Preliminary Test Results of Studies of Transonic Pro Ultrasound Units for Reduction of Insect and Spider Pests in Natural Settings.

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Introduction.

As a preliminary opening remark concerning the methods employed in these studies. I have read and considered the Walmart Cockroach and General Insect Protocol for testing responses of insects to various methods of sound production repeller units using plexiglass enclosures and confined insect populations. After serious reflection on that method versus real world tests on free populations I chose the latter methodology based on my background as a PhD in Ethology with 35 years experience in study design and testing based in the natural settings of the organisms to be studied. Efficacy is best tested in the natural environment for any species for normal responses to novel stimuli are far more likely to be witnessed in such settings than in unfamiliar settings.

The primary function of the earliest tests that have been done so far was to establish that the species studied could perceive and respond to the auditory signals generated by the equipment to be tested. There exist only limited means to test for perception ability, one being micro-implantation of electrodes into nerves of aural pathways, and the latter an indirect assessment of sound detection based on repeated observation of alteration of behavior of individual of the species when exposed to the sound source. Since little exists in the literature about the sensory range of many insect species, until one has proven this ability to detect the sound, there can be no meaning to larger scale tests of general behavior in response to prolonged or temporary exposure to auditory units intended to disperse unwanted insects or arachnids. Once a repeated response has indicated perception, tests of efficacy in dispersing specific species may begin.

Methods

The primary research site used for initial real world tests of perception of equipment and later efficacy tests for insects, spiders and mice 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 bedrooms and a second floor between 1920-25 and final additions of indoor bath and a hall to the fieldstone walled basement in 1964. An 8 m X 4 m insulated sun porch was added in 1982. It has been the recreational residence of the author for 53 years and thus has a well documented history of occupation by various species of pests, and attempts to remove many of them. In addition, three outbuildings, a barn and two sheds were used for research on bats response to ultra sound units provided by Bird-X, Inc. Chicago Il. Secondary outdoors tests on efficacy of eliminating mouse damage to crops were conducting in a 36 m X 25 m fenced garden area. Sound units tested and frequency and decibel ranges for the units are as follows, based on company provided literature: YARDGARD; freq. 15kHz-25 kHz, 90 dB at 1m maximum; QUADBLASTER, QB-4 Ultrasonic Bird Expeller, 22kHz at 112 dB @ 1 meter; TRANSONIC PRO, no Frequency/dB information in literature included with units.

Test methods used for all insects and spiders were initially to observe the species to be studied for 30 minutes to determine normal activities and activity levels to establish a baseline for behavior which could be compared to behavior observed later when the sound units were activated. Repeated alteration of behavior and/or activity levels when sound units were on versus when they were off was considered valid indirect evidence of sensitivity to the sound frequency broadcast by the units being tested. Once this was established further tests were attempted to evaluate efficacy at dispersing the species or reducing visible population of the test species. Repeated tests of 10 minutes observations with sound units off versus 10 minutes with sound unit turned on, followed by 1 hour off before retesting, were used to evaluate perception and behavioral changes of Asian Ladybug Beetle, Harmonia axyridis, within the confines of the sun porch. The first test of perception tested for an alteration of flight initiation

rates (# beetles initiating flight/10 minute) when sound units were on versus when they were off. Secondary tests looked for changes in the pattern of distribution of the beetles on ceiling and windows when units were on versus off. The sun porch has 6 double sliding .95 m X .95 m windows and a single exterior door with a .60m X .85 m window. It is paneled in ¼ inch plywood paneling for walls and 3/16th inch masonry board panels for the ceiling with ¾ inch curved pine moldings at corners and edges giving beetles access to the spaces behind the paneling for hiding and winter torpor. Tests began July 19, on a warm sunny day when the porch was teeming with the Asian lady beetles coming out of hibernation within the walls, with 140 – 180 beetles visibly present at the start of all observations, most on windows and white painted ceiling panels. The Transonic Pro was set on click pattern "B", "quiet" setting for volume. Distribution of beetles was fairly uniform across the ceiling panels and windows when preliminary observations began. Tests were conducted over three days with paired series of two hour blocks to assure that time of day, sun height, ambient temperature and other factors were as uniform as possible between all tests.

Results Flights initiated/10 minutes

		unit off	unit on	
July 19	10 am – 10:20	26	32	
	12 am - 12;20 pm	15	26	
	2 pm – 2:20 pm	14	18	
July 21	10 am-10:20	22	31	
	12am-12:20 pm	19	32	
	2pm – 2:20 pm	13	19	
July 23	10 am – 10:20	18	24	
	12am -12:20 pm	23	28	
	2 pm – 2:20 pm	16	23	
	Totals	166	233	28.8 % more when units on.

Tests found consistently higher flight initiation rates with sound units on than off. While not statistically significant, the data provides valid evidence that the sound is being perceived and potentially triggers some level of avoidance/escape behavior within beetles present in the test area.

A secondary result observed, that was to be studied in quantitative manner the next test date ,was distribution change of the beetles when the units were on. It was noted during the initial tests that they went from relatively uniform distribution across ceiling panels and windows when the unit was off, to grouping near the ceiling edges and window edges when the unit was on for 5-8 minutes as though they were collectively moving to the protective shelter of the cracks from which they had emerged earlier in the day and to which they returned after dark each evening. Unfortunately, I was not able to test that for upon my return 4 days later, for there were no Asian Lady beetles to be found on the porch. In past years these beetles remained abundant in the house for weeks after emergence, but this year for the first time they had apparently all evacuated the sun porch region of the premises and found their way outside. I'd never experienced this sudden mass exodus of this species in the

roughly 12 years since they first became a major nuisance at the farm. Beetles continued to be present in fair numbers within the main house and bedrooms for another 3-4 weeks. The cause of the disappearance from the sun porch could be a response to the repeated use of the ultra sound units, or to some other unknown phenomenon. Only further tests will say for certain.

Spider Tests

Again, these were done in a real world test situation in the old farm house previously described and sought to determine sound perception range of the species in question and/or efficacy in reducing numbers of that species present.

Methods

Spider tests were done in a manner dissimilar to those of the Asian Lady Beetle tests. In this case, spider numbers were counted in the bathroom, kitchen, inner hall between those rooms and in the back hall and basement stair well areas of the house. These sites have evidenced large numbers of long legged, light bodied spiders that construct minimal webs for roughly 12 years, and are a fairly recent invader of the property, not having been present at all in my youth in the house. The precise spider species in the house was identified by professional pest control personnel Shane McCoy, and Dale Bauerkemper of WIL-KIL Pest Control Offices, Sun Prairie, Wisconsin as the Long-legged Cellar Spider (Pholcus phalangiodes) based on identification materials provided by Clemson University in their on-line Entomology Insect Information Series, http://entweb.clemson.edu/cuentres/eiis/index.htm. This species is commonly found in damp basements of taverns and homes in Wisconsin. The young hatch from eggs and remain with the mother. They become adults after one year and may live for 2 years thereafter. Adult females may produce three egg sacs of 13-60 eggs each over a lifetime. This species has extremely long thin legs and small thorax and head regions so they are easily confused with " Daddy Long Legs," more properly termed "harvestmen." They build loose haphazard webs that they leave up and add to continually, thus creating large amounts of hanging webbing which becomes a nuisance to remove. (Most spider species consume their old webs frequently and redeposit the materials in making new webs). Methods of study in this case were to simply to count the number of spiders in each region of the house they normally occupied and to make repeated counts over the course of the summer while having a Transponic Pro Ultrasound Unit generating ultrasound clicks within the outer region of the back hall and placed parallel to the inner door leading to the rest of the house. The unit was set to the "B" setting and "quiet" volume and placed at floor level where I anticipated it would prevent spiders from moving under the gap beneath the closed door to come into the main house. Tests began with pre-sound unit employment counts of spiders of all sizes in all rooms/spaces designated beginning 6:20 pm Sunday, 2 August 2009 and continuing to 8/23/09 with a final count on 9/1/09 after the unit had been turned off for a week and a day.

Results		Bathroom	Hall	Kitchen	Back Hall/stair well
pretest #spiders/area	8/02/09	0	1	0	67
	8/14/09	1	1	0	24
	8/23/09	1	3	0	27
post test	9/1/09	6	3	3	43

Discussion

Normal pattern for this species of spider has been to appear in the house in early to midsummer and rapidly build in population and expand into the bathroom, hall, kitchen and livingroom. With a cool spring in 2009, they were slower to appear by three to four weeks than in prior years, so initiation of testing was later than planned. During the time the Transonic Pro was turned on in the back hall initial spider populations declined roughly 66%

and stayed well below initial pretest levels until the unit was turned off. As hoped, there was almost no movement of spiders from the back hall into the main house when the call unit was running, so the bathroom, small inner hall and kitchen remained nearly spider free for the duration of the test. Past years have seen spider numbers in the bathroom of 10-19, and the small hall 8-13, and kitchen 8-18 as standard numbers for August. The Transonic Pro appears to have been audible at some level to the spiders and to have largely prevented their movement through the 1.3 cm gap under the hall door and into the rest of the house. All evidence points towards considerable efficacy at reducing spider movement into the home and reducing resident populations within the outer hall area significantly from pretest populations. It was noted that the total numbers of adult spiders were greatly reduced in the back hall during the first week of the test and stayed low even after the test ended. The increase in total spider numbers in the back hall, kitchen and other sites at the 9/1 count was primarily the result of a marked increase in small, immature spiders, the result of summer reproduction and dispersal when they left the mother spider to find new homes. I can only speculate that smaller leg and body size reduces both number and length of sensory hairs on the body and legs and may mean the young are less able to respond to the sound frequency of the Transonic Pro units used in these tests. Further testing in future will help define the efficacy of these units more precisely, but there is considerable data to support the conclusion that the sound produced by these ultrasonic units is detectable and fairly effective at keeping them out of areas of the house where they are least wanted with minimal effort.

Black Carpenter Ants (Camponotus pennsylvanicus)

Black Carpenter Ants are native to most of the upper Midwest. They are normally found in decaying logs in the forest environment, but have adapted to human habitations and particularly to those with damp wood areas in the frame or window regions (Audubon Society Field Guide to North American Spiders and Insects, 6th ed. 1988, A. Knopf Inc, N.Y.) The old farm house has a steady source of them as new firewood (with ants) is brought to the wood shed, roughly 5 m from the kitchen window of the house- a window with definite wood rot issues in its 60+ year old frame, and in the underlying, oft damp, cabinet beneath the sink and faucets.

Perception tests for Black Carpenter Ants were opportunistic for they are common, but not terribly predictable "guests" in the old farm house. When present, they tend to work up and down the countertop near the sink and down to the garbage stored in paper bags under the end of the counter. Tests were done by setting up a single Transonic Pro Ultrasound Unit on the counter once Carpenter Ants were observed there July 21, 2009. The idea was to count average number of ants visible before and for 5 minutes after turning the sound unit on (setting "B", Volume "quiet") to determine if any ants left the area. As it turned out, the first thing noticed was that all ants within 3 m of the unit stopped moving as an initial response to turning the units on. Thus, it is fairly clear that they can perceive the sounds at some level and respond to it by becoming immobile, a fairly standard escape behavior that probably works much better at concealing ants in the natural outdoor landscape than on a yellow Formica countertop. Within 1-2 minutes they all began moving again and counts were not clear for some ants not seen before the sound unit came on would appear from under objects on the counter, while others vanished and still others moved in seemingly aimless paths. Once movement began it appeared more frenetic than before, but that was difficult to document without a means to measure distance in reasonable time units. The ants failed to reappear on any other day. So no further work was able to be done on them, at the time. Further work will be done in future, should they return.