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Shelter Island and Fire Island 4-Poster Deer and Tick Study

October 21, 2009

The 4-Poster device is a bait station that applies the pesticide permethrin to deer when they feed, with the intent of killing ticks on the deer. As part of a multi-year study to determine whether 4-Poster devices can reduce tick populations on Shelter and Fire Islands, deer are being sampled for residues of permethrin in meat, liver and on hide. Results of preliminary sampling for permethrin indicate that the health risks of handling and of consuming venison or liver from deer that have visited a 4-Poster device on Shelter Island are very low. The sampling results currently available represent samples collected in 2008 and the summer of 2009. More deer are planned to be tested during the fall of 2009 and in 2010.

Background

A multi-year study is being conducted on Shelter Island and Fire Island, New York to determine whether a device known as 4-Poster can reduce the population of ticks. The 4-Poster device is a passive feeding station designed to control ticks that use deer as a host, such as adult black-legged ticks (*Ixodes scapularis*) and immature and adult lone star ticks (*Amblyomma americanum*). These species of ticks can transmit diseases to humans including Lyme disease, babesiosis and ehrlichiosis. As a deer feeds on the bait (corn kernels) at a 4-Poster station, the animal's neck, head and ears brush against the rollers of the device which are coated with an oily liquid containing the insecticide permethrin. The permethrin then kills ticks on the deer, which should reduce the number of adult ticks that will lay eggs. Studies have shown reductions in tick populations in the years following use of 4-Poster devices, which may reduce the risks of disease transmission to humans.

Aside from its use on the 4-Poster device, permethrin is widely used as an insecticide on numerous food/feed crops, livestock and livestock housing, buildings, indoor and outdoor residential spaces, pets and for community-based mosquito control. In addition, certain products containing permethrin can be sprayed onto clothing, but not directly on skin. Permethrin-impregnated clothing is also available to hunters and hikers, and typically contains 0.5 percent permethrin. Permethrin kills ticks and insects that come in contact with it.

The New York State Department of Health and some hunters expressed concern during the 4-Poster evaluation process about the potential health risks from exposure to permethrin. Due to the use of the 4-Poster on Shelter Island (where deer hunting is permitted), hunters and others who eat the deer could be exposed to permethrin that is in or on the meat, or from contact with a deer's hide while handling and dressing the deer. To determine the levels of permethrin in and on deer, about ten deer from Shelter Island and about five deer from a comparison area (North Haven), are being harvested and sampled each year during the hunting season from 2008 to 2010.

In September 2008 prior to the hunting season, New York State Department of Environmental Conservation (DEC) and Cornell University staff harvested three deer on Shelter Island as a preliminary effort to measure permethrin levels. These deer were taken from an area where 4-Poster devices were deployed and used by deer since spring 2008. These initial samples were obtained from adult does, and included hide swabs and meat from the neck region, as well as liver. Swab samples from hides were analyzed by DEC chemists, and no permethrin residues were detected. No permethrin residues were detected (at a detection limit of 10 micrograms per kilogram) in the liver and meat samples analyzed by Cornell's Animal Health Diagnostic Center (AHDC) either. While these deer were harvested in areas near 4-Poster devices, it is not known if and when they actually fed at a device.

During October and November 2008, thirteen deer were harvested from Shelter Island, and four deer from North Haven where no 4-Poster devices are used. Eight of the deer from Shelter Island were verified as using 4-Poster devices through photo documentation during Cornell camera surveys. Verification of 4-Poster use was suggested by the presence of corn in the stomach of an additional two deer and no evidence of 4-Poster use was available for the three other deer. Meat and swab samples of hide from the neck region, as well as liver samples, were collected from each of these deer and sent to laboratories for measurement of permethrin residues. All samples from the seventeen Shelter Island and North Haven deer were analyzed by Cornell AHDC. Samples from two Shelter Island deer were also analyzed by Eurofins Central Analytical Laboratories (Metairie, LA).

Permethrin Residue Results for October and November 2008 Samples

Permethrin residues were detected in meat samples of three deer from the treatment area at levels ranging from 11.2 to 270.3 micrograms per kilogram. Permethrin residues were not detected (at a detection limit of 10 micrograms per kilogram) in meat of the other ten deer from the treatment area or in the four deer from the comparison area. Permethrin residues were not detected in liver samples from any of these seventeen deer from the treatment or comparison areas. The hide wipe samples from the thirteen deer in the treatment area contained levels of permethrin ranging from 0.02 micrograms per swab to 5110.3 micrograms per swab. Levels of 0.02 to 0.05 micrograms per swab were found on three of the four deer from the comparison area, while no permethrin residues were detected on the one other deer.

The meat samples were taken from the neck area of the deer directly below the area where the hide swabs indicated the presence of permethrin. Because the hide was cut open in this area to take the meat sample, there is the possibility that the permethrin residues measured in meat may have resulted from residues accidentally transferred from the hide to the meat during sampling. Because of this possibility, the sampling protocol was modified for deer harvested in 2009 to minimize the chances for such cross-contamination, while being more representative of handling and processing practices a hunter would typically use. The modified sampling protocol includes the addition of a second meat sample from the hindquarters of the deer to supplement the samples taken from the liver and the meat from the neck region.

Pre-Hunting Season Sampling for 2009

To determine permethrin residues on and in deer prior to the 2009 hunting season, three deer from Shelter Island that were known from photo documentation to have repeatedly visited 4-Poster stations were harvested and sampled using the revised sampling protocol. These deer were harvested in late July and early August when the coat of deer is much thinner than during the hunting season. This should increase the potential for absorption of permethrin residues from contact with the 4-Poster. The extent to which seasonal differences in 4-Poster visitation by deer would affect permethrin residues in meat and liver is not known. Additional sampling, using the same methods as those in the 2009 pre-season sampling, will be conducted on deer of both Shelter Island and North Haven during the hunting season as required by this multi-year study.

The 2009 pre-hunting season sampling of the three deer known to have repeatedly visited 4-Poster stations on Shelter Island did not detect (at a detection limit of 10 micrograms per kilogram) any permethrin residues in the liver, meat from the hindquarters or meat from the neck area. The hide wipe samples of the neck area from these three deer contained levels of permethrin ranging from 7.5 micrograms per swab to 108.1 micrograms per swab.

Health Risks from Permethrin Residues

Risks to people from eating venison from deer harvested on Shelter Island can be conservatively estimated. The U.S. Environmental Protection Agency's (EPA) Exposure Factor Handbook reports that an adult hunter consumes about 0.3 pounds of venison in a meal. If this meat contains the highest permethrin residue found thus far in the study (270.3 micrograms per kilogram in 2008) and such a meal is consumed every day of the year (approximately 110 pounds of venison per year), the hunter's permethrin exposure would be about 0.6 micrograms per kilogram body weight per day (assuming a body weight of 70 kilograms). This exposure level is about 450-fold lower than the chronic population adjusted dose (cPAD) established by the EPA. The cPAD is the amount of a chemical that a person (adults or children) could consume every day for a lifetime (70 years) and not be expected to have adverse non-cancer effects. While no information on children's consumption of venison is available, it is highly unlikely that a child would consume enough permethrin residues from venison to exceed the cPAD.

Permethrin caused some tumors in laboratory animals exposed to this chemical for their lifetime and is classified by EPA as a "likely human carcinogen." Using the number that EPA established to quantify the potency of permethrin's cancer causing ability, the highest permethrin residues measured in the study thus far, the daily venison consumption rate indicated above and a lifetime of exposure, the estimated increased lifetime cancer risk would be low (about five in a million).

The EPA sets limits on the amount of pesticide residues that may be present in food marketed in the U.S.; these limits are called tolerances. Tolerances have not been established for permethrin in deer meat, but the tolerance for cattle, goat and sheep meat is 100 micrograms per kilogram. The permethrin residues detected in meat of deer on Shelter Island are below these tolerances in all cases but one, the sample containing 270.3 micrograms per kilogram.

The swab samples from deer hide indicate that hunters could be exposed to permethrin residues from skin contact with the hide, particularly in the deer's neck region. The amount of permethrin a hunter might be exposed to by this route is difficult to determine, but if direct skin contact does occur, some skin absorption of permethrin is possible (when conducting risk assessments, EPA has assumed that 5.7 percent of the permethrin present on a person's skin will be absorbed into the body). Skin exposure to permethrin residues can be minimized by wearing rubber, vinyl or latex gloves when handling deer. To further minimize exposure to themselves and also reduce potential contamination of meat, hunters should skin deer starting from the hindquarters going to the neck, and otherwise avoid letting the outer hide contact venison, during handling of the deer.

Summary

The permethrin residue data currently available result from the sampling of nineteen deer from Shelter Island and four from North Haven. These sampling results indicate that permethrin residues can be present on the hide of deer. Thus, measures to reduce exposure, as indicated above, should be taken by hunters. The sampling results also indicate that most deer from Shelter Island do not contain detectable permethrin residues in their meat. Only three of the sixteen deer sampled in 2008 had detectable levels of permethrin in their meat and none of the three deer sampled in 2009 (by a revised methodology designed to reduce the risk of cross-contamination) had detectable permethrin residues. Thus, the health risks from permethrin residues when consuming venison from deer harvested on Shelter Island would be very low, and it is unlikely that anyone will experience any permethrin-related health effects from this source. Nevertheless, the choice of whether to consume venison from deer harvested in the treatment area is a personal one. The additional deer sampling that will take place over the next two years as part of the multi-year study will help further assess potential exposures and health risks.

Additional Information for Hunters

Deer and other game can carry infectious organisms. To minimize the transmission of these organisms when handling game, hunters should take appropriate precautions. For more information visit:

http://www.nyhealth.gov/environmental/outdoors/fish/fish.htm#other

Also, recent research indicates that small lead fragments can be present in deer harvested with lead bullets. Measures to reduce lead exposure from deer meat should be taken. For more information visit:

http://www.dec.ny.gov/outdoor/48420.html

For information on Cornell's permethrin residue investigation and results for the 4-Poster study, including "Cornell's White-tailed Deer Harvest & Safe Handling"fact sheet, visit:

http://wildlifecontrol.info/TickStudy/Pages/PermethrinResidueInvestigations.aspx

If you have questions on the subject of this fact sheet, call the New York State Department of Health, Center for Environmental Health hotline at 1-800-458-1158, extension 27820.

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