



The Commonwealth of Massachusetts

Division of Marine Fisheries

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May 28, 2020

Taryn LaScola-Miner
Director, Crop and Pest Services Division
Massachusetts Department of Agricultural Resources
251 Causeway Street
Boston, MA 02114

Dear Director LaScola-Miner:

The Division of Marine Fisheries (MA DMF) participated in a state inter-agency review of adulticide products being considered for use in the 2020 Massachusetts aerial spraying campaign for mosquito control. In addition to Anvil 10+10, the currently approved product, Duet HD, Merus 3.0, and Zenivex E20 were considered by the group as potential alternatives. Available information indicates that all four considered products are classified as being very highly toxic to fish and aquatic invertebrates. For all products, runoff from treated areas or deposition of spray droplets into a body of water may be hazardous to fish and aquatic invertebrates. Of the alternatives considered, Duet HD contains the same principal ingredients as Anvil, sumithrin and piperonyl butoxide (PBO), with Duet HD also containing prallethrin as a knock-down agent. Merus and Zenivex use alternative ingredients: pyrethrins and etofenprox, respectively. Efficacy data are generally lacking for use of the Merus product as an adulticide in New England while Zenivex poses a greater risk to fish and aquatic invertebrates than Anvil. Given that none of the considered alternatives alleviates potential threats to marine resources, MA DMF does not currently have any recommendations for transitioning away from the existing product for aerial spraying, Anvil 10+10.

Questions regarding this review may be directed to John Logan in our New Bedford office at john.logan@mass.gov.

Sincerely,

Daniel J. McKiernan
Director

cc: Catherine Brown, Matthew Osborne, Marc Nascarella, DPH
Diane Manganaro, Nancy Lin, Mark Smith, DEP
Alisha Bouchard, Juan Gutierrez, Jennifer Forman-Orth, Hotze Wijnja, DAR
Eve Schluter, DFW
Bev Vucson, DFG
Brad Chase, Eileen Feeney, Kathryn Ford, Jeff Kennedy, Ryan Nuttall, Tracy Pugh, Kelly Whitmore, DMF

DM/JL/sd



Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

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TO: Taryn LaScola-Miner, Director of Crop and Pest Services, MDAR
THROUGH: C. Mark Smith, Director, Office of Research and Standards
FROM: Diane Manganaro, Office of Research and Standards
DATE: May 12, 2020

SUBJECT: Evaluation and Selection of a Pesticide Product to be used During an Aerial Application for Mosquito Control in 2020

Thank you for providing the Massachusetts Department of Environmental Protection (MassDEP) Office of Research and Standards (ORS) the opportunity to participate on the interagency group reviewing mosquito adulticide options. The summary information developed by the Massachusetts Department of Agricultural Resources (MDAR) on application rates, toxicity, and efficacy for the four mosquito adulticide products, Anvil 10+10 (the most recently used adulticide), Duet HD, Merus 3.0 and Zenivex E20, was very helpful as was the opportunity to meet with MDAR and the other participating state agencies. As requested, we provide an opinion on which of these products would be most appropriate in terms of efficacy and toxicity for use in aerial spraying in 2020, should it be deemed necessary by the Massachusetts Department of Public Health (MDPH).

ORS' review of these adulticide products, discussed below, is based on the information received from MDAR. MassDEP also notes that it has extensive monitoring data for Anvil 10+10 in public water supplies in treated areas. This data has consistently demonstrated either no detections or detections at very low levels, far below public health concern. MassDEP does not have such data for the other pesticides considered.

Based on the data we received from Hotze Wijnja of MDAR, ORS concludes that, at this time, there is no compelling information to indicate that any of the alternative products are a better choice than Anvil 10+10, the adulticide that has been used for aerial spraying in Massachusetts since 2006.

A review of the product-specific efficacy summaries that we received from MDAR indicates that 1-hour knockdown and 24-hour mortality estimates for these products at various application rates, in a range of climates, and targeting a variety of mosquito species, are all consistently within the range of 90-100%. There were no standardized studies presented that would allow for an across-the-board comparison based on similar prescribed study conditions. Thus, based on this information, no one product stands out from the others as superior in terms of efficacy.

This information is available in alternate format. Contact Michelle Waters-Ekanem, Director of Diversity/Civil Rights at 617-292-5751.

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Regarding the toxicity of the four products, all of these are classified by the US EPA as “toxic” to aquatic life (except for Duet, which is classified as “highly toxic”) and “highly toxic” to honeybees by the US EPA. Thus, while Duet shows a higher toxicity to aquatic life, there is no information which distinguishes the toxicity of the other three products, including Anvil 10+10.

As for active ingredients, sumithrin, along with its Anvil 10+10 synergist, piperonyl butoxide (PBO) (and etofenprox, the active ingredient in Zenivex E20) are in the lowest toxicity category for mammalian toxicity.

Although all four active pyrethroid/pyrethrin ingredients are highly to very highly acutely toxic to fish, aquatic invertebrates and honeybees, the acute toxicity benchmarks for sumithrin for these groups are generally on the lower to lowest side of the four active ingredients.

Based on the toxicity data received from MDAR, sumithrin is consistently among the least toxic, both acutely and chronically, to freshwater fish and to both aquatic and benthic freshwater invertebrates.

The data indicate, however, that sumithrin is among the most toxic active ingredient, both acutely and chronically, to both aquatic and benthic estuarine and marine invertebrates. It also has the longest half-life in sediment and is therefore the most persistent in sediments.

Given that the group strongly felt that the current 300’ setback imposed on coastal areas during aerial spraying should be maintained based on continuing concerns for sensitive species, and the fact that MDPH does not necessarily consider the mosquito species in these coastal areas to be the most crucial ones to target, it seems that spraying in estuarine/marine areas will not occur or be very limited. Thus, impacts to aquatic and benthic toxicity from use of Anvil 10+10 would not be expected in these “no spray” areas.

In summary, no clear difference in efficacy among the four candidate products could be elucidated from the information received from MDAR. In terms of toxicity, Anvil 10+10 and its active ingredients, sumithrin and its PBO synergist, appear to have the best overall toxicity profile for use in targeted non-coastal areas. The toxicity data indicate that Zenivex E20, and its active ingredient, etofenprox, is clearly more toxic to freshwater fish, aquatic and benthic invertebrates and honeybees and of similar, to greater, toxicity to aquatic and benthic invertebrates than Anvil 10+10. Duet, which consists of a mixture of sumithrin and prallethrin, is of similar toxicity with regard to its active ingredient, sumithrin, but the formulated product, which also includes prallethrin is classified by the US EPA to be of higher toxicity to aquatic life than Anvil 10+10. Data for Merus 3.0, which indicate somewhat higher toxicity for freshwater aquatic and benthic invertebrates than Anvil 10+10, but much lower toxicity for marine/estuarine invertebrates suggests it could be a future option for treating coastal areas. However, under the current aerial spraying scenario, which maintains the 300’ coastal setbacks, there is no indication from the data received that Merus would be a better option at this time.



MASSWILDLIFE

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MEMORANDUM

To: Taryn LaScola-Miner, Director of Crop and Pest Services
Date: May 6, 2020
Regarding: Pesticide Product Review for Aerial Adulticiding

The Massachusetts Division of Fisheries and Wildlife (MassWildlife) participated in the 2020 pesticide planning process convened by the Department of Agriculture (MDAR) to review and evaluate four (4) products for use in aerial application for mosquito control. The products reviewed were:

- Anvil 10+10 ULV (Sumithrin & PBO)
- Duet HD (Sumithrin and Prallethrin)
- Merus 3.0 (Pyrethrins)
- Zenivex E20 (Etofenprox)

On an annual basis, MassWildlife, pursuant to its authority under the Massachusetts Endangered Species Act (MESA, M.G.L. c.131A) and its implementing regulations (321 CMR 10.00), reviews both routine mosquito control activities and aerial pesticide applications associated with public health emergencies (as necessary) and issues a Permit which authorizes the Take of state-listed species (321 CMR 10.04(3)(e)). When reviewing for potential impacts, MassWildlife considers the MESA-status of a species (Endangered, Threatened, Special Concern), its state-wide range, habitat and life-history activities during the proposed time of spraying (typically 2-week windows), body size, and other pertinent information. To date, aerial application has been conducted by ultra-low volume, fixed-wing aircraft and applied between dusk and dawn. Anvil 10+10 has been used during past aerial spraying (2007, 2019) and was permitted by the MassWildlife. Additionally, Anvil 10+10, Zenivex E20, and Duet are also used by the Mosquito Control Districts during routine annual mosquito control efforts under a Memorandum of Understanding with the MassWildlife.

MassWildlife reviewed the four aerial adulticide products listed above and their active ingredients for potential impacts to state-listed species. Although their use may be warranted to protect public health as determined by the relevant authorities, unfortunately, all of these products impact a variety of native insects. Aerial application of these products in certain areas of the state would result in a Take of state-listed species and require a Permit from MassWildlife. MassWildlife defers to MDAR and the Massachusetts Department of Public Health (DPH) to identify the appropriate product to manage the public health threat from Eastern Equine Encephalitis. However, given the increased uncertainty that would be introduced through the deployment of an alternative product, all else being equal, there may not be a compelling reason to switch to a different product for aerial pesticide application at this time.



THE COMMONWEALTH OF MASSACHUSETTS

EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS



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Date: 5/14/20

From: Taryn LaScola-Miner, Director Crop and Pest Services

Subject: Evaluation of Adulticide Products for Aerial Application in Mosquito Control

Introduction

In 2019, Massachusetts experienced a historically bad mosquito season with record numbers of human and animal cases of Eastern Equine Encephalitis (EEE) virus. The 2019 emergency mosquito response took place on 6 different spray events. The first event of aerial mosquito control spraying operations began on August 8, 2019 and the final spray event ended on September 24, 2019. It took a total of 26 days of spraying, with 2,048,865 total of acres treated, and 9,939 gallons on Anvil 10+10 applied.

Based on the 2019 Arbovirus Season Response, leadership has identified essential elements to improve in the upcoming season. One of those elements is the evaluation and reevaluation of adulticide products for aerial application. Anvil 10+10 was reexamined to ensure new information was considered. Three other products were examined for potential use, these included Duet HD, Merus 3.0, and Zenivex E20.

Evaluations

Adulticide products considered for evaluation and re-evaluations are Anvil 10+10 (sumithrin + piperonyl butoxide (PBO)), Duet HD (sumithrin, prallethrin, and PBO), Merus 3.0 (pyrethrins), and Zenivex E20 (etofenprox).

Anvil 10+10 has a history of use in MA for aerial applications in mosquito control. It has a record of providing effective control in most situations without having caused unreasonable adverse effects to human health and non-target organisms.

The other three products have a similar use pattern, including that they are allowed to be applied over crops and water. Merus 3.0 is the only product that is allowed to be applied over organically grown crops.

Available efficacy data for the three new introduced products were limited. While the available data indicate that high efficacy is possible, the scarcity or absence of regional or local efficacy data makes it uncertain what their efficacy would be in MA situations. Once such data becomes available, it would improve our ability to assess their value in MA aerial adulticiding programs.

The mammalian toxicity profile of all the active ingredients considered here is such that their use in mosquito adulticiding poses low risk to human health, pets, livestock, and non-target mammalian wildlife. Given their nature and properties as insecticides, all are classified as being highly to very highly toxic to

aquatic organisms and honeybees. By considering more detailed information on aquatic risk assessment information, a more refined comparison of these active ingredients was made. Although toxicity data suggest that there may be potential risks to honey bees, the night-time application of adulticides minimizes exposure and risks to honey bees.

Risk assessments conducted by U.S. EPA indicate that sumithrin and prallethrin have similar risk profiles and pose the lowest risk to fish and aquatic invertebrates. A somewhat higher risk was identified for pyrethrins. Etofenprox appears to pose overall the highest risk to aquatic organisms. Information for PBO, a synergist included in Anvil 10+10 and Duet HD, indicates that it poses low risk to non-target organisms, including aquatic organisms, due to its low toxicity profile.

It should be noted that EPA's risk assessments are conservative. EPA uses a high number of applications per season (up to 26, as allowed by the label) with short intervals (1-10 days) resulting in high-end estimates for environmental concentrations. As a result, the risk quotients are also high-end estimates. The typical aerial adulticide spray scenarios in MA have much lower application frequencies. Therefore, the risk potential in the MA scenario is expected to be lower. A refined assessment with better representation of the MA situation would be helpful with future evaluations of adulticide product.

The active ingredients' environmental fate profiles show dissipation in air and water dominated by rapid photolysis. Half-life values are less than one day, except for etofenprox with a half-life of 8.4 days. They generally have low volatility, with prallethrin and some pyrethrin compounds having a somewhat higher volatility. Once these compounds reach water or land surfaces, they have a strong tendency to bind to soils and sediments, thereby reducing their availability to impact organisms. Compared to air and water, they are somewhat more persistent in soils and sediments, with etofenprox being more persistent than sumithrin, prallethrin and pyrethrins. The synergist PBO appears to be the most persistent compound. Overall, the environmental fate properties are not expected to be a major factor in selecting one over the other active ingredient in this evaluation.

Conclusion

The selection of Anvil 10+10 as the adulticide product for aerial applications in MA can be supported based on the information reviewed above. Its efficacy record and effective control make this product the safest and most reliable out of all 4 options. The department will be revisiting this review in the future and its hope is that more efficacy information is available for a complete review. As additional information on the alternatives may become available, a better evaluation may be possible in the future.



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TO: State Reclamation and Mosquito Control Board

FROM: Catherine M. Brown, DVM MSc MPH, State Epidemiologist
Marc A. Nascarella, MS, PhD, CPH, Environmental Toxicology Program Director, Bureau of
Environmental Health

DATE: June 5, 2020

RE: Product Review of Aerial Spray Pesticides Recommendation Memo

Introduction:

The 2019 season was notable for Eastern equine encephalitis (EEE) activity; both in the large number of human and animal cases and the widespread nature of the activity. There were 12 human cases with at least 6 deaths (reported as of May 1, 2020), the highest number of cases in a single year since 1956. In addition, there were 8 horse cases and one goat case. The most significant activity occurred in Bristol, Essex, Hampden, Middlesex, Plymouth and Worcester counties with measurable activity in Barnstable, Franklin, and Norfolk counties. By the end of the season, the Commonwealth had responded to the threat of EEE with six rounds of aerial application of pesticide to target adult mosquitoes ("adulticiding") designed to reduce risk to the over 1.5 million residents in the areas.

Reduction of risk from EEE relies primarily on the use of personal prevention behaviors by individuals and includes recommendations to use mosquito repellent with a US Environmental Protection Agency (US EPA)-registered active ingredient, clothing to reduce mosquito access to bare skin and rescheduling outdoor events to avoid the hours of dusk and dawn when mosquitoes most likely to spread EEE are most active. In established mosquito control districts, truck-based ultra-low volume (ULV) adulticiding to reduce populations of adult mosquitoes capable of carrying and spreading EEE virus can be used. When EEE risk continues to increase despite the combined use of personal prevention and local mosquito control activities, the state may determine that there is a necessity to conduct aerial adulticiding activities to help further reduce risk.

Aerial spray operations to reduce human risk from EEE have been conducted in 2006, 2010, 2012 and 2019. The last comprehensive review of pesticide products available for use in aerial spray operations occurred in 2006 when Anvil 10 + 10 was selected. Following the 2019 arbovirus season, the Massachusetts Department of Public Health requested a multi-agency review of available products, registered for use in Massachusetts to ensure the selection of a product that provides the best possible balance between maximizing efficacy as an adulticidal agent and minimizing the potential for harmful levels of exposure to humans.

Review:

The four products chosen for review were:

- Anvil 10+10 ULV (Sumithrin & piperonyl butoxide),
- Duet HD (Sumithrin and Prallethrin),
- Merus 3.0 (Pyrethrins), and
- Zenivex E20 (Etofenprox).

The Massachusetts Department of Agricultural Resources (MDAR) provided information from US EPA on the toxicologic profiles of the active ingredients from the products and what limited data are available on the comparable efficacy of the products. Data indicated that within a range of application rates, climates and mosquito species, all products consistently reduced targeted mosquito populations by 90-100%. Experience in Massachusetts with Anvil 10 + 10 has resulted in a wide range of efficacies from approximately 30-90% dependent upon weather and timing of application relative to the mosquito life cycle. Although it is impossible to measure the reduction in EEE cases based on aerial applications of pesticide, reductions in populations of mosquitoes that transmit the virus can be considered as a proxy metric for risk reduction. Massachusetts does not have any direct experience with using any of the other products as an adulticidal agent.

Potential for Harmful Levels of Exposure

US EPA evaluates and registers pesticides before they are used in the United States. When evaluating a pesticide for either registration or re-registration, US EPA assesses a wide variety of potential human health effects associated with use of the product. The pesticide registrant provides US EPA data from tests done according to established guidelines. These tests determine whether a pesticide has the potential to cause adverse effects. If a pesticide meets US EPA requirements, the pesticide is approved for use in accordance with label directions.

Adulticide products considered for this assessment are Anvil 10+10 (sumithrin + piperonyl butoxide (PBO)), Duet HD (sumithrin, prallethrin, and PBO), Merus 3.0 (pyrethrins), and Zenivex E20 (etofenprox). MDAR has provided information for agency review that has been extracted from the US EPA pesticide registration packages. The table summary that has been provided identifies categories that are significant for stakeholders to consider (e.g., human health effects, ecological effects, non-target species effects, fate and transport, efficacy, etc.). When evaluating the table of available evidence and considering acute health risks to humans (e.g., brief high-level exposure), the data suggests that both Anvil 10+10, containing the active ingredient (ai) sumithrin (d-Phenothrin) and the synergist piperonyl butoxide (PBO), and Zenivex E20 containing the active ingredient etofenprox, all have very low acute toxicity to humans. By comparison, Duet HD containing the active ingredient prallethrin is classified as having moderate toxicity and pyrethrin (in Merus) is classified as having low toxicity.

While the toxicological summary provided by MDAR suggests that Anvil 10+10 and Zenivex E20 have similar low potential for acute toxicity, the active ingredient in Anvil 10+10 appears to have the most robust database from which to characterize chronic health effects (e.g., longer-term, low-level exposure). For example, sumithrin has been a US EPA-approved pesticide since 1976, and a re-review of the available toxicology data by US EPA in 2011, did not identify any public health risks after 35 years of widespread use.

Sumithrin also has a US Food and Drug Administration regulatory toxicology criterion (e.g., acceptable daily intake level) that would facilitate any necessary post-spray assessment of human exposure. For example, sumithrin has an established 0.01 ppm food tolerance level that has been developed for all food/feed crops applicable to area-wide aerial applications.

Despite widespread use of sumithrin for over 40 years, the potential for significant human exposure appears to be limited due to the fact that the chemical biodegrades rapidly in the presence of sunlight and/or microorganisms. For example, in 2009 the US Department of Agriculture (USDA) sampled approximately 9,000 agricultural products for sumithrin and did not detect any pesticide residues in these samples. Similarly, the US Food and Drug Administration sampled pesticide residues in over 700 domestic and 1,200 imported food samples over 8 years and found that only one sample had detectable residues (at 0.022 ppm).

Conclusion:

At this time, there is no compelling evidence that any of the products reviewed would represent an improvement from the public health perspective. Anvil 10 + 10 is recommended as the product of choice at this time.