THE EFFECTIVENESS OF MOSQUITO REPELLENTS

BIOS 569 Practicum in Aquatic Biology

Julianne Stavisky

342 Farley Hall

Dr. George B. Craig, Jr.

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ABSTRACT

An eight week long study was conducted in May, June, and July of 1991 at UNDERC to test the effectiveness of seventeen mosquito repellents. It was a continuation of a study started in 1989. Heavy biting pressures occurred for most of the summer, allowing the student volunteers to successfully collect mosquitoes for each evening's test. Repellents were tested for initial usefulness, and if effective, were tested one, two, three, and four hours after applications. Tests focused on repellents containing different concentrations of deet.

Many uncontrollable variables presented themselves, including personal attractivity differences and environmental conditions. Most repellents on the market do not meet the claims that manufacturers set. Mechanical sound makers were ineffective, as were the area repellents tested. In general, a different concentration of deet in a repellent changes the repellent's effectiveness minimally.

Mosquito Repellents

INTRODUCTION

Most of the tested and documented information of the effectiveness of mosquito repellents is a result of tests conducted under laboratory conditions. The true value of an insect repellent for a consumer is how it performs under actual outdoor conditions. UNDERC is a location known to have large quantities of at least thirty species of mosquito since its vernal ponds provide many ideal breeding habitats, and can it serve as a valuable location to test repellent effectiveness. Similar experiments were conducted in the summers of 1989 and 1990. Many of the ideas from last year's study were useful in designing this experiment. (Bernard, 1990).

Previous evidence implies that deet, or N, N, diethyl meta toluamide, is an effective mosquito repellent. It is questionable, however, for what length of time deet remains effective, especially if the user is active. Amounts of deet in marketed repellents vary greatly, and it is not known if repellents with higher concentrations remain effective for longer. A combination of active ingredients may increase the effectiveness of a repellent. Other ingredients, such as hair spray, may be mixed with deet to enhance a lasting effect by preventing rapid evaporation of the repellent. In many laboratory experiments, the testers are probably not engaged in outdoor activities that may cause the repellent to wear off or become less effective. Tests have been done to conclusively show that as skin temperature increases, the protection time of repellent decreases (Khan et.al. 1972). Physical activity may have the same effect.

Because of the wide variety of repellents on the market, it is only fair for the consumer to have enough information about many of them in order to give aid in making a decision about what repellent will best meet the user's need. Deet in high percentages has been shown to cause minor health problems in children's skin, so the public should know if they are any more protected from mosquitoes, and the diseases they may carry, if using 100 percent deet formulas to make it worth the potential risk by using the higher percentage formula. Many repellents claim to remain effective for ten hours, and this statement should be true under outdoor conditions, not simply as a laboratory conclusion. Mechanical devices, which have in the past been proven to be ineffective are also sold. The effectiveness and limitations of area repellents, as opposed to personal repellents, also should be made clear to concerned consumers.

MATERIALS AND METHODS

Over the course of the summer, between May 28 and July 18, seventeen repellents were tested. The repellents tested included a fifteen percent deet aerosol by Revco; an aerosol containing fifteen percent deet plus hairspray; Skin So Soft, a bath oil; Natrapel, containing citronella; a blackfly repellent with active ingredients other than deet; three liquids containing 100 percent deet, including Muskol, Off, and Ben's; a spray by Cutter's containing deet and dimethyl phthalate; Repel liquid with fifty five percent deet; a deet "stick" by Cutter's; Downy fabric softener; Off Bug barriers, an area repellent; and four different mechanical devices, or "clickers" and "buzzers." (See appendix for specific ingredients of each repellent). Forty six testing nights were used. Most of the repellents tested were personal repellents.

For each of the repellents studied, preliminary tests were done to establish which repellents are effective upon initial applications. Using the most effective repellents, variables of time, physical activity, and use in different forms were tested. A test was performed every night close to sundown (between 8:30 and 9:30), and for each test, six volunteers were used. For five minutes, each collector used an aspirator, a modified flashlight with a slight suction and a collection vial, to remove any landing and biting mosquitoes from their forearms. Only this limited area was used for collection in order to keep tests relatively consistent between individuals. In some cases, volunteers used their legs as collection surfaces. They were instructed to collect just from the knee down, and they collected from this area for both five minute portions of the test. Because of this consistency, this data should be comparable to the collection from forearms. Head nets were worn for protection during each test. After a brief pause that was necessary to cover and gather the first set of vials, and to distribute the second set of vials, the trials were attempted again for an additional five minutes. In the case of the initial tests, the repellent to be tested was applied during the period between the two trials.

As the experiment proceeded, topics of interest that had not been considered earlier arose. It seemed obvious after the first week of tests that the repellents other than the mechanical devices were unquestionably effective when they were applied minutes before the testing, so the more significant question to study became determining which repellents would last the longest. Once it had been established which repellents kept mosquitoes away initially, timed tests were performed. In these cases, the volunteers were

recruited earlier in the day or evening, and repellents were applied one, two, three, or four hours before the test was to be made. In each of these test cases, at least two of the six volunteers served as controls, in which events they simply collected all landing and biting mosquitoes for both five minute test periods so that effectiveness of the repellents could be seen to decrease from the time of application. The two trials were performed close enough in time to each other that the time delay between trials was negligible compared to the time of application. In performing the timed tests, there was a concentration on relatively few repellents with very specific questions in mind. For example, how do repellents containing deet compare to repellents that are moisturizers with a scent or had different active ingredients? How did repellents with low concentrations of deet compare to those with more deet? The amount of deet was a specific concern in terms of consumer safety since high concentrations of deet have demonstrated some health hazards. Did the extra deet increase the length of time of effectiveness? How did deet with other active ingredients (for example, dimethyl phthalate) work compared to a repellent with only deet? How did different concentrations of deet compare to the effectiveness of deet combined with hairspray?

During the course of the testing throughout the summer, different locations were used with the hope of determining the most useful site. Temperature, general weather conditions, and time were recorded every night to attempt to determine when mosquito numbers were the greatest and to demonstrate nightly variations.

After each test, the vials containing mosquitoes were placed in the freezer. The mosquitoes were identified to species the next morning, often with the help of Dr. Craig.

The ineffectiveness of last year's attempted study of body temperature, and the difficulty of finding a relatively easy and more reliable method of measurement, combined with the realization that it would be difficult to link personal attractivity to just one variable kept this study from being conducted again.

RESULTS

The first analysis made was a study comparing the testing day to the average number of mosquitoes caught by the controls in one five minute trial. Graph 1 shows this comparison. In general, the overall number dwindled through the course of the summer, but no other pattern can be inferred. This lack of trend implies that no two testing nights have the same conditions, so data cannot be compared because of the lack of consistency in numbers. There was

no night to night constancy except that one tester was present for every test.

After all of the questions of differences in time related to effectiveness were addressed, and all of the tests were performed, statistical analysis of the number of mosquitoes collected and repellent variations were studied.

For the initial tests in which repellent was applied just at the time of the tests, a comparison was made between the numbers of mosquitoes caught with no repellent in the first five minutes versus the number caught when the repellent was applied. A probability value of .05 or less indicates effectiveness. Only six of the repellents proved to be effective from this comparison. These six were 15 percent deet Revco aerosol, Skin so soft, Natrapel, blackfly repellent, 32 percent active ingredient Cutter's pump spray, and Cutter's stick with 26 percent deet. Only these repellents appeared effective because of a great deal of variability in the numbers caught on compared nights, not simply within one night. For example, hairspray registered a probability value of .101 even though on one night of testing, 26 and 16 mosquitoes were caught by two different volunteers when they wore no repellent, yet neither of them caught any mosquitoes in the second trial, after hairspray had been applied. But, the test was repeated much later in the summer when biting pressure had decreased significantly, so the variability between the two testing nights was too great to prove conclusive effectiveness. Despite this probability value, timed tests were performed.

Several other repellents, which were Muskol liquid with 100 percent deet, Ben's liquid with 100 percent deet, and Off liquid with 100 percent deet, when compared pairwise to each other repelent, proved to be significantly more effective than repellents that did not work, such as the mechanical devices. Therefore, these three repellents were also used in timed tests. The pairwise comparison also showed that most of the "effective" repellents were also significantly different in effectiveness than several ineffective repellents. None of the mechanical devices, or "clickers" and "buzzers" showed probability values in the less than .05 range. Downy fabric softener, which some fishermen claim to use to ward off mosquitoes (see Appendix 6), did not show an effective probability value either.

In analyzing the timed tests with an analysis of variance, it was first determined whether the change in time had any effect on the repellent's usefulness. In the cases where there was a significance based on time, a pairwise comparison was done to determine between which time periods (between which hours after

application) the difference occurred. The point at which the difference becomes evident indicates when the repellents wore off the most.

Ten repellents were tested for varying time periods. Hairspray proved to show a great variability between the number caught at one hour versus the number caught at four hours. Upon examination of the pairwise comparisons, the time interval that proved to show the most significantly different number of mosquitoes caught was between two and four hours. This is probably true because the repellent still had some effectiveness at two hours, but was nearly worn off by four hours after application.

Revco aerosol with 15 percent deet also proved to show a significant difference between the number of mosquitoes caught at one hour compared to four hours. But in this case, the greatest pairwise differences occurred between one and three hours, and between two and three hours. Possibly, the repellent was most effective at one or two hours after the repellent was applied, but had nearly worn off by three hours. Therefore, there was little difference in usefulness of the repellent between three and four hours. In comparing these two repellents, hairspray and Revco, which have comparable amounts of deet, it may demonstrate that hairspray works until four hours have passed, but Revco has worn off before then.

The only other repellant that demonstrated a significant difference between one and four hours was Ben's liquid containing 100 percent deet. It was most significantly different between two and four hours, and between three and four hours after application. The location of these differences may indicate that 100 percent deet Ben's was still fairly useful as a repellent at both two and three hours after application, but by four hours, it had worn off significantly. This comparison would imply that 100 percent active deet is comparable to a low concentration of deet plus an added ingredient, hairspray.

Although only one repellent showed to be ineffective when put up against a statistical test comparing the number caught without repellent and the number caught four hours after application, it cannot be assumed that the repellents still work for all users after four hours. For all of the deet containing repellents, there was at least one example of specific numbers demonstrating that the repellent was useless for one or more volunteers after four hours. For example, on July 5, the average number of mosquitoes caught by the controls over two trials was 113. One tester who had been wearing hairspray repellent for four hours also caught 113 mosquitoes. Hairspray was useless to this tester after four hours

of wear. On another test night, 100 percent deet Muskol liquid was tested. One control collector had 38 mosquitoes, and the tester who had worn 100 percent deet Muskol collected only eleven mosquitoes. But, the other control collector had only ten mosquitoes. These data show the variability in both experimental and control numbers collected, causing great variability that prevented data from being statistically significant overall.

In order to determine the length of time that Skin So Soft and Natrapel last, the number caught after wearing the repellent for two hours and control numbers caught on the same test nights were statistically compared. Again, a probability value of less than .05 indicates a significant difference. Skin So Soft registered a probability value of .00, and Natrapel registered a value of .007, implying that both of these repellents were ineffective after two hours. Because these repellents had worn off by the time two hours had passed, and it was demonstrated statistically that Skin So Soft and Natrapel had significantly different effectiveness than several of the deet containing repellents, it can be concluded that those deet repellents (including hairspray, Ben's 100 percent, Revco with fifteen percent deet, and Cutter's spray with thirty two percent active ingredients) were still able to keep mosquitoes away after two hours of wear. This data would back up the proposed statements that hairspray, for example, was still useful at two hours, but had worn off significantly by the time four hours had passed.

Tests were performed to study whether exercise makes repellents wear off faster. Exercise became a challenging variable to regulate. A very small number of these tests were done, and the number of mosquitoes collected by exercisers were insignificantly different than the number caught by non-exercisers, partly because none of the testers were completely inactive for the hours prior to the tests.

The temperature and mosquito species were observed carefully to try to note any trends in the environment that would affect biting pressure. The various dominant mosquito species tended to come in waves, and between the peaks of species were decreases in biting pressure. Whenever biting pressure was low, fewer mosquitoes were caught by the controls, so data is less reliable at such times. At the beginning of the summer, black legged species predominated, especially Aedes punctor. Mansonia perturbans dominated later in the summer. Aedes cinereus was present in fairly low numbers all summer, but certain volunteers seemed especially prone to attract this species of mosquito. This trend must be associated with general uncontrollable personal variation. By the last week of the testing period, collected numbers of mosquitoes had dwindled so much

that the last few tests of the summer were canceled.

DISCUSSION

Several definite conclusions can be drawn from the collected data. None of the mechanical devices are useful in repelling mosquitoes. Skin So Soft and Natrapel, despite the fact that they are effective for short periods of time, are of no use as little as two hours after application. The following repellents are useful upon initial application: 15 percent deet Revco aerosol, Skin So Soft, Natrapel, Blackfly repellent, 32 percent active ingredient Cutter's pump spray, Cutter's stick with 26 percent deet, Muskol liquid with 100 percent deet, Ben's liquid with 100 percent deet, and Off 100 percent deet liquid. Formulations of repellents with low deet combined with hairspray, which prevents evaporation, is comparable to 100 percent deet formulations in the amount of time after application that they last. Dimethyl phthalate combined with deet does not enhance a repellent's effective period. Off Bug Barriers, an area repellent, proved ineffective.

Upon examination of deet containing repellents, it appears that 100 percent active ingredient does not necessarily cause a repellent to last, or remain effective, for a longer period of time. Hairspray material combined with fifteen percent deet appears to be just as effective as a 100 percent liquid. Could the amount of hairspray, or the stickiness of it, be increased to allow the repellent to remain on the skin longer? A mixture of active ingredients, such as deet and dimethyl phthalate does not seem to have any longer lasting effects than a repellent with an equal amount of deet without the extra active ingredient. A useful experiment to perform would be to determine how much deet (how low a concentration) can prove to have the same effect as a 100 percent deet formula. The best "form" of repellent should also be found. An aerosol can be applied the most evenly, and a pump spray works quite well also. A liquid (as all of the 100 percent formulas were) was hard to spread properly and evenly on the forearms, and tended to be concentrated on spots on the skin. This difficulty could add to the potential health hazards of 100 percent formulations.

Speculations can be made about why repellents that work very well when first applied can lose potency relatively quickly. Skin So Soft is a bath oil with a scent. The scent may have some effect in keeping mosquitoes away, but it is more likely that the oiliness prevents biting. After a brief period of time, such an oil will soak into the skin, and allow mosquitoes to land and bite. Similar thoughts hold true for Natrapel, a repellent containing ten percent

citronella. In past experiments, citronella in candles used as area repellents did not effectively prevent mosquitoes from biting (Bernard, 1990). Perhaps, therefore, it is not the citronella in Natrapel that keeps mosquitoes away, but instead just the lotion that it is in acts as the Skin So Soft's moisturizer.A seemingly straightforward experiment turned out to be complex with a surprising array of results. Because volunteers were used in every test, excessive demands could not be requested. For example, testing how exercise causes repellent to wear off over time was a greater demand than was expected. Testers who applied repellent before exercising would want to take a shower after running or playing basketball instead of waiting extra time until the tests. A large part of personal attractivity differences was probably due in part to a person's "scent," caused by deodorant, clothes detergent, etc. so each volunteer could not be sterilized before each test. Even differences in diet may have caused different attractiveness. For example, high amounts of vitamin B tend to keep mosquitoes away. Therefore, different numbers of mosquitoes flocked to each person, independently from effects caused by repellents alone, which can be seen by the variety of numbers caught by controls over the whole summer. This trend can be seen in graph 1. Slight differences in collector's ability and effort put forth also played a role in determining how many mosquitoes were caught. Class schedules often made consistency in applications before tests difficult.

Aside from personal differences, the environment was also uncontrollable. Ideally, the same number of mosquitoes ought to have been collected by controls each night of testing. This was far from the case in this experiment, and it only verifies the need for repellents to work over a broad range of conditions. The changes in numbers and species of mosquitoes caused variables that could not be corrected for. In the future, if timed tests are attempted again, it would be advantageous to perform two and four hour tests in the same test period so that mosquito numbers are consistent from one test to the next. For more accuracy, a much greater number of volunteers would be needed to lessen the effects of personal variability. More than six volunteers should have been present for each test, especially to have more control collectors, but that would be impractical with a limited sized volunteer pool. Ideally, the tests should have been carried on for longer in order to test each repellent enough times to correct for variability due to personal attractiveness, catching ability, and environmental conditions. It is obvious from these frustrations why most previous mosquito repellent tests of effectiveness have been confined to

laboratory experiments.

An extra challenge was the quest to find an ideal testing site. Unfortunately, depending upon what type of setting, either wooded or open, biting pressures varied greatly, which could make data difficult to compare. Tender Bog was used for most of the tests of the summer because of convenience since volunteers could walk to it. There were several places to stand for tests at Tender Bog: the walkway, a clearing, a boardwalk through the woods, or the dock by the water. The heaviest biting occurred when the testers stood in the woods adjacent to the clearing, but it was difficult to ensure that each tester had enough space if all were in the woods. Another fairly successful site was just off of the road, halfway between the camp and the lab (on the left hand side of the road travelling toward the lab). It was even more difficult here to make sure that the testers were spread out enough. Firestone Lake was tried on several occasions, but the tests attempted there were almost always repeated at Tender Bog because of the low biting pressure. Firestone was also a site to be avoided because of the large number of ticks present. Brown Lake and Bay Lake were also used as alternate sites. If class was being held at those locations at the approximate time that tests had to be performed, volunteers collected there for convenience. In last year's study, it was suggested to use North Gate Bog, also. Unfortunately, the road was inaccessible to there for much of the summer, and the distance from camp made it difficult to use. An ideal sight would be large, fairly wooded, near water (where the mosquitoes breed), yet accessible. In the future, the large areas of vernal ponds may be useful to try as test sites.

Twilight, between 8:30 and 9:30, was the ideal testing time. In some cases, 7:00 was a time when mosquitoes were caught, but any earlier tests usually had to be repeated.

The most successful aspect of the experiment was the conclusion drawn about "clickers" and "buzzers." Four different types were tested for at least half of the trials of the summer (more than twenty tests), a wide variety of volunteers tried them, and biting pressures, time, and weather conditions varied for the tests. The most tested was the "new, improved" Mosquito Hawk (see copied information in Appendix 5). All of them proved to be consistently worthless in repelling mosquitoes from the testers.

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Appendix 1: Repellents tested and their ingredients

DEET REPELLENTS

Ben's Repellent, liquid	
N-N-Diethyl toluamide	100%
meta isomer	95%
other isomers	5%
Maximum Protection Off, liquid	
N,N-diethyl-meta-toluamide	95%
other N,N diethyl toluamide isomers	5%
Maximum Strength Muskol,liquid	
N,N-Diethyl-m-toluamide	95%
other isomers	5%
Repel Insect Repellent, sportsmen Formula, liquid	
N,N-Diethyl-m-toluamide	52.25%
other isomers	2.75%
inert ingredients	45.00%
Revco Insect Repellent, aeresol	
N,N-Diethyl-m-toluamide	14.25%
other isomers	.75%
inert ingredients	85.00%
Cutter Insect Repellent, pump spray	
N,N-Diethyl-m-toluamide	17.1%
other isomers	.9%
dimethyl phthalate	12%
N-octyl dicycloheptene dicarboximide	1%
Di-N-propyl isocinchomeronate	1%
inert ingredients	68%
Cutter Insect Repellent, stick	
N,N-Diethyl-meta-toulamide	31.35%
other isomers	1.65%
inert ingredients	67.00%
Albert Laboratories Insect Repellent Hairspray, aeresol	
N,N-Diethyl-m-toluamide	15%

FORMULAS WITHOUT DEET

LJB's Blackfly Repellent, liquid	
2 Ethyl-1,3 Hexanediol	61.25%

Dimethyl Phthalate 38.75%

Natrapel, lotion
citronella 10%
inert ingredients 90%

Avon Skin So Soft, bath oil
Mineral oil
isopropyl palmitate
diapryl adipate
fragrence
dioctyl sodium sulfosuccinate
BHT
lanolin alcohol
D and C yellow #11 and D and C red #17

Downy Fabric Softener Sheets
non-ionic and cationic fabric softening agents
bentonite
perfume

AREA REPELLENT
Johnson Wax Off! Yard and Patio Bug Barriers, burning sticks
Esbiothrin
(d/L-allethrolone d-trans chrysanthemate) .15%
vegetable matter and wood fiber 98.24%
inert ingredients 1.61%

ELECTRONIC DEVICES
Moltron Bug shield
small clip-on electronic device
runs on AA battery
repells with high pitched noise

Bye! Bye! Mosquitos
small clip-on electronic device
runs on AA battery
repells with high pitched noise

Mosquito Hawk
small attachable electronic device
runs on 9-volt battery
repells with clicking noise

New, Improved Mosquito Hawk
Original mosquito hawk with an on/off switch

Appendix 2: List of Abbreviations

Repellents:

- 100Ben.....Ben's Repellent
- 1000ff.....Maximum protection Off!
- 100Musk.....Maximum Strength Muskol
- repliq.....Repell Insect Repellent
- revco.....Revco Insect Repellent
- 32cut.....Cutter Insect Repellent, pump spray
- cutstick.....Cutter Insect Repellent, stick
- hairsp.....Albert Laboratories Insect Repellent Hairspray
- blfly.....LJB's Blackfly Repellent
- natr.....Natrapel
- sss.....Skin So Soft
- downy.....Downy Fabric Softener Sheets
- offbugbar.....Off! Yard and Patio Bug Barriers
- buzold.....Moltron Bug Shield
- buznew.....Bye! Bye! Mosquios Repellent
- clickold.....Mosquito Hawk
- clicknew.....New, Improved Mosquito Hawk

Headings on Data Tables:

Initial Test Data:

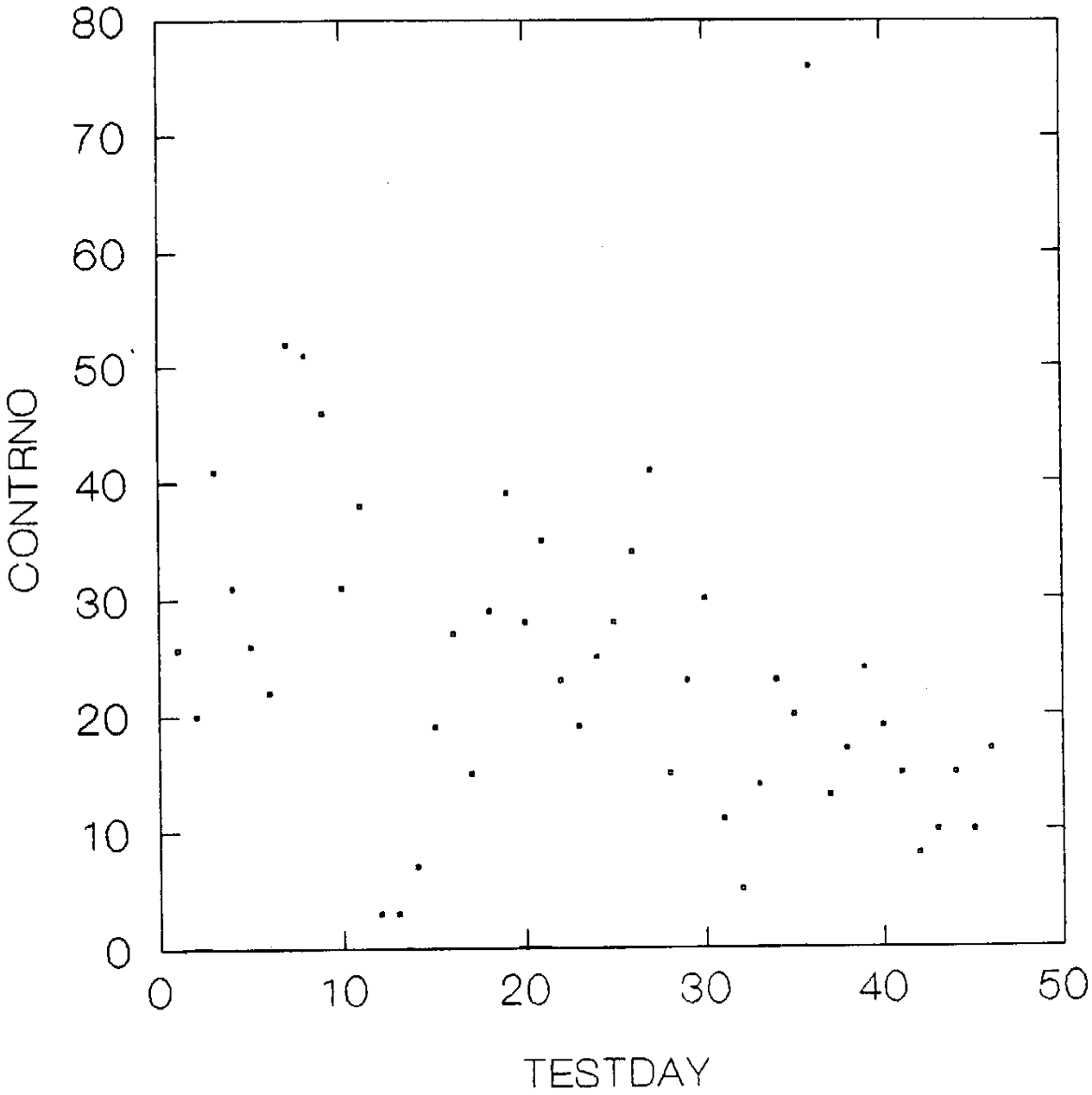
- DATE$.....date the test was performed
- AIRTEMP.....air temperature at the time of the test
- OBSERV.....the tester (each volunteer was assigned a number)
- REPELL.....a number coded for each repellent
- REPELL$.....the name of the repellent tested
- DATENO.....the number assigned to the test day
- CONTROL.....the number of mosquitoes caught without repellent
- EXPER.....the number of mosquitoes caught after repellent was applied

Time Delay Test Data:

- DATE$.....date the test was performed
- AIRTEMP.....air temperature at the time of the test
- OBSERV.....the tester (each volunteer was assigned a number)
- REPELL.....a number coded for each repellent
- REPELL$.....the name of the repellent tested
- DATENO.....the number assigned to the test day
- TS.....the number of hours before the test that repellent was applied
- EXPER.....the number of mosquitoes caught in the two trials

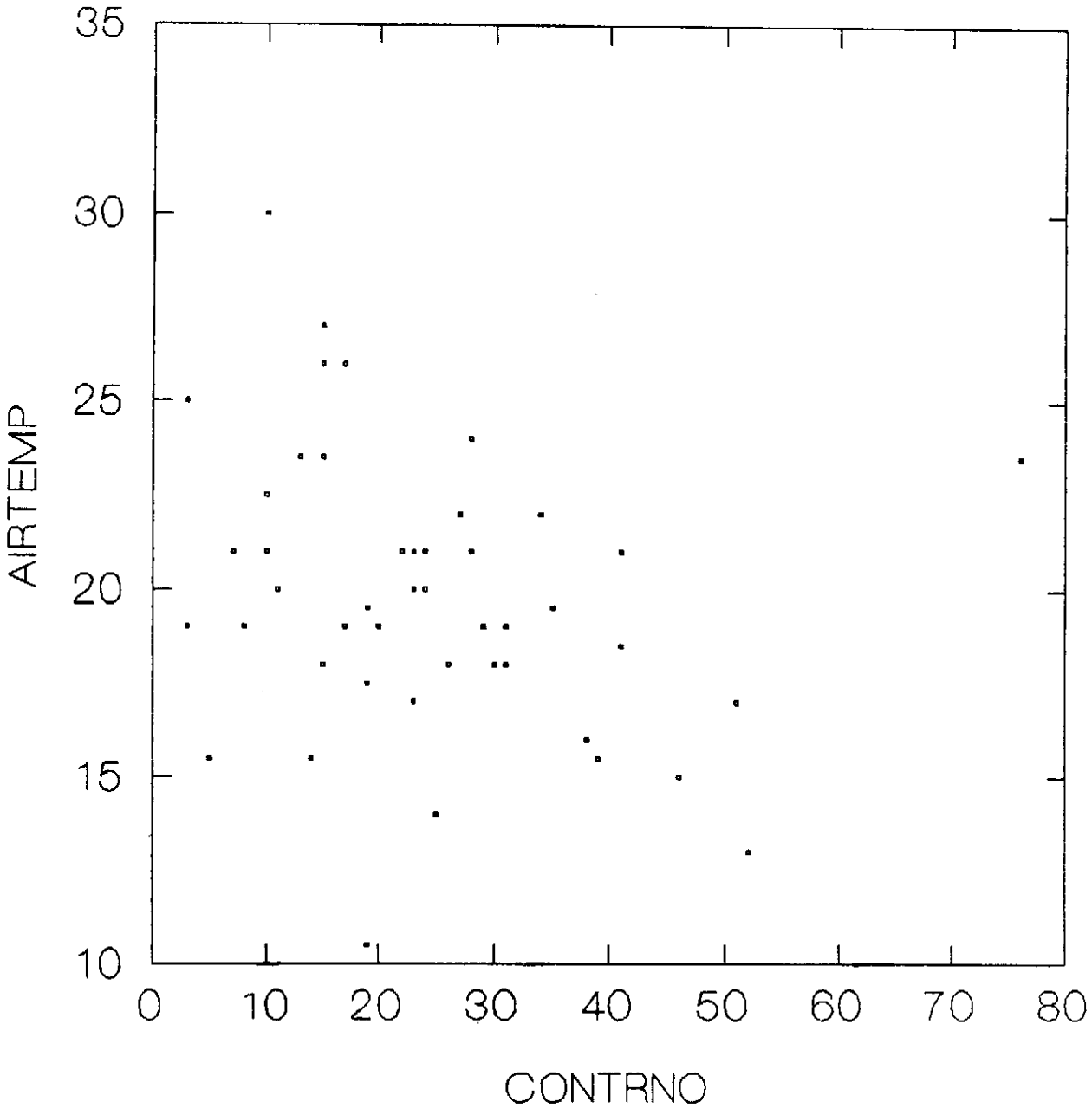
Graph 1:

The average number of mosquitoes caught by controls vs. the test day



Graph 2:

The air temperature vs. the average number of mosquitoes caught by controls



Appendix 3: Data from Initial Tests, page 1

		DATE$	AIRTEMP	OBSERV	REPELL	REPELL$
		CONTROL	EXPER	DATENO		
CASE	1	5/28	22.500	6.000	1.000	hairsp
CASE	1	26.000	0.000	1.000		
CASE	2	5/28	22.500	5.000	1.000	hairsp
CASE	2	16.000	0.000	1.000		
CASE	3	5/28	22.500	2.000	2.000	15rev
CASE	3	14.000	0.000	1.000		
CASE	4	5/28	22.500	14.000	2.000	15rev
CASE	4	4.000	0.000	1.000		
CASE	5	5/28	22.500	11.000	3.000	buzold
CASE	5	10.000	9.000	1.000		
CASE	6	5/28	22.500	15.000	3.000	buzold
CASE	6	31.000	53.000	1.000		
CASE	7	5/29	20.000	3.000	4.000	sss
CASE	7	16.000	0.000	2.000		
CASE	8	5/29	20.000	1.000	4.000	sss
CASE	8	10.000	1.000	2.000		
CASE	9	5/29	20.000	8.000	4.000	sss
CASE	9	15.000	0.000	2.000		
CASE	10	5/29	20.000	7.000	5.000	natr
CASE	10	6.000	1.000	2.000		
CASE	11	5/29	20.000	11.000	5.000	natr
CASE	11	24.000	2.000	2.000		
CASE	12	5/29	20.000	12.000	5.000	natr
CASE	12	22.000	0.000	2.000		
CASE	13	5/30	18.500	4.000	6.000	blfly
CASE	13	46.000	8.000	3.000		
CASE	14	5/30	18.500	2.000	6.000	blfly
CASE	14	22.000	1.000	3.000		
CASE	15	5/30	18.500	3.000	6.000	blfly
CASE	15	3.000	0.000	3.000		
CASE	16	5/30	18.500	1.000	6.000	blfly
CASE	16	28.000	4.000	3.000		
CASE	17	5/30	18.500	16.000	7.000	clickold
CASE	17	81.000	74.000	3.000		
CASE	18	5/30	18.500	11.000	7.000	clickold
CASE	18	41.000	32.000	3.000		
CASE	19	5/31	19.000	9.000	8.000	100musk
CASE	19	47.000	0.000	4.000		
CASE	20	5/31	19.000	10.000	8.000	100musk
CASE	20	36.000	0.000	4.000		
CASE	21	5/31	19.000	12.000	9.000	100bens
CASE	21	32.000	0.000	4.000		
CASE	22	5/31	19.000	11.000	9.000	100bens
CASE	22	31.000	0.000	4.000		
CASE	23	5/31	19.000	13.000	10.000	100off
CASE	23	30.000	0.000	4.000		
CASE	24	5/31	19.000	7.000	10.000	100off
CASE	24	30.000	0.000	4.000		
CASE	25	6/1	18.000	6.000	11.000	cutstick
CASE	25	31.000	1.000	5.000		
CASE	26	6/1	18.000	14.000	11.000	cutstick
CASE	26	7.000	0.000	5.000		

CASE	27	6/1	18.000	8.000	11.000	cutstick
CASE	27	13.000	0.000	5.000		
CASE	28	6/1	18.000	4.000	12.000	repliq
CASE	28	40.000	0.000	5.000		
CASE	29	6/1	18.000	5.000	12.000	repliq
CASE	29	20.000	0.000	5.000		
CASE	30	6/1	18.000	11.000	12.000	repliq
CASE	30	26.000	0.000	5.000		
CASE	31	6/3	13.000	1.000	3.000	buzold
CASE	31	63.000	70.000	6.000		
CASE	32	6/3	13.000	10.000	3.000	buzold
CASE	32	11.000	12.000	6.000		
CASE	33	6/3	13.000	14.000	16.000	downy
CASE	33	26.000	24.000	6.000		
CASE	34	6/3	13.000	5.000	16.000	downy
CASE	34	35.000	44.000	6.000		
CASE	35	6/3	13.000	7.000	16.000	downy
CASE	35	77.000	72.000	6.000		
CASE	36	6/3	13.000	11.000	16.000	downy
CASE	36	52.000	44.000	6.000		
CASE	37	6/4	17.000	11.000	3.000	buzold
CASE	37	51.000	52.000	7.000		
CASE	38	6/4	17.000	12.000	3.000	buzold
CASE	38	48.000	46.000	7.000		
CASE	39	6/4	17.000	8.000	13.000	32cut
CASE	39	31.000	1.000	7.000		
CASE	40	6/4	17.000	6.000	13.000	32cut
CASE	40	52.000	0.000	7.000		
CASE	41	6/4	17.000	2.000	13.000	32cut
CASE	41	30.000	0.000	7.000		
CASE	42	6/4	17.000	4.000	13.000	32cut
CASE	42	45.000	2.000	7.000		
CASE	43	6/5	15.000	5.000	7.000	clickold
CASE	43	28.000	26.000	8.000		
CASE	44	6/5	15.000	11.000	7.000	clickold
CASE	44	45.000	47.000	8.000		
CASE	45	6/11	17.500	11.000	3.000	buzold
CASE	45	23.000	15.000	9.000		
CASE	46	6/11	17.500	16.000	3.000	buzold
CASE	46	29.000	11.000	9.000		
CASE	47	6/12	22.000	12.000	4.000	sss
CASE	47	8.000	0.000	10.000		
CASE	48	6/12	22.000	11.000	4.000	sss
CASE	48	27.000	1.000	10.000		
CASE	49	6/12	22.000	10.000	4.000	sss
CASE	49	6.000	0.000	10.000		
CASE	50	6/12	22.000	9.000	5.000	natr
CASE	50	2.000	0.000	10.000		
CASE	51	6/12	22.000	3.000	5.000	natr
CASE	51	7.000	0.000	10.000		
CASE	52	6/12	22.000	13.000	5.000	natr
CASE	52	7.000	0.000	10.000		
CASE	53	6/17	24.000	11.000	3.000	buzold
CASE	53	32.000	23.000	11.000		
CASE	54	6/17	24.000	15.000	15.000	buznew
CASE	54	20.000	22.000	11.000		

CASE	55	6/18	19.500	11.000	3.000	buzold
CASE	55	31.000	38.000	12.000		
CASE	56	6/18	19.500	15.000	15.000	buznew
CASE	56	28.000	33.000	12.000		
CASE	57	6/19	17.000	4.000	3.000	buzold
CASE	57	33.000	16.000	13.000		
CASE	58	6/19	17.000	11.000	7.000	clickold
CASE	58	26.000	21.000	13.000		
CASE	59	6/19	17.000	15.000	15.000	buznew
CASE	59	31.000	29.000	13.000		
CASE	60	6/21	10.500	1.000	3.000	buzold
CASE	60	14.000	24.000	14.000		
CASE	61	6/21	10.500	15.000	7.000	clickold
CASE	61	21.000	10.000	14.000		
CASE	62	6/22	14.000	9.000	3.000	buzold
CASE	62	30.000	19.000	15.000		
CASE	63	6/22	14.000	5.000	15.000	buznew
CASE	63	17.000	16.000	15.000		
CASE	64	6/23	21.000	15.000	3.000	buzold
CASE	64	47.000	40.000	16.000		
CASE	65	6/23	21.000	11.000	3.000	buzold
CASE	65	38.000	18.000	16.000		
CASE	66	6/23	21.000	17.000	3.000	buzold
CASE	66	45.000	34.000	16.000		
CASE	67	6/24	22.000	15.000	3.000	buzold
CASE	67	30.000	36.000	17.000		
CASE	68	6/24	22.000	11.000	3.000	buzold
CASE	68	32.000	36.000	17.000		
CASE	69	6/24	22.000	17.000	6.000	blfly
CASE	69	26.000	2.000	17.000		
CASE	70	6/24	22.000	2.000	6.000	blfly
CASE	70	7.000	2.000	17.000		
CASE	71	6/24	22.000	12.000	6.000	blfly
CASE	71	33.000	1.000	17.000		
CASE	72	6/24	22.000	8.000	6.000	blfly
CASE	72	2.000	1.000	17.000		
CASE	73	6/25	21.000	15.000	3.000	buzold
CASE	73	30.000	36.000	18.000		
CASE	74	6/26	26.000	15.000	3.000	buzold
CASE	74	30.000	27.000	19.000		
CASE	75	6/26	26.000	3.000	15.000	buznew
CASE	75	5.000	10.000	19.000		
CASE	76	6/27	21.000	15.000	14.000	clicknew
CASE	76	22.000	19.000	20.000		
CASE	77	6/27	21.000	11.000	14.000	clicknew
CASE	77	24.000	21.000	20.000		
CASE	78	6/28	18.000	15.000	14.000	clicknew
CASE	78	25.000	23.000	21.000		
CASE	79	6/28	18.000	11.000	14.000	clicknew
CASE	79	21.000	38.000	21.000		
CASE	80	6/29	20.000	10.000	14.000	clicknew
CASE	80	8.000	6.000	22.000		
CASE	81	6/29	20.000	11.000	14.000	clicknew
CASE	81	6.000	15.000	22.000		
CASE	82	6/30	15.500	11.000	14.000	clicknew
CASE	82	4.000	5.000	23.000		

CASE	83	6/30	15.500	13.000	14.000	clicknew
CASE	83	4.000	8.000	23.000		
CASE	84	7/1	15.500	4.000	3.000	buzold
CASE	84	7.000	8.000	24.000		
CASE	85	7/1	15.500	11.000	15.000	buznew
CASE	85	11.000	16.000	24.000		
CASE	86	7/1	15.500	14.000	17.000	offbugbar
CASE	86	4.000	6.000	24.000		
CASE	87	7/1	15.500	10.000	17.000	offbugbar
CASE	87	6.000	4.000	24.000		
CASE	88	7/1	15.500	9.000	17.000	offbugbar
CASE	88	8.000	3.000	24.000		
CASE	89	7/1	15.500	2.000	17.000	offbugbar
CASE	89	3.000	2.000	24.000		
CASE	90	7/2	20.000	6.000	3.000	buzold
CASE	90	9.000	10.000	25.000		
CASE	91	7/2	20.000	1.000	7.000	clickold
CASE	91	12.000	14.000	25.000		
CASE	92	7/2	20.000	11.000	14.000	clicknew
CASE	92	21.000	24.000	25.000		
CASE	93	7/3	19.000	4.000	2.000	15rev
CASE	93	15.000	3.000	26.000		
CASE	94	7/3	19.000	7.000	2.000	15rev
CASE	94	6.000	0.000	26.000		
CASE	95	7/3	19.000	10.000	3.000	buzold
CASE	95	4.000	11.000	26.000		
CASE	96	7/3	19.000	3.000	13.000	32cut
CASE	96	7.000	4.000	26.000		
CASE	97	7/3	19.000	13.000	13.000	32cut
CASE	97	9.000	0.000	26.000		
CASE	98	7/3	19.000	11.000	14.000	clicknew
CASE	98	12.000	27.000	26.000		
CASE	99	7/5	23.500	11.000	14.000	clicknew
CASE	99	85.000	66.000	27.000		
CASE	100	7/5	23.500	13.000	14.000	clicknew
CASE	100	36.000	39.000	27.000		
CASE	101	7/6	23.500	2.000	8.000	100musk
CASE	101	5.000	1.000	28.000		
CASE	102	7/6	23.500	1.000	8.000	100musk
CASE	102	4.000	2.000	28.000		
CASE	103	7/6	23.500	9.000	14.000	clicknew
CASE	103	9.000	5.000	28.000		
CASE	104	7/6	23.500	11.000	14.000	clicknew
CASE	104	10.000	16.000	28.000		
CASE	105	7/7	19.000	1.000	3.000	buzold
CASE	105	6.000	9.000	29.000		
CASE	106	7/7	19.000	11.000	14.000	clicknew
CASE	106	19.000	14.000	29.000		
CASE	107	7/7	19.000	14.000	14.000	clicknew
CASE	107	8.000	7.000	29.000		
CASE	108	7/8	21.000	11.000	15.000	buznew
CASE	108	20.000	28.000	30.000		
CASE	109	7/9	19.500	5.000	3.000	buzold
CASE	109	6.000	4.000	31.000		
CASE	110	7/9	19.500	11.000	3.000	buzold
CASE	110	14.000	24.000	31.000		

CASE	111	7/11	18.000	7.000	3.000	buzold
CASE	111	6.000	7.000	32.000		
CASE	112	7/11	18.000	11.000	15.000	buznew
CASE	112	13.000	16.000	32.000		
CASE	113	7/12	19.000	14.000	3.000	buzold
CASE	113	2.000	4.000	33.000		
CASE	114	7/12	19.000	9.000	14.000	clicknew
CASE	114	9.000	6.000	33.000		
CASE	115	7/14	21.000	6.000	3.000	buzold
CASE	115	0.000	0.000	34.000		
CASE	116	7/14	21.000	11.000	3.000	buzold
CASE	116	11.000	9.000	34.000		
CASE	117	7/14	21.000	12.000	17.000	offbugbar
CASE	117	5.000	19.000	34.000		
CASE	118	7/14	21.000	1.000	17.000	offbugbar
CASE	118	1.000	2.000	34.000		
CASE	119	7/14	21.000	3.000	17.000	offbugbar
CASE	119	2.000	0.000	34.000		
CASE	120	7/14	21.000	7.000	17.000	offbugbar
CASE	120	0.000	1.000	34.000		
CASE	121	7/15	27.000	9.000	9.000	100ben
CASE	121	5.000	0.000	35.000		
CASE	122	7/15	27.000	4.000	9.000	100ben
CASE	122	7.000	0.000	35.000		
CASE	123	7/15	27.000	11.000	14.000	clicknew
CASE	123	13.000	16.000	35.000		
CASE	124	7/15	27.000	12.000	14.000	clicknew
CASE	124	12.000	14.000	35.000		
CASE	125	7/16	30.000	13.000	10.000	100off
CASE	125	12.000	1.000	36.000		
CASE	126	7/16	30.000	6.000	10.000	100off
CASE	126	4.000	0.000	36.000		
CASE	127	7/16	30.000	11.000	15.000	buznew
CASE	127	11.000	9.000	36.000		
CASE	128	7/16	30.000	10.000	15.000	buznew
CASE	128	2.000	2.000	36.000		
CASE	129	7/18	26.000	3.000	1.000	hairsp
CASE	129	3.000	0.000	37.000		
CASE	130	7/18	26.000	1.000	1.000	hairsp
CASE	130	5.000	0.000	37.000		
CASE	131	7/18	26.000	9.000	3.000	buzold
CASE	131	1.000	3.000	37.000		
CASE	132	7/18	26.000	11.000	3.000	buzold
CASE	132	17.000	17.000	37.000		

		DATE$	AIRTEMP	OBSERV	REPELL	REPELL$
		TS	NOMOS	DATENO		
CASE	1	6/2	21.000	4.000	1.000	hairsp
CASE	1	1.000	4.000	1.000		
CASE	2	6/2	21.000	11.000	1.000	hairsp
CASE	2	1.000	3.000	1.000		
CASE	3	6/2	21.000	6.000	1.000	hairsp
CASE	3	0.000	39.000	1.000		
CASE	4	6/2	21.000	9.000	1.000	hairsp
CASE	4	0.000	42.000	1.000		
CASE	5	6/2	21.000	2.000	2.000	15rev
CASE	5	1.000	7.000	1.000		
CASE	6	6/2	21.000	9.000	2.000	15rev
CASE	6	0.000	42.000	1.000		
CASE	7	6/2	21.000	6.000	2.000	15rev
CASE	7	0.000	39.000	1.000		
CASE	8	6/2	21.000	7.000	2.000	15rev
CASE	8	1.000	3.000	1.000		
CASE	9	6/5	15.000	10.000	12.000	repliq
CASE	9	2.000	5.000	2.000		
CASE	10	6/5	15.000	13.000	12.000	repliq
CASE	10	2.000	14.000	2.000		
CASE	11	6/5	15.000	5.000	12.000	repliq
ASE	11	0.000	54.000	2.000		
CASE	12	6/5	15.000	3.000	12.000	repliq
CASE	12	2.000	3.000	2.000		
CASE	13	6/5	15.000	11.000	12.000	repliq
CASE	13	0.000	92.000	2.000		
CASE	14	6/5	15.000	1.000	12.000	repliq
CASE	14	2.000	7.000	2.000		
CASE	15	6/6	18.000	9.000	1.000	hairsp
CASE	15	2.000	5.000	3.000		
CASE	16	6/6	18.000	2.000	1.000	hairsp
CASE	16	0.000	34.000	3.000		
CASE	17	6/6	18.000	11.000	1.000	hairsp
CASE	17	0.000	55.000	3.000		
CASE	18	6/6	18.000	6.000	1.000	hairsp
CASE	18	2.000	3.000	3.000		
CASE	19	6/6	18.000	12.000	2.000	15rev
CASE	19	2.000	15.000	3.000		
CASE	20	6/6	18.000	7.000	2.000	15rev
CASE	20	2.000	3.000	3.000		
CASE	21	6/6	18.000	2.000	2.000	15rev
CASE	21	0.000	34.000	3.000		
CASE	22	6/6	18.000	11.000	2.000	15rev
CASE	22	0.000	55.000	3.000		
CASE	23	6/7	16.000	4.000	1.000	hairsp
CASE	23	3.000	21.000	4.000		
CASE	24	6/7	16.000	1.000	1.000	hairsp
ASE	24	3.000	5.000	4.000		
CASE	25	6/7	16.000	12.000	1.000	hairsp
CASE	25	0.000	125.000	4.000		
CASE	26	6/7	16.000	11.000	1.000	hairsp
CASE	26	0.000	75.000	4.000		

ASE	27	6/7	16.000	11.000	2.000	15rev
CASE	27	0.000	75.000	4.000		
CASE	28	6/7	16.000	10.000	2.000	15rev
CASE	28	3.000	17.000	4.000		
CASE	29	6/7	16.000	7.000	2.000	15rev
CASE	29	3.000	21.000	4.000		
CASE	30	6/7	16.000	12.000	2.000	15rev
CASE	30	0.000	125.000	4.000		
CASE	31	6/9	25.000	1.000	1.000	hairsp
CASE	31	2.000	3.000	5.000		
CASE	32	6/9	25.000	8.000	1.000	hairsp
CASE	32	2.000	0.000	5.000		
CASE	33	6/9	25.000	10.000	1.000	hairsp
CASE	33	0.000	6.000	5.000		
CASE	34	6/9	25.000	14.000	1.000	hairsp
CASE	34	0.000	1.000	5.000		
CASE	35	6/9	25.000	11.000	9.000	100ben
CASE	35	2.000	7.000	5.000		
CASE	36	6/9	25.000	14.000	9.000	100ben
CASE	36	0.000	1.000	5.000		
CASE	37	6/9	25.000	5.000	9.000	100ben
CASE	37	2.000	3.000	5.000		
CASE	38	6/9	25.000	10.000	9.000	100ben
CASE	38	0.000	6.000	5.000		
CASE	39	6/10	21.000	3.000	1.000	hairsp
ASE	39	0.000	7.000	6.000		
CASE	40	6/10	21.000	4.000	1.000	hairsp
CASE	40	3.000	7.000	6.000		
CASE	41	6/10	21.000	11.000	1.000	hairsp
CASE	41	3.000	17.000	6.000		
CASE	42	6/10	21.000	6.000	1.000	hairsp
CASE	42	0.000	14.000	6.000		
CASE	43	6/10	21.000	3.000	8.000	100musk
CASE	43	0.000	7.000	6.000		
CASE	44	6/10	21.000	2.000	8.000	100musk
CASE	44	3.000	19.000	6.000		
CASE	45	6/10	21.000	7.000	8.000	100musk
CASE	45	3.000	6.000	6.000		
CASE	46	6/10	21.000	6.000	8.000	100musk
CASE	46	0.000	14.000	6.000		
CASE	47	6/11	17.500	8.000	4.000	sss
CASE	47	1.000	20.000	7.000		
CASE	48	6/11	17.500	1.000	4.000	sss
CASE	48	1.000	32.000	7.000		
CASE	49	6/11	17.500	16.000	4.000	sss
CASE	49	0.000	40.000	7.000		
CASE	50	6/11	17.500	11.000	4.000	sss
CASE	50	0.000	38.000	7.000		
CASE	51	6/11	17.500	11.000	5.000	natr
CASE	51	0.000	38.000	7.000		
CASE	52	6/11	17.500	5.000	5.000	natr
ASE	52	1.000	18.000	7.000		
CASE	53	6/11	17.500	6.000	5.000	natr
CASE	53	1.000	25.000	7.000		
CASE	54	6/11	17.500	16.000	5.000	natr
CASE	54	0.000	40.000	7.000		

CASE	55	6/13	23.500	14.000	8.000	100musk
CASE	55	0.000	19.000	8.000		
CASE	56	6/13	23.500	8.000	8.000	100musk
CASE	56	2.000	0.000	8.000		
CASE	57	6/13	23.500	2.000	8.000	100musk
CASE	57	2.000	2.000	8.000		
CASE	58	6/13	23.500	11.000	8.000	100musk
CASE	58	0.000	29.000	8.000		
CASE	59	6/13	23.500	14.000	9.000	100ben
CASE	59	0.000	19.000	8.000		
CASE	60	6/13	23.500	4.000	9.000	100ben
CASE	60	2.000	4.000	8.000		
CASE	61	6/13	23.500	18.000	9.000	100ben
CASE	61	2.000	0.000	8.000		
CASE	62	6/13	23.500	11.000	9.000	100ben
CASE	62	0.000	29.000	8.000		
CASE	63	6/14	19.000	11.000	1.000	hairsp
CASE	63	0.000	57.000	9.000		
CASE	64	6/14	19.000	6.000	1.000	hairsp
CASE	64	0.000	38.000	9.000		
CASE	65	6/14	19.000	5.000	1.000	hairsp
CASE	65	2.000	3.000	9.000		
CASE	66	6/14	19.000	13.000	1.000	hairsp
CASE	66	2.000	9.000	9.000		
CASE	67	6/14	19.000	11.000	2.000	15rev
CASE	67	0.000	57.000	9.000		
CASE	68	6/14	19.000	12.000	2.000	15rev
CASE	68	2.000	9.000	9.000		
CASE	69	6/14	19.000	6.000	2.000	15rev
CASE	69	0.000	38.000	9.000		
CASE	70	6/14	19.000	8.000	2.000	15rev
CASE	70	2.000	3.000	9.000		
CASE	71	6/16	15.500	2.000	8.000	100musk
CASE	71	2.000	3.000	10.000		
CASE	72	6/16	15.500	1.000	8.000	100musk
CASE	72	0.000	77.000	10.000		
CASE	73	6/16	15.500	3.000	8.000	100musk
CASE	73	0.000	73.000	10.000		
CASE	74	6/16	15.500	11.000	8.000	100musk
CASE	74	2.000	26.000	10.000		
CASE	75	6/16	15.500	1.000	9.000	100ben
CASE	75	0.000	77.000	10.000		
CASE	76	6/16	15.500	3.000	9.000	100ben
CASE	76	0.000	73.000	10.000		
CASE	77	6/16	15.500	10.000	9.000	100ben
CASE	77	2.000	0.000	10.000		
CASE	78	6/16	15.500	7.000	9.000	100ben
CASE	78	2.000	4.000	10.000		
CASE	79	6/17	24.000	16.000	4.000	sss
CASE	79	0.000	59.000	11.000		
CASE	80	6/17	24.000	12.000	4.000	sss
CASE	80	0.000	35.000	11.000		
CASE	81	6/17	24.000	5.000	4.000	sss
CASE	81	1.000	8.000	11.000		
CASE	82	6/17	24.000	13.000	4.000	sss
CASE	82	1.000	43.000	11.000		

ASE	83	6/18	19.500	15.000	4.000	sss
CASE	83	0.000	61.000	12.000		
CASE	84	6/18	19.500	2.000	4.000	sss
CASE	84	2.000	17.000	12.000		
CASE	85	6/18	19.500	11.000	4.000	sss
CASE	85	0.000	69.000	12.000		
CASE	86	6/18	19.500	5.000	4.000	sss
CASE	86	2.000	7.000	12.000		
CASE	87	6/18	19.500	11.000	5.000	natr
CASE	87	0.000	69.000	12.000		
CASE	88	6/18	19.500	7.000	5.000	natr
CASE	88	2.000	13.000	12.000		
CASE	89	6/18	19.500	15.000	5.000	natr
CASE	89	0.000	61.000	12.000		
CASE	90	6/18	19.500	12.000	5.000	natr
CASE	90	2.000	25.000	12.000		
CASE	91	6/19	17.000	1.000	8.000	100musk
CASE	91	3.000	5.000	13.000		
CASE	92	6/19	17.000	11.000	8.000	100musk
CASE	92	0.000	47.000	13.000		
CASE	93	6/19	17.000	13.000	8.000	100musk
CASE	93	3.000	19.000	13.000		
CASE	94	6/19	17.000	4.000	8.000	100musk
CASE	94	0.000	49.000	13.000		
CASE	95	6/21	10.500	14.000	8.000	100musk
ASE	95	0.000	23.000	14.000		
CASE	96	6/21	10.500	15.000	8.000	100musk
CASE	96	0.000	31.000	14.000		
CASE	97	6/21	10.500	11.000	8.000	100musk
CASE	97	3.000	22.000	14.000		
CASE	98	6/21	10.500	4.000	8.000	100musk
CASE	98	3.000	15.000	14.000		
CASE	99	6/22	14.000	13.000	1.000	hairsp
CASE	99	3.000	17.000	15.000		
CASE	100	6/22	14.000	8.000	1.000	hairsp
CASE	100	3.000	0.000	15.000		
CASE	101	6/22	14.000	9.000	1.000	hairsp
CASE	101	0.000	49.000	15.000		
CASE	102	6/22	14.000	5.000	1.000	hairsp
CASE	102	0.000	33.000	15.000		
CASE	103	6/22	14.000	6.000	2.000	15rev
CASE	103	3.000	16.000	15.000		
CASE	104	6/22	14.000	5.000	2.000	15rev
CASE	104	0.000	33.000	15.000		
CASE	105	6/22	14.000	9.000	2.000	15rev
CASE	105	0.000	49.000	15.000		
CASE	106	6/22	14.000	11.000	2.000	15rev
CASE	106	3.000	25.000	15.000		
CASE	107	6/23	21.000	11.000	9.000	100ben
CASE	107	0.000	56.000	16.000		
CASE	108	6/23	21.000	4.000	9.000	100ben
ASE	108	3.000	7.000	16.000		
CASE	109	6/23	21.000	15.000	9.000	100ben
CASE	109	0.000	87.000	16.000		
CASE	110	6/23	21.000	3.000	9.000	100ben
CASE	110	3.000	5.000	16.000		

ASE	111	6/25	21.000	15.000	10.000	100off
CASE	111	0.000	66.000	17.000		
CASE	112	6/25	21.000	5.000	10.000	100off
CASE	112	2.000	0.000	17.000		
CASE	113	6/25	21.000	8.000	10.000	100off
CASE	113	2.000	0.000	17.000		
CASE	114	6/25	21.000	4.000	10.000	100off
CASE	114	0.000	41.000	17.000		
CASE	115	6/25	21.000	15.000	13.000	32cut
CASE	115	0.000	66.000	17.000		
CASE	116	6/25	21.000	11.000	13.000	32cut
CASE	116	3.000	25.000	17.000		
CASE	117	6/25	21.000	12.000	13.000	32cut
CASE	117	3.000	19.000	17.000		
CASE	118	6/25	21.000	4.000	13.000	32cut
CASE	118	0.000	41.000	17.000		
CASE	119	6/27	21.000	15.000	4.000	sss
CASE	119	0.000	41.000	18.000		
CASE	120	6/27	21.000	11.000	4.000	sss
CASE	120	0.000	45.000	18.000		
CASE	121	6/27	21.000	7.000	4.000	sss
CASE	121	2.000	15.000	18.000		
CASE	122	6/27	21.000	5.000	4.000	sss
CASE	122	2.000	9.000	18.000		
CASE	123	6/27	21.000	13.000	5.000	natr
ASE	123	2.000	32.000	18.000		
CASE	124	6/27	21.000	11.000	5.000	natr
CASE	124	0.000	45.000	18.000		
CASE	125	6/27	21.000	15.000	5.000	natr
CASE	125	0.000	41.000	18.000		
CASE	126	6/27	21.000	2.000	5.000	natr
CASE	126	2.000	20.000	18.000		
CASE	127	6/29	20.000	11.000	1.000	hairsp
CASE	127	0.000	21.000	19.000		
CASE	128	6/29	20.000	6.000	1.000	hairsp
CASE	128	4.000	9.000	19.000		
CASE	129	6/29	20.000	10.000	1.000	hairsp
CASE	129	0.000	14.000	19.000		
CASE	130	6/29	20.000	4.000	1.000	hairsp
CASE	130	4.000	17.000	19.000		
CASE	131	6/29	20.000	3.000	2.000	15rev
CASE	131	4.000	4.000	19.000		
CASE	132	6/29	20.000	8.000	2.000	15rev
CASE	132	4.000	12.000	19.000		
CASE	133	6/29	20.000	10.000	2.000	15rev
CASE	133	0.000	14.000	19.000		
CASE	134	6/29	20.000	11.000	2.000	15rev
CASE	134	0.000	21.000	19.000		
CASE	135	6/30	15.500	11.000	11.000	cutstick
CASE	135	0.000	9.000	20.000		
CASE	136	6/30	15.500	6.000	11.000	cutstick
ASE	136	2.000	1.000	20.000		
CASE	137	6/30	15.500	14.000	11.000	cutstick
CASE	137	0.000	12.000	20.000		
CASE	138	6/30	15.500	7.000	11.000	cutstick
CASE	138	2.000	7.000	20.000		

CASE	139	6/30	15.500	9.000	13.000	32cut
CASE	139	2.000	8.000	20.000		
CASE	140	6/30	15.500	11.000	13.000	32cut
CASE	140	0.000	9.000	20.000		
CASE	141	6/30	15.500	5.000	13.000	32cut
CASE	141	2.000	5.000	20.000		
CASE	142	6/30	15.500	14.000	13.000	32cut
CASE	142	0.000	12.000	20.000		
CASE	143	7/2	20.000	6.000	2.000	15rev
CASE	143	0.000	19.000	21.000		
CASE	144	7/2	20.000	8.000	2.000	15rev
CASE	144	2.000	3.000	21.000		
CASE	145	7/2	20.000	12.000	2.000	15rev
CASE	145	2.000	12.000	21.000		
CASE	146	7/2	20.000	1.000	2.000	15rev
CASE	146	0.000	26.000	21.000		
CASE	147	7/5	23.500	4.000	1.000	hairsp
CASE	147	4.000	41.000	22.000		
CASE	148	7/5	23.500	14.000	1.000	hairsp
CASE	148	0.000	75.000	22.000		
CASE	149	7/5	23.500	11.000	1.000	hairsp
CASE	149	0.000	151.000	22.000		
CASE	150	7/5	23.500	11.000	1.000	hairsp
CASE	150	4.000	113.000	22.000		
CASE	151	7/5	23.500	10.000	13.000	32cut
CASE	151	4.000	31.000	22.000		
CASE	152	7/5	23.500	5.000	13.000	32cut
CASE	152	4.000	27.000	22.000		
CASE	153	7/5	23.500	14.000	13.000	32cut
CASE	153	0.000	75.000	22.000		
CASE	154	7/5	23.500	11.000	13.000	32cut
CASE	154	0.000	151.000	22.000		
CASE	155	7/6	23.500	11.000	6.000	blfly
CASE	155	0.000	26.000	23.000		
CASE	156	7/6	23.500	6.000	6.000	blfly
CASE	156	2.000	26.000	23.000		
CASE	157	7/6	23.500	8.000	6.000	blfly
CASE	157	2.000	9.000	23.000		
CASE	158	7/6	23.500	9.000	6.000	blfly
CASE	158	0.000	14.000	23.000		
CASE	159	7/7	19.000	13.000	1.000	hairsp
CASE	159	3.000	22.000	24.000		
CASE	160	7/7	19.000	12.000	1.000	hairsp
CASE	160	3.000	25.000	24.000		
CASE	161	7/7	19.000	11.000	1.000	hairsp
CASE	161	0.000	33.000	24.000		
CASE	162	7/7	19.000	14.000	1.000	hairsp
CASE	162	0.000	15.000	24.000		
CASE	163	7/8	21.000	1.000	10.000	100off
CASE	163	4.000	37.000	25.000		
CASE	164	7/8	21.000	11.000	10.000	100off
CASE	164	0.000	48.000	25.000		
CASE	165	7/8	21.000	9.000	10.000	100off
CASE	165	4.000	31.000	25.000		
CASE	166	7/8	21.000	7.000	10.000	100off
CASE	166	0.000	29.000	25.000		

CASE	167	7/8	21.000	7.000	13.000	32cut
CASE	167	0.000	29.000	25.000		
CASE	168	7/8	21.000	11.000	13.000	32cut
CASE	168	0.000	48.000	25.000		
CASE	169	7/8	21.000	10.000	13.000	32cut
CASE	169	3.000	11.000	25.000		
CASE	170	7/8	21.000	14.000	13.000	32cut
CASE	170	3.000	16.000	25.000		
CASE	171	7/9	19.500	8.000	8.000	100musk
CASE	171	4.000	11.000	26.000		
CASE	172	7/9	19.500	5.000	8.000	100musk
CASE	172	0.000	10.000	26.000		
CASE	173	7/9	19.500	11.000	8.000	100musk
CASE	173	0.000	38.000	26.000		
CASE	174	7/9	19.500	6.000	8.000	100musk
CASE	174	4.000	21.000	26.000		
CASE	175	7/9	19.500	5.000	10.000	100off
CASE	175	0.000	10.000	26.000		
CASE	176	7/9	19.500	13.000	10.000	100off
CASE	176	4.000	9.000	26.000		
CASE	177	7/9	19.500	11.000	10.000	100off
CASE	177	0.000	38.000	26.000		
CASE	178	7/9	19.500	2.000	10.000	100off
CASE	178	4.000	12.000	26.000		
CASE	179	7/11	18.000	6.000	9.000	100ben
CASE	179	4.000	25.000	27.000		
CASE	180	7/11	18.000	5.000	9.000	100ben
CASE	180	4.000	14.000	27.000		
CASE	181	7/11	18.000	11.000	9.000	100ben
CASE	181	0.000	29.000	27.000		
CASE	182	7/11	18.000	7.000	9.000	100ben
CASE	182	0.000	13.000	27.000		
CASE	183	7/11	18.000	9.000	13.000	32cut
CASE	183	4.000	2.000	27.000		
CASE	184	7/11	18.000	13.000	13.000	32cut
CASE	184	4.000	23.000	27.000		
CASE	185	7/11	18.000	7.000	13.000	32cut
CASE	185	0.000	13.000	27.000		
CASE	186	7/11	18.000	11.000	13.000	32cut
CASE	186	0.000	29.000	27.000		
CASE	187	7/12	19.000	4.000	12.000	repliq
CASE	187	3.000	5.000	28.000		
CASE	188	7/12	19.000	14.000	12.000	repliq
CASE	188	0.000	6.000	28.000		
CASE	189	7/12	19.000	10.000	12.000	repliq
CASE	189	3.000	4.000	28.000		
CASE	190	7/12	19.000	9.000	12.000	repliq
CASE	190	0.000	15.000	28.000		
CASE	191	7/12	19.000	9.000	13.000	32cut
CASE	191	0.000	15.000	28.000		
CASE	192	7/12	19.000	14.000	13.000	32cut
CASE	192	0.000	6.000	28.000		
CASE	193	7/12	19.000	11.000	13.000	32cut
CASE	193	3.000	19.000	28.000		
CASE	194	7/12	19.000	2.000	13.000	32cut
CASE	194	3.000	4.000	28.000		

BREAKTHROUGH IN THE MOSQUITO REPELLENT ARSENAL

The amazing *MOSQUITO HAWK* sonic mosquito repeller is a naturalistic product in an age of chemicals and zappers. The concept takes its origin in prehistoric swamps and forests in a time when survival was the most important aspect of existence. Over the ages natural behavior patterns of basic survival developed in all living creatures, especially the constant day to day struggle between prey and predator. More precise the Dragonfly (slang term Mosquito Hawk) and the mosquito (slang term not printable). This incredible device electronically reproduces the wingbeat frequency of that skilled aerial hunter, the Dragonfly, the number one predator of the mosquito since the beginning of time.

By blending these time proven natural behavior patterns with today's technology, the remarkable *MOSQUITO HAWK* sonic mosquito repeller will effectively repel mosquitoes thru natural programmed patterns of response.

The *MOSQUITO HAWK* mosquito repeller is rugged and ready to go anywhere you are, making it ideal for any outdoor or indoor activity. It's a clean alternative to the current gooey, smelly liquids that are rubbed or sprayed on the skin, causing that uncomfortable "greasy" feeling. The *MOSQUITO HAWK* mosquito repeller really works; make it your defense against mosquitoes and you will wonder how you ever got along without it.

HELPFUL HINTS SO MOSQUITO HAWK WILL WORK MORE EFFECTIVELY

- Restrict heavy use of cologne or perfumes
- Restrict heavy use of scented deodorants
- Background noise levels should be moderate to low
- Be aware of potential resting areas for mosquitoes
- Try to stay relatively cool during hot weather

IMPROVED

MOSQUITO HAWK™

Sonic Mosquito Repeller

THE ULTIMATE IN PROTECTION AGAINST BITING MOSQUITOES

- ☑ GOES ANYWHERE ACTIVE PEOPLE GO
- ☑ NO REPEAT APPLICATIONS
- ☑ PROTECTION THAT WON'T WEAR OFF
- ☑ NO CHEMICALS

Congratulations and thank you for your purchase of what we feel is the finest mosquito repeller on today's market. To help you understand the concept behind MOSQUITO HAWK we have compiled the following brief informative information for your use and enjoyment.

A FEW WORDS ABOUT THE DRAGONFLY

Dragonflies have been around for a very long time. They were among the earliest flying insects to evolve on earth, first appearing more than 300 million years ago. These early dragonflies were quite large, some had wingspans of two feet (70cm) or more. By 180 million years ago these giants had developed into insects with the same basic size and body structures as the dragonflies of today. Modern day dragonflies have an average wingspan of three to four inches (6.5-10cm), although some measure as much as six inches (15cm) across their wings. Its Latin name Odonata means toothed. While its slang name is MOSQUITO HAWK. There are 5000 species of dragonflies today and they are found in all parts of the world, wherever there are freshwater ponds, streams or lakes. In the early stages of their life dragonflies live entirely in the water and for the first few days of life are nourished by the yolk material from the egg that is stored in the body. Once used up the nymph begins life as a *predator* with a huge appetite for other immature insects, especially mosquitoes. Dragonflies however, are most familiar to us in winged adult form and are admired not only for the beauty of their wings but also for the power and grace of their flight. The two pairs of wings work efficiently together to help the dragonfly maneuver skillfully through the air. They are strong and swift and can dart and dodge with great speed and agility in pursuit of their prey. There are many patterns of flight depending on the type of species, some fly high above the trees while others skim low over water just as some patrol back and forth c ertain territories or regular routes. However, all return to water to mate a. .y eggs. Normally, dragonflies do not stray many miles from their original homes and they spend most of their adult lives in the continual hunt for food. Truly a *predator on the prowl*. To be successful hunters, they must fly fast enough and well enough to capture mosquitoes, flies, gnats and even bees which they must catch on the wing

Yet mosquitoes are their favorite food source

They are able to change directions abruptly and dart from side to side or backwards to snatch their prey. Strong wings, keen vision, sharp jaws and powerful legs all contribute to making the dragonfly one of the most successful hunters in the air. Truly a predator supreme.

As the "MOSQUITO HAWK" zooms through the air and overtakes its potential meal it holds the first two pairs of its six long thin legs crooked together to form a basket used to scoop up its meal. The spines on its legs prevent the prey from escaping and then is consumed while in flight without missing a wing beat. The empty shell is discarded and the cycle of swoop and scoop is repeated throughout the day

Once mating and egg-laying is finished the life cycle of the dragonfly is now complete and it soon dies. Most Odonata live about a year including the time spent as nymphs. During that year an individual dragonfly will have consumed thousands of mosquitoes and other insects in satisfying their enormous appetite

The dragonfly is a most fascinating member of the insect world, providing a valuable service to humans in keeping down the numbers of annoying insects. We have learned much from detailed studies of these beautiful creatures who at one time were thought to sting humans and were avoided or needlessly destroyed. But studies have proved them to be harmless, unless of course, you happen to be one of the things it likes to hunt and eat.

UNDERSTANDING MOSQUITOES IN GENERAL

It is safe to say that little would be known about mosquitoes if they did not make such a serious impact on man. *That little lone visitor that ruins one's sleep on a warm summers night as it hums momentarily but repeatedly past one's ear.* From the arctic to the equator, in cities, in country and the desert the total number of species is more than 2500. This is because some of them are found in more than one region. Mosquitoes have gained their notoriety thru their bloodsucking habit. Not all mosquitoes suck blood; some do not take a blood meal of any kind, there are species that hardly ever attack humans. There are bird feeders and rodent feeders, some even restrict their feeding to ants, some are unable to feed on vertebrates of any kind. Others feed exclusively on fruit or flowers. Each mosquito contains everything that is required for survival in an inhospitable world. As a larve it is perfectly adapted to aquatic life, yet like a whale it must make periodic trips to the surface in order to take in fresh oxygen. Then sooner or later the larve must undergo the transformation into the flying mosquito. As an adult it can walk on land and fly in the air. The principals of flight are the same for the mosquito, an eagle, or even a large modern aircraft — although there are special problems associated with size. The tiny computer making up the brain and associated ganglia allows the flying mosquito to make split second adjustments to cope with ever-changing situations. It can adjust its airspeed from zero to bursts of 4-7KM per hour. it is able to hover over potential landing sites or take sudden evasive action. In some respects the flight of the mosquito shares the properties of both airplane and helicopter.

To a mosquito flying thru rain each drop must appear as a gigantic missile several times its own weight, yet this tiny insect can fly safely through the rain and land for a meal having avoided every drop. A mosquito is capable of recognizing or perceiving when it is threatened and in no sense is its flight merely a haphazard wind-dependent affair. *The mosquito's behavior owes much to a fixed pattern of response which it inherits* along with its coloring, shape and general ornamentation. Just as there are programmed patterns of development, a phenomenon commom to all living creatures so there are also programmed patterns of response.

Male mosquitoes do not bite, their mouth parts are not adapted for piercing, they feed principally on nectar and juices of plants. It is surprising but when the mosquito is ready for its first meal it is usually nectar taken directly from flowers. Both males and females feed on flowers as its main source of energy. This side of mosquitoes' nature is less well known because nectar feeding takes place at dusk, during the night or just before sunrise, yet mosquitoes are rarely mentioned as pollinators of flowers.

Of great interest and important to us is just how do these tiny flying machines set out, often in total darkness and in rain to find their way to ourselves or some other unsuspecting host for a drink of blood?

Female mosquitoes take their blood meals from vertebrates of all kinds, but some prefer one host species or group of species over others. The female requires a blood meal as the stimulus for egg production and also to supply material used to nourish the developing eggs. Some species of mosquitoes are particularly choosy about their sources of blood, others quite the reverse. Mosquitoes rely on various sources of information to allow them to home in on their target. The main sequence of events of initial activation, exploration, patrolling location and homing in on the target zone and the selection of the final feeding site is determined largely by the inborn circadian rhythm, their internal clock mechanism. An increase in carbon dioxide in the air and the rise in relative humidity are other factors for initial activation. If the patrolling mosquito now encounters a stream of warm moist air from man or some other mammal or bird, it continues its flight unaltered. Should its flight path now take it out of the host beam it turns immediately at about a right angle back into the beam again, it then continues on a zig zag pattern turning only when its course takes it out of the beam. Naturally, the stream of moist air becomes narrower the nearer the mosquito approaches the source and so the turns become more and more frequent and the zig zag pattern tighter to fit the beam. It seems at this point smell now takes over for the final approach and unless this is right, the mosquito will remain in the immediate vicinity, dipping and sampling the air but not actually going in for the attack.

It also seems that lactic acid formed by the host is important as a short distance attractant and if this is not present in sufficient concentration the mosquito will not feed even though she has landed. The amount of lactic acid increases after exercise but then so does body temperature.

This is a gross oversimplification and is inadequate to account for all the events that lead the flying mosquito to its source of blood.

It also seems that some mosquitoes are tempted out because they are already near the host and receive the signal to activate before their appointed time. Each time a female ventures forth from its resting place its sound stimulates nearby resting mosquitoes who then join to produce a wave of feeding activity.

A mosquito takes only some *two to eight milligrams of blood per meal*, depending largely on the size of the mosquito. The total amount of blood when taken by many thousands of feedings can be considerable. There are cases on record of dogs and even cattle dying following mass attacks by mosquitoes. It has been demonstrated that the attack rate by the northern Canadian mosquito on a single exposed forearm may be as high as 289 bites per minute, thus a totally unprotected man could receive more than 9000 bites per minute which would result in a loss of about half his blood supply in less than two hours. People and other hosts develop an allergy to mosquito bites and at times this can be very severe. Fortunately, such cases are rare and usually the allergic responses involve no more than the familiar itching and red wheal.

The period of activity of adult mosquitoes does not confine itself to the twilight hours of evening and morning. Some bite freely during the day in direct sunlight and also attack at night. There are others that may bite during cloudy days or when their haunts are invaded during the daylight hours. The common house mosquito is nocturnal but will bite during dark days and in darkened rooms. In cloudy weather and in dark woodlands they are easily aroused to unwanted activity at almost any time. The working day for any one mosquito probably only lasts for an hour or so. Since man declared war on this insect, it has prevailed. When one considers the average blood meal takes about two minutes from landing to take off, the mortality rate is high but in 180 million years only one species has become extinct.

OTHER REPELLENTS

Most brands of repellents contain DT (Diethyl Toluamide) or EH (Ethyl Hexanediol) and should be kept away from the eyes and mouth and must never be permitted to come in contact with plastics, for which they are a solvent. Rayon and man made fabrics are said to be harmed by the ingredients, but nylon, cotton and wool are not affected. DT is 50% more effective than EH, hence the latter is required in greater potency for the same effect. Applications to the entire body can be injurious to health. Concentrations of DT in various brands of repellents vary from a few percent (having little value) to 50%.

Concentrations of EH run from 75% to compensate for less effectiveness. Compounds with greater amounts of active ingredients are usually more effective and last longer. Repellents are available in liquids, sprays, creams, foams, towelettes and sticks and are usually applied to clothing as well as exposed skin. Liquids in general contain more active ingredients so lesser amounts and fewer applications are required. Sprays have the advantage of being easier to apply to clothing, but require more frequent applications

IT SHOULD BE COMPLETELY UNDERSTOOD THAT THESE APPLICATIONS DO NOT KEEP INSECTS FROM FLYING AROUND YOU OR TOUCHING THE SKIN. IT IS THE CONTACT WITH THE REPELLENT THAT PREVENTS THEM FROM BITING. THE TOUCH, NOT THE SMELL IS THE WORKING AGENT TESTS REVEAL THAT SIMPLY SPRAYING A REPELLENT IN AN ENVIRONMENT DOES NOT TEST THE MOSQUITOES' ABILITY TO SURVIVE WILL DETER A CERTAIN PERCENTAGE OF MOSQUITOES. THE MOSQUITO HAWK, MOSQUITO REPELLER TESTS THAT FORCE TO SURVIVE THE NATURAL WAY. HOWEVER, AS NATURE INTENDED, NO CHEMICAL REPELLENT OR MOSQUITO HAWK IS ABSOLUTELY 100% EFFECTIVE. NOTHING IS, EXCEPT TOTAL AND COMPLETE ISOLATION.

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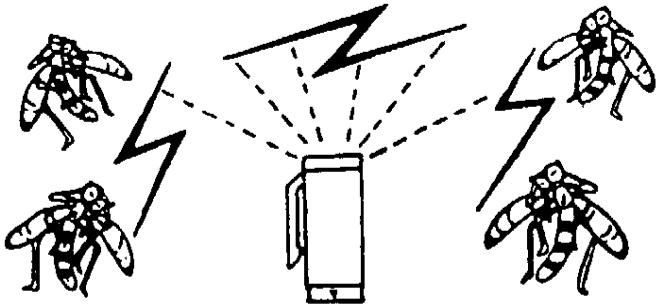
Northwest Merchants Ltd.
Portland, Oregon 97203

NEW

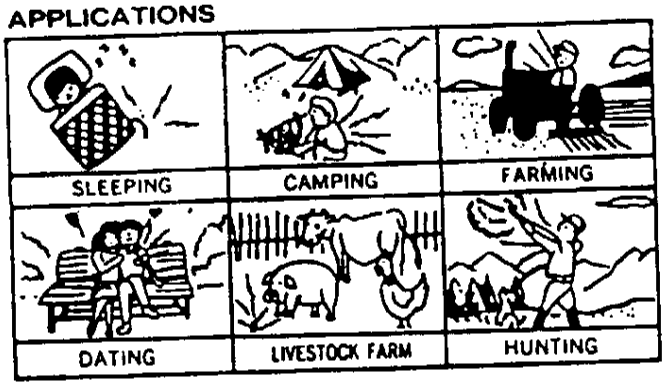
BYE! BYE!
MOSQUITOS

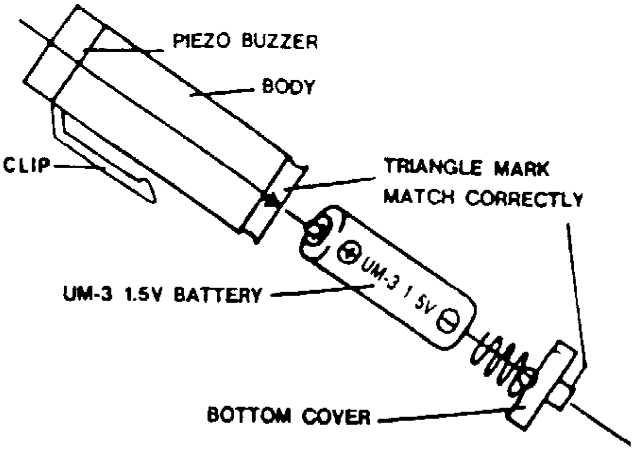
ELECTRONIC MOSQUITO REPELLER

- Use special frequency and waveform to repell the mosquito away
- No harm to human beings and pets
- Only one UM-3 battery
- Simple and safe operation
- Effective distance about 4 meters



APPLICATIONS





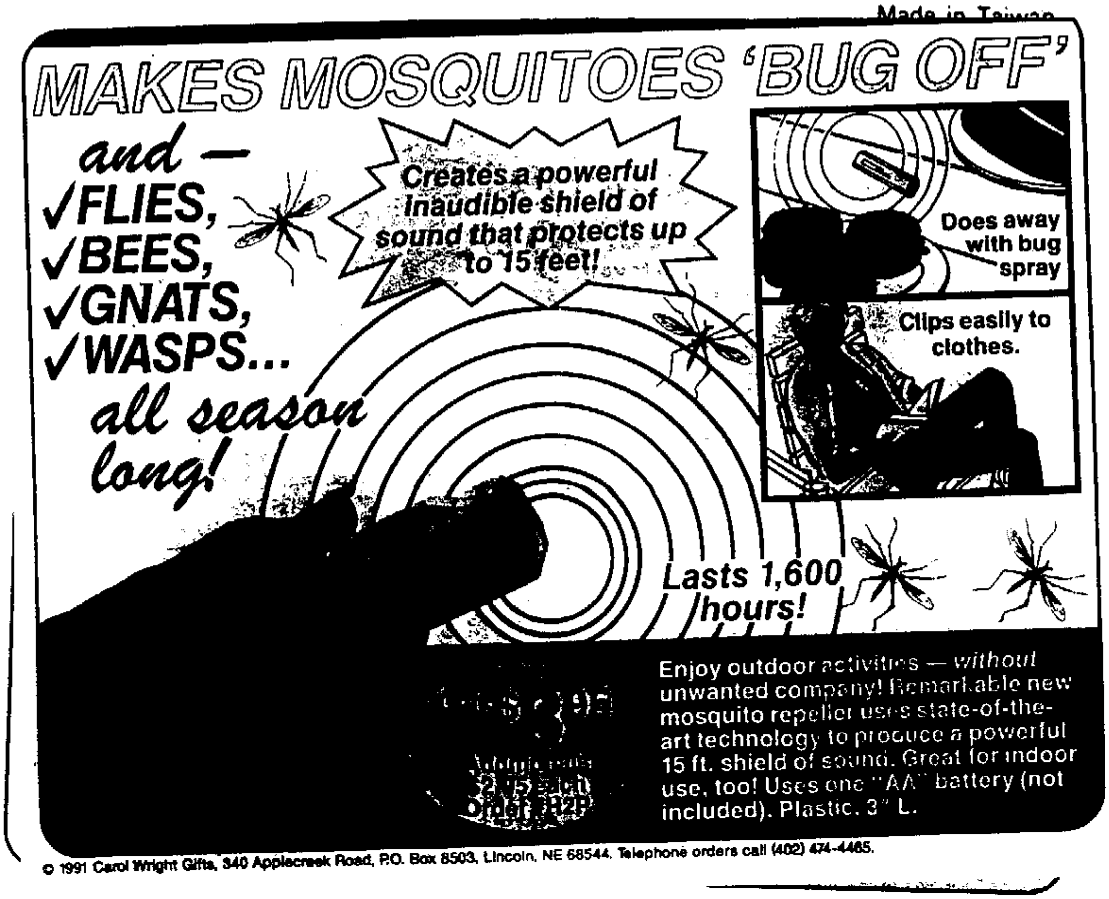
Directions for Use:

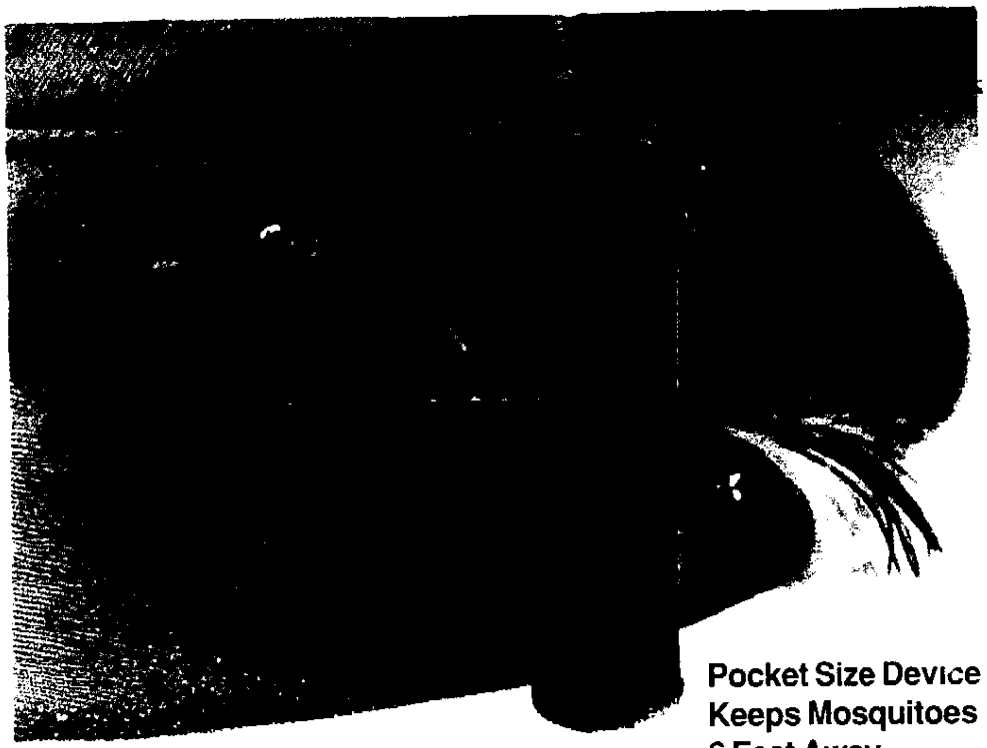
1. Remove bottom cover by pulling downwards. (the triangle mark of the bottom cover must point directly to the triangle mark of the body.)
2. Insert battery (+ upwards)
3. Close bottom (the triangle mark of the bottom cover must point directly to the tringle mark of the body.)
4. Don't obstruct the buzzer and keep it in dry place.

Experiments Report

Mosquitoes frequently infect you place in Summer, especially at night, They are extrernely irritating as they disturbed our sleep and the most annoying of all is the difficulty in getting rid of the itch & soreness. After, ordinary mosquito-increase or "Electrified Mosquito Killer" are used. However the odour is unbearable and the abuse of some of them may become dangerous. In order to do away with the above nuisance, a brand new production called "Electronic Mosquito Repeller" Has now been produced. According to the research of insect ecology, most of biting mosquitos are female ones in spawning period. A Spawning female mosquito is very disgusted at the approaching of male mosquito, Therefore, the trequency of Repel-It' is made to imitate the sound signal of male mosquitos to repell female mosquitos away.

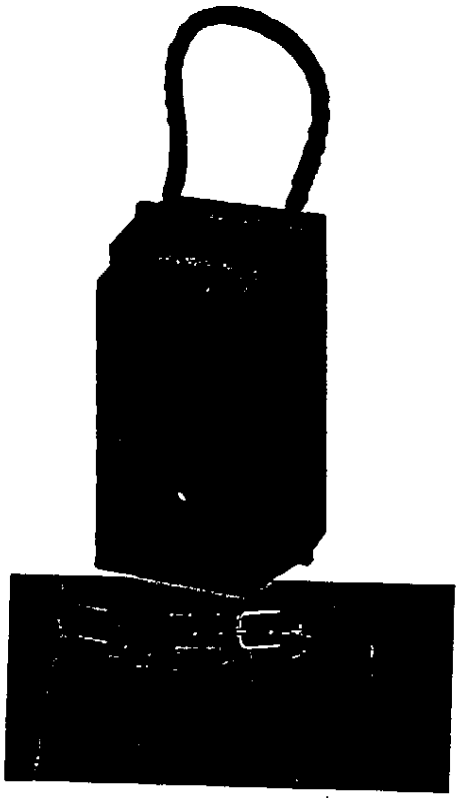
Made in Taiwan





Pocket Size Device Keeps Mosquitoes 6 Feet Away

(Moltron Bug Shield)



DRAGONFLY-SIMULATING MOSQUITO REPELLER can be worn around a belt loop or hung in a camping tent, on a patio or porch to repel the mosquito by simulating the attacking wing-beat sound of its natural enemy, the dragonfly. Its solid-state circuitry precisely duplicates the low clicking sound made by a dragonfly, creating up to a 25-foot radius of protective sonic vibrations that are barely audible to humans and harmless to animals. Running on one 9-volt battery (included), it provides continuous protection once activated, eliminating the need for messy chemical repellents which require frequent re-application. Made of impact-resistant ABS plastic. Sold in sets of two. 2½" H x 1⅜" W. (2 oz.)
40502M $29.95

Pests

Hammacher Schlemmer

Midwest Operations Center
9180 Le Saint Drive
Fairfield, OH 45014

Appendix 6

Tribune Photo/ LOUIE STOUT

Lake Seminole fishing guide Bill Rosenberry shares a tip with anglers plagued by gnats. Simply cut a sheet of Downy fabric softener into strips and pin one on your shirt or jacket. He's not quite sure if it will work on mosquitoes, but it's worth a try

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