks to reach full effect, and must be used 2 times per month to remain effective, it is fair to state the two mice caught were caught either prior to advertised effective start date or more than 28 days after last application, thus well past the required 2 week reapplication date. Therefore, actual efficacy from the end of the first 2 weeks to two weeks after last application date was 100% based on zero mice being caught or evidence of droppings being seen during that time period.

## INTRODUCTION

**L**ocal garden shops and catalogues offer many non-toxic chemicals meant to cause herbivore aversion to feeding on crops, ornamental shrubs or lawns: such as wolf, coyote or fox urine; and, distasteful chemicals (grape extracts, such as Bird Stop, (Bird-X Chicago IL.) and anthraguinone and similar chemicals (Ayers et. al. 2010, Cummings et. al. 1991) to prevent goose damage to lawns/ golf greens; and, capsaicin and its spicy derivatives to provide protection to crops,

flowers, and even bird seed from rodents and deer. Despite all this, little has been written about scent aversion success for dispelling mice. Mice damage homes by gnawing on wiring or baseboards, and contaminating food supplies. They are vectors for human diseases such as Hanta Virus and Lyme's disease. At the least, mice in a house are a nuisance, leaving droppings on counters, table tops, and in cupboards. In older homes, and restaurants it requires continual effort to clean up after mice. As such, most humans trap mice or poison them. What most of us would prefer is simple means to keep mice out of their homes without risk of physical injury to or poisoning of pets and non-target species. An effective scent-based repellent offers hope of providing just such a means to keep mice out, but the technology has remained largely untested. Sonic/ultrasonic frequency sound generating devices, such as the Transonic Pro (Bird-X Inc. Chicago IL.) also offer relatively new and recently proven methods to keep mice out of houses (Whitford 2011). The current study was designed to evaluate the efficacy of Nature's Defense Organic Mouse and Rat Repellent in reducing mouse presence and evidence in homes.

## METHODS

Rather than use unnatural lab based testing using plexiglass enclosures and confined mouse populations, I chose to use free natural populations of mice as in test designs previously used to test efficacy of sound devices against the Norway rat *Rattus norvegicus* (Ashton, 1999) and mice (Whitford 2011). I feel such real world tests on free populations produce far more valid results than artificial enclosure studies, based on my 35 years field experience doing research in natural settings as a PhD in ethology. Repellent efficacy is best tested in the natural target environment for any species, for normal responses to novel stimuli are far more likely to be witnessed in such settings than in unfamiliar surroundings. This same principle of testing in natural settings has also been strongly advocated for in print (Beck and Stein 1979) as a means of obtaining the most valid results of new equipment/materials to be tested in repelling vertebrate pests.

The necessary first step to this type of research is to design tests that help to establish that the species studied can perceive and does show response to the olfactory stimuli provided by the scent-based repellent to be tested. Lacking references for details of specific olfactory sensitivities and limitations of White-footed Deer Mice, *Peromyscus leucopus*, and the House Mouse, *Mus musculus*, I relied on an indirect assessment of olfactory detection and scent avoidance. I hypothesized that repeated observation of alteration of behavior or avoidance of normally used areas by individuals of P. leucopus or M. musculus when exposed to scents from the Nature's Defense Mouse and Rat Repellent would constitute the needed evidence that they perceived and responded with avoidance to such scents. I set my study design to determine whether the scents associated with this product do or do not alter behavior/presence of mice in a measureable, repeatable fashion and whether they demonstrated efficacy in repelling mice from the home environment.

### Research site

The primary research site used for these tests was an old farm house in Marquette County, Shields Township section 6, in Central Wisconsin. It was constructed in stages with central rooms dating to 1870 and addition of 2 extra bedrooms and a second floor with 4 bedrooms between 1920 and 1925. Final additions of indoor bathroom and a back hall that provided access to a new stairwell leading to the fieldstone-walled basement were made in 1964. Its construction and age make it highly porous to the invasion of mice. It has been the weekend recreational residence of the author and his family for 53 years. As an obsessive compulsive biologist, I have

kept marginally complete 25 year records of small mammals caught or killed there. Of more than 500 mice caught in the house in that time in snap traps, live traps, on glue pads, and drowned in antifreeze in winter toilets or water drain buckets in the basement, only two have been the common gray "House Mouse" from Europe. All remaining mice were the native White-footed Deer Mouse. Among the highest recorded two day (generally weekend time frame) totals were 7 deer mice trapped in 48 hours Dec 26 and 27, 1996 (Whitford 1997). Reproduction in this species continues as long as the mice are warm and Central Wisconsin litters were reported to average 4.77 per pregnancy (Long, 1973). Mouse numbers vary seasonally and year to year, based on food supply, habitat and weather. My trapping records indicate they generally begin entering the house in late August or early September, and peak in November or December, as they search out winter homes. Suffice it to say that mouse droppings and sightings (and continual trapping) were a normal part of life in this house since I first came there in 1955.

**Study design**

Nature's Defense Mouse and Rat Repellent tested was provided by Bird-X, Inc. Chicago IL., 60612. It included organic garlic, organic cinnamon, organic clove, organic white pepper, organic rosemary, organic thyme, and organic peppermint as active ingredients to repel mice and rats. This was sprinkled, per label instructions, in areas where mice were thought to be entering the house or traveling through to reach living areas. It was applied to the lowest 4 steps of the basement stairs and in a 1 sq meter area of the back hall entry just prior to the inner door to the kitchen area and bathroom where the 1.2 cm gap beneath the inner door to the main house provided what I believed to be the principle entrance to the rest of the house for mice. The other end of the hall ended at an exterior storm door that prevented mouse entry from that point and intersected the flight of concrete stairs leading up from the basement. Mice were presumed to regularly enter the house along old decaying wooden foundations laid atop a short stone base beneath the main rooms of the house. From there, they moved into the main house by entering the basement and then coming up the basement stairs and in through the back hall. Placement of the repellent powder there in the hall forced mice to pass through it to gain entry to the main house, thus almost certainly getting it stuck on paws and tail in passing.

The first cycle of trapping and recording mice caught ran 167 days from 2 August, 2010- 19 January 2011 as a control and was carried out within the back hall/stair well area of the farm house. From 19 January to 21 April 2011 a second cycle of trapping was done for 90 days with all things done just the same and in the same location, except that the repellent was applied at one week interval for the first four weeks, at two week intervals for the second four weeks and at a one month interval for the final four weeks of this stage of the tests. This provided 2 sets of comparable mouse trapping data for the exact same location and house during periods when high past trapping was recorded in prior years. A follow up test using only snap traps ran for 90 days after the test of the repellent powder was completed. At all times in all test cycles 6 Victor@ brand mouse snap traps were present on the top three steps of the basement stairs. Bait was changed once every 30 days, or when fully consumed on any trap, to provide equal freshness of peanut butter used on all traps for control and repellent test studies. As usual for the house, garbage and recycling bags were placed between stove and counter end on the kitchen floor and left there until full for disposal in both test cycles. Additionally, a 3.8 liter, uncovered compost bucket was continually present on the kitchen counter for both tests. Again, it was emptied only when near full. Mouse traps were checked and emptied every 4-5 days and reset/rebaited as needed. Dropping counts were also made upon entry for counters, stove and floors, All floors,

counters, stairs and basement areas were thoroughly vacuumed before each stage of the research was begun to remove all prior visible mouse evidence.

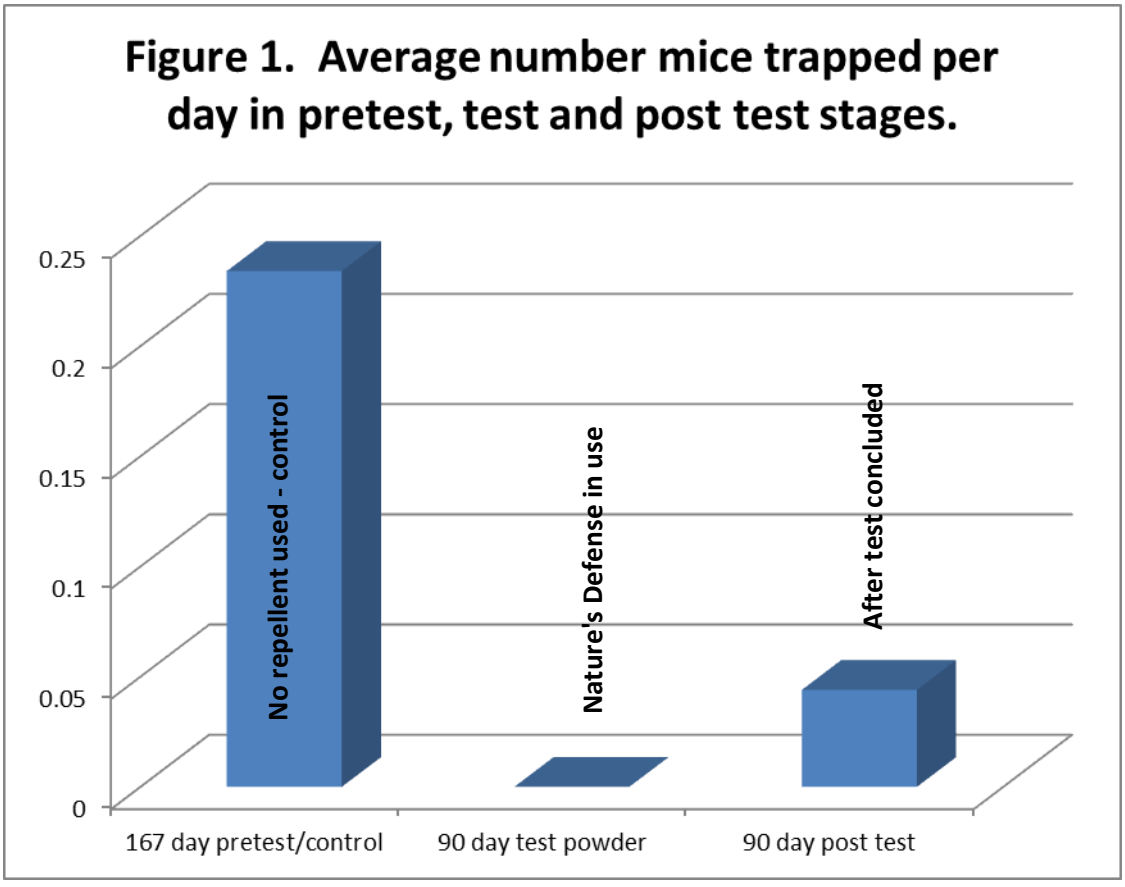
Lack of evidence of droppings and/or absence of mice in traps was considered to be valid indirect evidence of mice avoidance of the scent treated areas and to represent documentable reproducible changes in behavior in response to the repellent being broadcast in the described locations. Thus, any or all of these were considered to be indicative of efficacy of the repellent in reducing mouse presence and/or damage in the house.

**RESULTS**

Table 1. Average number mice trapped per day in pretest, test and post test stages. (See Fig. 1)

| 0.234 | 0.022 * | 0.044 |
|---|---|---|
| 167 day pretest/control | 90 day test powder | 90 day post test |

*** this is a 94.1 % reduction versus pretest rate.**




Only 2 mice were trapped on the top 3 basement steps or elsewhere in the house from 19 January – 21 April 2011, the time when the repellent granules were present on the lowest 4 basement stairs and in the back hall. Two mice caught in 90 days when the test was being done, produces a

rate of 0.022 mice per day for the test cycle. In addition, it is only fair to say that the two mice caught were trapped as follows: one during the first week following application; and, the second in the last week of the study. These were time periods that the product label instructions stated might see mice present or caught. In the first week the repellent powder was said not to reach full strength/function until at least two weeks of use was completed. The instructions also called for reapplication of the powder every two weeks after the first four weeks use to keep it working. The final mouse was caught 3.5 weeks after the last application date, thus when the repellent was expected to begin to fail for lack of reapplication. No droppings were observed/removed from kitchen counters, stove top or floor during this entire 90 day period. Four more mice were trapped during the 90 days April 21-July 21, a follow up to the tests when no new powder was applied, so by 21 July no powder had been added for 120 days.

In contrast, to the test period, there were 39 mice caught on the basement stairs during the pretest phase from 2 August 2010 to 19 January 2011, when neither the repellent powder or any other form of mouse deterrent other than traps were use. This represents an average of 0.234 mice trapped per day for that time period, or 10.64 times the rate of mice trapped per day than during the entire test period when the organic repellent powder was present in the hall and on the stairs. This translates into a 94.1 % reduction from the expected mouse capture rate in the prior 167 days. Additionally, without the powder, even with 39 mice removed, there were multiple sightings of mice in the kitchen, and more than 67 droppings were counted on the kitchen counter and dozens more were swept up off the floor near the garbage storage area during those 167 days the repellent powder was not in use in these tests.

Since no other differences were present between the pretest, post-test and the test phases when the repellent powder was present, the only reasonable conclusion is that the use of Nature's Defense Organic Mouse and Rat Repellent was the explanation for the difference in number of mice trapped. Thus, one can safely conclude there is no question that the mice perceive the scents and/or tastes generated by the organic chemical complex in the powder and respond to them by near complete avoidance of the area. Efficacy of the scent powder used in these tests was 100 % for the areas tested from the end of week 2, post applications one and two, until 3.5 weeks after last application, just as stated in the information provided with the repellent. The area affected/protected during that time period included the basement stairs and hallway, kitchen and basement, or roughly 440 sq feet (roughly 42 sq meters) on two levels.

## DISCUSSION

While the use of powdered scent granules for repelling mice and rats is rather new and untested, results of using Nature's Defense organic mouse and rat repellent were unequivocal and strongly indicated scent/taste based aversion to treated areas. Placement of the powder where mice had to pass through it to enter the kitchen and other main house areas, as suggested in use instructions, exposed the mice to the greatest scent concentrations, and, I suspect, contributed strongly to the repellent efficacy observed. However, it also appeared, based on lack of visible evidence to the contrary, to keep mice from using the entire basement area, so that chosen placement of the powder may not have been the sole issue in its success. The success demonstrated for Nature's Defense organic repellent powder in this test series was very similar to efficacy observed for the sonic/ultrasonic sound generating unit, (Transonic Pro, Bird-X, Chicago IL.) in this same test location in earlier trials (Whitford 2011). They both offer humane, non-toxic, non-lethal options to reduce mouse damage and presence in human habitations, restaurants and other situations.

Both are safe for pets and children as well, and highly effective at reducing mouse/human conflicts and reducing time and effort to trap and remove mice on a regular basis.

## CONCLUSIONS

It is clear that scents/tastes generated by Nature's Defense organic mouse and rat repellent used in this study are detectable to wild white-footed deer mice and house mice and cause them to avoid proximity of such aromas. In indoor settings, there was a complete absence of evidence of mice presence during the time from completion of the first two week application cycle until more than 3 weeks after cessation of further biweekly applications. This contrasted strongly with the abundance of mice present in spite of continual trapping efforts and removal of 32 mice from the house when the powder was not in use. With proper placement and following use guidelines this organic repellent presents an extremely easy, inexpensive and humane means to keep mice out of the home or other human occupied areas. There was no sign that mice habituate to the scent or that it loses effectiveness with continued use. Whenever possible, I would advocate applying the powder near any and every probable entry point into the kitchen or food service area of restaurants and homes for maximum efficacy in reducing/preventing rodent entry. This natural organic product provides a simple means to keep mice out of homes without risk of physical injury to or poisoning of pets and non-target species or use of toxic substances.

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