

Compendium of mosquito control studies 2003 – 2020
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Introduction

This is a collection of reports on the effects of aerial spraying for mosquito control in Meeker, CO, beginning in 2003. The Town of Meeker traditionally contracts with a local aviator to spray the river corridor and fair grounds before the 4th of July celebration. The sprays target adult mosquitoes to eliminate the public nuisance of biting insects. Town crews and the county public health department provide other mosquito control services including efforts to educate the public and to eliminate mosquito breeding habitat and mosquito larvae, but the Town and County have yet to adopt a rigorous integrated pest management program.

As documented in these studies, the spray program kills mostly beneficial or otherwise harmless insects with little contribution to public health. That is of concern especially in light of accumulating scientific evidence that insect populations are plummeting worldwide.

Reference

Francisco Sanchez-Bayo et al. 2019. Worldwide decline of the entomofauna: A review of its drivers. *Journal of Biological Conservation*.
<https://doi.org/10.1016/j.biocon.2019.01.020>

**Effect of Aerial Insecticide Spray on Insect Populations
Distant from the Spray Flight Path
2003 – 2019
by Bob Dorsett**

Effect of Malathion in 2003

Abstract: This study measured the effects of aerial spraying (Malathion ULV) on insects and arachnids at approximately one-quarter mile distance from the spray flight path over the Town of Meeker, CO, in the summer of 2003. It found that aerial spray caused significant insect mortality at that distance, and most insects killed by the spray were of species considered beneficial or harmless.

Introduction

Aerial spraying remains a common method of pesticide application to control insect pests, especially mosquitoes. Malathion ULV is formulated to kill adult insects by contact, though it has little impact on mosquito larvae (U.S. EPA 2002). It is considered relatively safe, when used properly; it causes limited toxicity at the concentrations used in sprays (U.S. EPA 2002). Half-life of malathion ranges from less than one day to several days, depending on weather conditions (National Pesticide Information Center, 2001). It is moderately toxic to birds, moderate to highly toxic to fish, and highly toxic to bees (National Pesticide Information Center, 2001).

The present study was designed to investigate the effects of aerial spray on insect populations in the Town of Meeker distant from the flight path used in aerial spraying around the 4th of July holiday in 2003.

Methods

The study site included my home and yard, located approximately 450 m north of the published spray path along the White River and approximately 330 m southeast of the spray path at the Rio Blanco County Fairgrounds. Aerial spraying occurred in the early morning of June 30, 2003. I used a beater net to collect live insects and arachnids on vegetation in my back yard two days before the application of aerial spray and again in the evening after morning application of aerial spray ULV (ultra-low volume) Malathion in oil base, 3 oz/acre (Coulter, pers. comm.). All insects were identified at least to Order taxon using Peterson's Field Guide as reference (Borror and White, 1970). On the evening of June 28, I placed a 5 m² sheet on the lawn to collect insects overnight from overhanging branches of a box elder tree and juniper bush. I counted all of the dead insects and arachnids on the sheet on the morning of June 29. I repeated the ground sheet collection overnight on June 29 and counted dead insects and arachnids on sheet 4 hours after the spraying on the morning of the 30th.

Results

Similar weather conditions obtained during the nights of June 28 and 29. Winds were variable at 3 kts at 0600 on the morning of Jun 30, temperature 9 C, rising to 27 C at the time of counting insects (1000 h) on the collection sheet, and skies were clear (NOAA weather data archive). I could smell the distinctive odor of the malathion mixture while counting. Tree leaves and grass blades were noticeably sticky, and small transparent dots, presumably spray residue, were visible on leaves. My open notebook pages became sticky while I worked counting insects.

Table 1 shows insect counts in the beater net before and after spraying. Table 2 lists counts of dead insects and arachnids on the ground sheet before and after spraying. Fewer insects were found in the beater net after spraying than before, but the difference was not significant (Kruskal-Wallis test, $n = 15$ locations, $p = 0.133$, chi-square approximation). Significantly fewer species of insects were found in the beater nets after spraying than before spraying (Kruskal-Wallis test, $n = 15$ locations, $p = 0.034$, chi-square approximation). Significantly more dead insects were found on the ground sheet after spraying than before (Kruskal-Wallis test, $n = 19$ species, $p < 0.001$, chi-square approximation).

Discussion

Insects removed from the beater net collection after spraying were mostly Dipterids, especially gnats (data not shown), which is consistent with known effects of malathion. Dead insects collected on the ground sheet after spraying included primarily those considered harmless and many considered beneficial: lacewings and ladybug beetles prey on aphids, for example, and ichneumon wasps also prey on insect pests. The only two mosquitoes found dead after spraying were *Aedes* ("snow mosquito"), which are not known to carry pathogens.

Conclusion

The results of this study indicate, first of all, that aerial spraying in summer 2003 over the Town of Meeker caused measurable insect and arachnid mortality even at a distance approximately one-quarter mile from the published flight paths. Secondly, most of the insects killed by spray were harmless or beneficial, and no *Culex* mosquitoes, the carriers of West Nile virus, were found. This study did not address the consequences of spraying on the food chain, but other studies have shown adverse secondary effects on birds, especially (National Pesticide Information Center, 2001).

Literature Cited

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Table 1: Total number of insects and arachnids and number of species found in beater net before (June 29) and after (June 30) aerial spraying.

Location	Count	
	29-Jun	30-Jun
chestnut	0	0
snow leaves	7	8
lilac	6	0
snowballs	4	1
berry bush	2	0
big apple	1	1
juniper	4	6
little apple	1	0
lilac 2	1	0
aspen	5	7
chokecherry	1	1
Russ olive	1	1
poppy	2	0
juniper 2	6	2
box elder	46	7
Total	87	34

Location	# Species	
	29-Jun	30-Jun
chestnut	0	0
snow leaves	6	6
lilac	2	0
snowballs	2	1
berry bush	2	0
big apple	1	1
juniper	3	1
little apple	1	0
lilac 2	1	0
aspen	1	4
chokecherry	1	1
Russ olive	1	1
poppy	2	0
juniper 2	3	2
box elder	5	1
Total	31	18

Table 2: Number of insects and arachnids found dead on ground sheet before (June 29) and after (June 30) aerial spraying.

Insect	29-Jun	30-Jun
empid	1	15
plant bug	1	7
ichneumon		4
drosoph.		1
lacewing		2
moth		1
house fly		3
spider		3
ant		2
leafhopper		5
ladybug		3
small dipterid		2
weevil		1
halictid		2
beetle		1
tachinid		2
aedes		2
mayfly		1
earwig		2
Total	2	59

Effects of aerial malathion in 2007

Abstract: The Town of Meeker contracts one aerial application of long-acting malathion each year on a day preceding the Fourth of July celebration for the nominal purpose of eliminating mosquito nuisance and possible exposure to vector-borne disease such as West Nile Virus. Previous studies have shown that this program eliminates very few mosquitoes but kills large numbers of other beneficial or otherwise harmless insects. The purpose of this study was to collect further data to document the effects of aerial malathion spray on insect populations near the flight path through the Town of Meeker.

Introduction

Vector-borne diseases threaten public health, and communities use various measures to control insect pests. West Nile Virus, especially, has become a concern, with documented cases in domestic livestock and humans throughout Colorado.

Public health authorities use various measures to control mosquitoes, including programs combining larvicides, measures to knock down adult mosquitoes, and public education programs to eliminate mosquito habitat and to minimize exposure.

Each year, prior to its Fourth of July celebration, the Town of Meeker applies long-acting malathion by aerial spray (spray plane) along the White River, which runs through town, and over the Fairgrounds, where most public events are held. Several members of the community have complained about the noise of spraying and about adverse health effects, including acute respiratory symptoms, and previous studies have shown that the spray knocks down disproportionate numbers of non-target insects. The present study continues a program to document the effects of aerial spray on insect populations near the flight path.

Methods

Each of the two days prior to the spraying, I spread a 4 m² white bed sheet under overhanging juniper and box elder branches on a residential lawn 400 m from the spray plane flight path along the White River in the Town of Meeker, CO. The sheet was positioned and anchored at 2200 h at night, and dead insects on the sheet were counted at 0900 h on the following morning. Insects were identified by species, if possible, and at coarsest categorization by Order. I repeated this procedure on the night preceding / morning of the spraying. Spraying occurred starting about 0530 h on July 1, 2007, along the river and also over the Fairgrounds, about 800 m from the collection site. The plane applied a standard preparation of malathion lv.

Results

Results are shown in Table 1. Besides the dead insects, a number of live leafhoppers were seen on the sheet, as well as some live ants. No mosquitoes were found.

The odor of the malathion was not as strong on the morning after spraying as I remember from previous years, but it was still detectable.

Conclusion

Malathion aerial spray knocked down beneficial or otherwise harmless insects at this study site in Meeker on July 1, 2007, but no mosquitoes. Extrapolating these results to the entire flight path, this spray flight killed tens of millions of beneficial or otherwise harmless insects.

Table 1. Number of dead insects on 4 m² sheet each of two mornings preceding aerial spray malathion lv and on the morning after spray.

Insect	Before spray		After spray
	29-Jun	30-Jun	1-Jul
Chironomid	2	1	149
Ant			12
Bee			5
Beetle			4
Ephemeroptera			3
Fruit fly			3
Aphid		1	2
Moth			1
Plant bug	1		
Anthomyiid fly		1	
Mosquito			
Total	3	3	179

Effects of aerial permethrin spray in 2016

Abstract: The Town of Meeker contracts one aerial application of insecticide each year on a day preceding the town's Fourth of July celebration for the purpose of eliminating mosquito nuisance and possible exposure to vector-borne disease such as West Nile Virus. Previous studies have shown that this program eliminates very few mosquitoes but kills large numbers of other beneficial or otherwise harmless insects. This study adds to the record by comparing the effects of Kontrol 30-30, used this year, with malathion lv used in previous years.

Introduction

Vector-borne diseases pose public health risks, and communities use various measures to control insect pests. West Nile Virus, especially, is a concern, with documented cases in domestic livestock and humans throughout Colorado. Public health authorities use various measures to control mosquitoes, including programs combining larvacides, measures to knock down adult mosquitoes, and public education programs to eliminate mosquito habitat and to minimize exposure.

Biting insects also pose a nuisance to people participating in outdoor activities. When large numbers of people gather at festivities, such as on the Fourth of July, communities might elect to apply pesticides beforehand in order to minimize complaints.

Each year, prior to its Fourth of July celebration, the Town of Meeker applies an insecticide by aerial spray (spray plane) along the White River, which runs through town, and over the County Fairgrounds, where most public events are held. Previous studies have shown that the spray knocks down disproportionate numbers of non-target insects. The present study continues a program to document the effects of aerial spray on insect populations near the flight path.

Methods

On the day prior to the spraying, I spread a 4 m² sheet under box elder branches on a residential lawn located 500 m from the spray plane flight path along the White River in the Town of Meeker, CO, and 400 m from the County Fairgrounds. I placed the sheet at 0730 h in the morning before the day of spraying and counted insects on the sheet at 0830 h. Insects were identified by species, if possible, or by Order if the particular species could not be determined. I repeated this procedure on the morning of the spraying. Spraying started at about 0730 h on June 28, 2016. The plane applied a standard preparation of Kontrol 30-30 (permethrin and piperonyl butoxide). I also counted mosquito bites for fifteen minutes sitting in my back yard at about 7:00 PM DST on the evening before spraying and again in the evening after spraying.

Results

Results are shown in Table 1. No mosquitoes were found. None of the insects knocked down by the spray posed a risk to human health or, with the possible exception of gnats, to comfort. I was bitten four times by mosquitoes on the evening before spraying. I was bitten twice on the evening after spraying, and I saw a third mosquito flying. Results of aerial spraying with malathion lv in 2007 are presented in Table 2 for comparison.

Conclusion

Kontrol 30-30 aerial spray knocked down beneficial or otherwise harmless insects at this study site in Meeker on June 28, 2016, but no mosquitoes. Mosquitoes were still active after the spraying. Extrapolating these results to the entire flight path, this spray flight killed tens of millions of beneficial or otherwise harmless insects.

Table 1. Results of aerial spraying, 2016. Number of dead insects on 4 m² sheet on the day preceding aerial spray Kontrol 30-30 and on the morning of spraying, immediately after spray.

Insect	Before spray 27-Jun		After spray 28-Jun	
	live	dead	live	dead
Ant	1		3	
Braconid wasp				3
Beetle				4
Ephemeroptera				1
Aphid	2			13
Plant bug				1
Leaf hopper	3			
Gnat	5			5
Midge				5
Mosquito				
Total	11	0	3	32

Table 2. Results of aerial spraying, 2007. Number of dead insects on 4 m² sheet each of two mornings preceding aerial spraying with malathion lv and on the morning after spray.

Insect	Before spray		After spray
	29-Jun	30-Jun	1-Jul
Chironomid	2	1	149
Ant			12
Bee			5
Beetle			4
Ephemeroptera			3
Fruit fly			3
Aphid		1	2
Moth			1
Plant bug	1		
Anthomyiid fly		1	
Mosquito			
Total	3	3	179

Effects of aerial permethrin spray in 2017

Abstract: The Town of Meeker contracts one aerial application of insecticide each year on a day preceding the town's Fourth of July celebration for the purpose of eliminating mosquito nuisance and possible exposure to vector-borne disease such as West Nile Virus. Previous studies have shown that this program eliminates very few mosquitoes but kills large numbers of other beneficial or otherwise harmless insects. This study adds to that record. The results presented here document that aerial spray with Kontrol 30-30 knocks down large numbers of beneficial or otherwise harmless insects, that proportionally very few mosquitoes are eliminated, and that the mosquito population recovers rapidly after aerial spraying.

Introduction

Vector-borne diseases pose public health risks, and communities use various measures to control insect pests. West Nile Virus, especially, is a concern, with documented cases in domestic livestock and humans throughout Colorado. Public health authorities use various measures to control mosquitoes, including programs combining larvicides, measures to knock down adult mosquitoes, and public education programs to eliminate mosquito habitat and to minimize exposure.

Biting insects also pose a nuisance to people participating in outdoor activities. When large numbers of people gather at festivities, such as on the Fourth of July, communities might elect to apply pesticides beforehand in order to minimize complaints.

Each year, prior to its Fourth of July celebration, the Town of Meeker contracts for spray plane application of an insecticide along the White River, which runs through town, and over the County Fairgrounds, where most public events are held. Previous studies have shown that the spray knocks down disproportionate numbers of non-target insects. The present study extends a research program to document the effects of aerial spray on insect populations near the flight path.

Methods

On the day prior to the spraying, I spread a 4 m² sheet under box elder branches on a residential lawn located approximately 500 m from the spray plane flight path along the White River in the Town of Meeker, CO, and 400 m from the County Fairgrounds. I placed the sheet at 0630 h in the morning before the day of spraying and counted insects on the sheet at 0730 h. Insects were identified by species, if possible, or by Order if the particular species could not be determined. I repeated this procedure on the next morning immediately after the spraying. The plane dispersed a standard preparation of Kontrol 30-30 (permethrin and piperonyl butoxide). I also counted mosquito bites for fifteen minutes sitting in my back yard at about 7:00 PM DST on the evening before spraying and again in the evening after spraying.

Results

Results are shown in Table 1. Only one mosquito was found among a total 161 dead insects after the spraying. None of the other insects knocked down by the spray posed a risk to human health or to comfort. I was bitten twice by mosquitoes on the evening before spraying. I was bitten once on the evening after spraying. Results of aerial spraying with malathion lv in 2007 are presented in Table 2 for comparison.

Conclusion

Kontrol 30-30 aerial spray knocked down beneficial or otherwise harmless insects at this study site in Meeker on June 30, 2017, far out of proportion to the target insects. Mosquitoes at the study site were still active after the spraying. Extrapolating these results to the entire flight path, this spray flight killed tens of millions of beneficial or otherwise harmless insects. The present study confirms the results of several previous studies over the past ten years.

The Town of Meeker should consider other measures to control biting insects, such as elimination of mosquito breeding sites, application of larvicides in standing water, and public education to eliminate mosquito habitat and to provide personal protection. Particular consideration, also, should be given to the many commercial and hobby bee keepers in our community, as bees are especially susceptible to this insecticide. (Kontrol 30-30 MSDS.)

Although it is unlikely, given river flows at this time of year, aerial application of insecticides over the river may harm fish and aquatic insect populations critical to the aquatic ecosystem. (Kontrol 30-30 MSDS.) Further investigation is required to determine whether or not such effects are contributing to recent algae blooms in the White River.

References:

MSDS for Kontrol 30-30.

<http://www.ongov.net/health/documents/MasterLineKontrol30-30label.pdf>

Table 1. Results of aerial spraying, 2017. Number of dead insects on 4 m² sheet on morning preceding aerial spraying with Kontrol 30-30 and on the next morning immediately after spray.

Insects on 2 X 2 m sheet before and after aerial spray Kontrol 30-30				
Collection sheet was placed on ground under box elder tree from 0630 - 0730				
on June30, 2017, the day before aerial spraying and again on July 1, 2017, immediately after aerial spraying				
Insect	Before spray		After spray	
	30-Jun		1-Jul	
	live	dead	live	dead
Ant			2	
Braconid wasp	1			6
Beetle				2
Ephemeroptera	1		1	2
Aphid				11
Plant bug				5
Leaf hopper	4			4
Gnat				
Chironomids	1			55
Mosquito				1
small flies				51
rove beetles			1	12
andrenid bee				6
fruit fly				5
lacewing				1
Total	Before spray		After spray	
	live	dead	live	dead
	7	0	4	161

Table 2. Results of aerial spraying, 2007. Number of dead insects on 4 m² sheet each of two mornings preceding aerial spraying with malathion lv and on the morning after spray.

Insect	Before spray		After spray
	29-Jun	30-Jun	1-Jul
Chironomid	2	1	149
Ant			12
Bee			5
Beetle			4
Ephemeroptera			3
Fruit fly			3
Aphid		1	2
Moth			1
Plant bug	1		
Anthomyiid fly		1	
Mosquito			
Total	3	3	179

Yet another report on chemical warfare in Meeker
July, 2019

Meeker's celebratory Fourth of July spraying has resumed. I have fresh data on the results of that spraying but no new conclusions. I might as well recycle the report from 2017 – or from 2002 or any of the intervening years.

With my wife's help, I sampled insects knocked down by aerial spraying ahead of the Fourth. We're not directly on the flight path, but insecticide drifts to us on the breeze from the flight paths along the river and Sulfur Creek. We counted insects that fell on a two-meter square sheet, spread on the ground under vegetation for half an hour. That's a standard collection method.

A control sample before spraying found fifteen leaf hoppers, five gnats, and one mosquito, all alive. The sample immediately after aerial spraying found 34 gnats, 14 dipterids, 4 beetles, two weevils, two plant bugs, two leaf hoppers, one brachonid wasp, one lady bug larva, one halictid bee, and one andrenid bee. All dead.

There were no mosquitoes in the after-spray collection. They came out the following evening, though. I counted two bites in a ten-minute exposure, six bites in the evening two days after the spray.

Just a few thoughts for the obituaries. Brachonid wasps prey on aphids and other garden pests. So do lady bugs. The two little bees you wouldn't notice unless you're looking close. But they're among the critical pollinators for our wildflowers. And they're endangered by habitat loss and competition with commercial bees. Against Univar Chemical Corp., they don't stand a chance.

Scale this count up to the numbers of dead insects all along the spray paths through Town. As a minimum estimate, we knocked down four million beneficial or otherwise harmless insects. Certainly the spray killed some adult mosquitoes, just not at our sample site. As in years past, aerial spray with adulticides kills very few target insects (mosquitoes and other pests) in comparison with the slaughter of harmless and beneficial insects. And, as usual, the mosquito population bounces right back, within a day or two, with the next larva hatch. Just like in years past.

Town and County need to adopt a sensible and effective insect pest management program. The present plan is neither. It causes far more harm than benefit, and it does not control the mosquito population (even assuming that population is more than just a nuisance). In the interval until our local governments adopt an integrated pest

management plan, and as an essential component of that plan if it ever occurs, individuals can protect themselves with some basic measures. Drain or frequently change standing water around the home, e.g. in ponds, bird baths, dog bowls, old tires, etc, where mosquito larvae develop. Apply Bti pellets to standing water that can't be drained. (Bti is a larvacide specific to mosquitoes and harmless to other organisms.) Wear long pants and long sleeves, especially in the evening when mosquitoes are most active. Apply insect repellent containing DEET if you're out and the critters are a bother. (Other repellents are available, too, but not as effective.)

If you get bit, swat the critter, and keep a tally for the records. See if human reflexes can do a better job controlling mosquitoes than the celebratory chemical mist.

Effects of aerial permethrin on insect populations in Meeker, 2020

Same spray, Kontrol 30-30, but the plane flew in the evening this time so there's a different mix of dead insects. Same basic results: only one mosquito in the sample, but lots of otherwise beneficial or harmless insects. And the nuisance bites returned in same numbers after only a day. Permethrin knocks down adults, but those are replaced immediately by maturing larvae.

Results

2020

Insects on 2 X 2 m sheet before and after aerial spray Kontrol 30-30

Collection sheet was placed on ground under box elder tree from 0800 - 0830

on June 28, 2020 before aerial spraying

and from 2020-2050 h on July 1, immediately after aerial spraying.

Insect	Before spray 28-Jun		After spray 1-Jul	
	live	dead	live	dead
Ant	9			
Braconid wasp				
Beetle				
Ephemeroptera				
Aphid				
Plant bug	2			
Leaf hopper	2			4
Gnat	2			9
Chironomids	8			23
Mosquito				1
small flies				22
rove beetles				
andrenid bee				
fruit fly	1			
lacewing				
weevil				
lady bug larva				
dragon fly	1			
crane fly				1

	Totals Before spray		After spray	
	live	dead	live	dead
Total	25	0	0	60

