

Maine Board of Pesticides Control

**Miscellaneous Pesticides Articles
August 2015**

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Aerial spraying of Cicero Swamp for mosquitoes to begin Tuesday

spray2005.jpg

A plane sprays the Cicero Swamp in this file photo (*David Lassman | dlassman@syracuse.com*)

Sarah Moses | smoses@syracuse.com By **Sarah Moses | smoses@syracuse.com**

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on July 06, 2015 at 11:30 AM, updated July 06, 2015 at 11:31 AM

CICERO, N.Y. -- The Onondaga County Health Department will begin conducting **aerial spraying** of Cicero Swamp Tuesday night.

The aerial spraying will help reduce the number of mosquitoes in the area of the Cicero Swamp and reduce the risk of disease. The county Health Department announced the spraying **last week after finding mosquitoes infected** with Eastern equine encephalitis.

EEE is a rare viral disease carried by mosquitoes. County officials urged residents to take precautions against mosquitoes, including using bug spray.

There were two human cases of the virus last year, the county said. **Five Central New Yorkers have died** from EEE since 1971, **including Maggie Wilcox**, a 4-year-old Oswego resident, four years ago.

The spraying is scheduled for the hours between 7 and 10 p.m., weather permitting.

The product that will be used is "Anvil 10 + 10" and will be applied at very low concentrations to control mosquitoes. "Anvil 10 + 10" is a pesticide product that is used to control mosquitoes in outdoor residential and recreational areas. It contains sumithrin and piperonyl butoxide as active ingredients. Sumithrin is a man-made pyrethroid insecticide that can also be found in other pesticide products used indoors and on pets to control ticks and insects, such as fleas and ants.

For more information, contact the county's Division of Environmental Health at 435-1649.

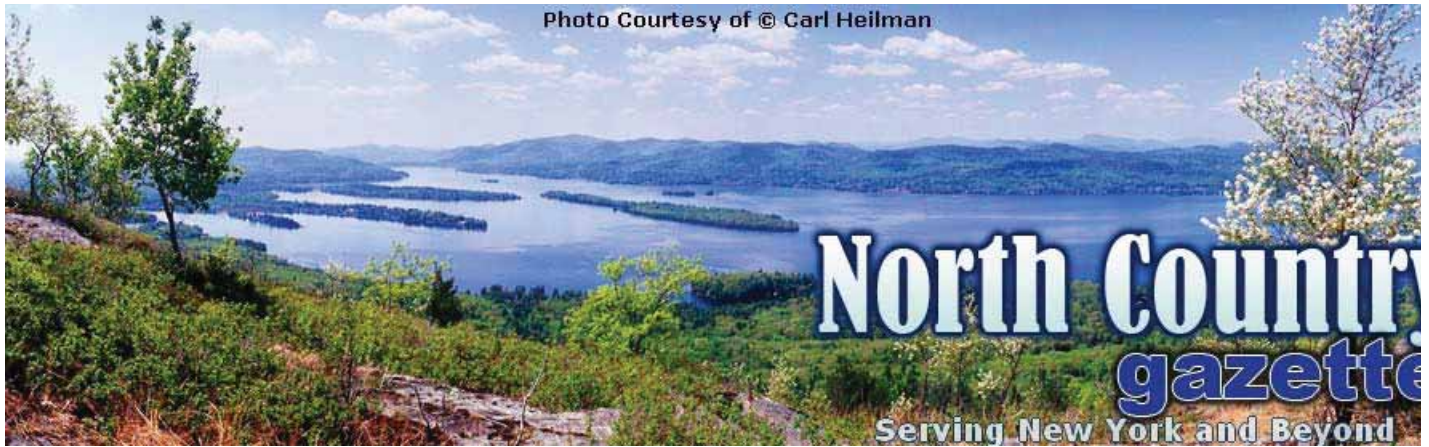
Here's some tips to help reduce mosquito breeding grounds:

- Throw away outdoor containers, ceramic pots or containers that hold water
- Remove all tires from your property
- Drill holes in the bottoms of recycling containers that are kept outdoors
- Clean clogged rain gutters and make sure they continue to work properly
- Turn over wheelbarrows and wading pools when not in use
- Change water in bird baths at least every four days
- Clear vegetation and debris from the edges of ponds
- Clean chlorinated swimming pools, outdoor saunas, and hot tubs
- Drain water from pool covers
- Use landscaping to eliminate low spots where standing water accumulates

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Avoid Mosquito Bites, West Nile Virus Confirmed

by NORTH COUNTRY GAZETTE on JULY 2, 2015 · LEAVE A COMMENT

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ALBANY—The state Department of Health is urging New Yorkers to take personal protective measures to avoid mosquito bites, after confirming the presence of West Nile Virus in mosquitos collected in Suffolk and Rockland Counties.

West Nile Virus is a mosquito-borne infection that can cause serious illness and occasionally death. Many people who contract the virus do not experience any symptoms of illness, while an estimated 20 percent of infected people develop mild symptoms including fever, headache and body aches, skin rash or swollen lymph glands. It is estimated that one in 150 persons infected with West Nile Virus will experience a more severe case of the disease that could develop into West Nile encephalitis (inflammation of the brain) or meningitis. These more severe cases may also cause additional symptoms including stupor, disorientation, tremors, convulsions, paralysis or coma.

The Rockland and Suffolk County ‘pools’ of mosquitoes are the first in the state to test positive for West Nile and to date, there have been no reported human cases. In 2014, 752 mosquito pools tested positive statewide, with 21 reported human cases and no deaths.

In addition to West Nile, mosquitoes may also carry Eastern Equine Encephalitis (EEE).

EEE is a rare, but extremely serious viral disease spread by mosquitoes that can affect people and horses. People of all ages are susceptible to infection, but people over 50 and younger than 15 are at greatest risk for acquiring the virus. While most people

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bitten by an infected mosquito will not develop any symptoms, severe cases begin with the sudden onset of headache, high fever, chills and vomiting. The illness may then progress into disorientation, seizures, encephalitis and coma. Approximately a third of patients who develop EEE die, while many patients who survive EEE experience mild to severe brain damage.

EEE has not been detected in any mosquito samples tested to date this year, and there have been no human cases. In 2014, 87 mosquito pools tested positive statewide, with two reported human cases. No deaths occurred, however there have been three confirmed deaths from the disease in New York over the past five years.

There is no commercially available human vaccine for either West Nile Virus or EEE, so the best way to protect yourself is to keep mosquitoes from biting you. One of the best ways to do this is to take steps to reduce the number of mosquitoes around your home or property, including eliminating standing water in yards, by:

- Disposing of used tires, tin cans, plastic containers, ceramic pots or similar containers in which water collects.
- Drilling holes in the bottoms of recycling containers that are kept outdoors.
- Making sure roof gutters drain properly; cleaning clogged gutters in the spring and fall.
- Turning over plastic wading pools and wheelbarrows when not in use and changing the water in bird baths twice a week.
- Cleaning vegetation and debris from the edges of ponds.
- Cleaning and chlorinating swimming pools, outdoor saunas and hot tubs, and draining water from pool covers.

Repellents also provide protection against tick and mosquito bites. The federal Centers for Disease Control and Prevention (CDC) recommend choosing a repellent that contains DEET, IR3535, or oil of lemon eucalyptus for use on skin. Clothing and gear, such as boots, pants, socks and tents, can be treated with products containing permethrin. (Permethrin should not be used on skin.) Treated clothing or gear remains protective through several washings. Pre-treated clothing is also available and remains protective for up to 70 washings. For all repellents, follow the label directions and apply in small amounts, avoiding contact with the eyes, nose or mouth. Use only small amounts when applying repellents on children.

For more information on West Nile virus visit: www.health.ny.gov/diseases/west_nile_virus/fact_sheet.htm.

For more information on eastern equine encephalitis virus visit: www.health.ny.gov/diseases/communicable/eastern_equine_encephalitis/fact_sheet.htm. 7-2-15

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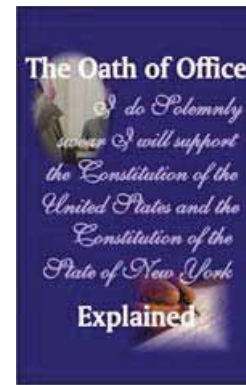
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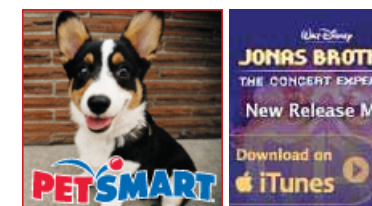
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South Portland considers citywide pesticide ban

4:51 p.m. EDT August 3, 2015



(Photo: NEWS CENTER)

SOUTH PORTLAND, Maine (NEWS CENTER) -- South Portland city councilors are looking into banning pesticides throughout the city.

Councilor Tom Blake said pesticides are wreaking havoc on the environment, and they want to protect the health of their citizens.

Phil Roberts has been in the gardening business his entire life; his family owns Broadway Gardens. He's been studying the effects of pesticides for 30 years, and said he's worried the city is acting without enough information.

While he agrees there should be limits on the use of harmful products, organic options don't always solve the problem; need to be sprayed more often; and in some cases, can actually be more harmful.

The ban would mean that homeowners have to start with organic options to freshen up their lawn, or get rid of any pests. That means if a family has a flea or ant infestation, they'd be forced to start with organic products for treatment, which Roberts said often don't work as well.

Councilor Blake said in cases like that, homeowners would be able to file an appeal to use something stronger to rid their home of pests.

"Southern Maine has a very high incidence of cancer and respiratory problems especially in young people," said Blake. "Nationwide there is a severe decline in bats, bees, and birds, and it's a proven fact that this is primarily due to America's excessive use of pesticides."

Ogunquit is the only other town in Maine to place restrictions on landscaping pesticides. Code enforcement officer Scott Heyland admits it's been a learning curve.

He said residents have complained that organic alternatives aren't working as well to get rid of pests, but they're moving in the right direction for the town's overall health.

South Portland plans to continue the conversation in a few more workshops. You can find out more information on when those are happening by visiting the city's [website \(http://www.southportland.org/\)](http://www.southportland.org/).

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Under the influence: sublethal exposure to an insecticide affects personality expression in a jumping spider

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Summary

1. Consistent behavioural differences between individuals have far-reaching implications for ecology and evolution, including how populations cope with increasing anthropogenic changes, notably pesticides. Although sublethal doses of insecticides are known to alter behaviour, current studies on the relationship between toxicants and behaviour tend to ignore effects on individual variation.

2. Our objective was to determine whether sublethal exposure to an organophosphate insecticide could affect the consistency of individual behaviour and disrupt behavioural correlations, in a jumping spider occurring in agroecosystems. Adults of the jumping spider *Eris militaris* (Araneae: Salticidae) were scored by an open-field and a prey-capture assay, each conducted pre- and post- exposure to the organophosphate insecticide phosmet. Half of the individuals received no exposure to the insecticide to provide a control group. We then estimated the changes in repeatability, a measure of the extent of personality differences, and in behavioural correlations between control and insecticide-treated groups.

3. Although insecticide exposure had no discernable effects on the population's average behaviours, insecticide-exposed individuals showed an average of 23% lower repeatability and the correlation between activity and prey capture was more strongly collapsed in females.

4. Our results provide clear evidence that exposure to sublethal doses of insecticides on an important arthropod predator in agroecosystems causes substantial alteration of personality differences even in absence of a population-wide shift in behaviour. This suggests that insecticide effects are more complex than previously thought and indicates high variation in the way individuals coped with insecticidal exposure.

5. By altering the consistency of behavioural traits and their correlations, exposure to sublethal concentrations of insecticides can have subtle effects on behavioural expression, which may ultimately affect biocontrol performance in an important arthropod predator in agroecosystems. Our study calls for an increasing focus on individual behavioural variation when testing the effects of pesticides on non-targeted fauna.

Key-words: animal personality, anthropogenic disturbance, behavioural syndromes, consistent individual variation, contaminants, multivariate mixed models, pesticides

Introduction

The study of animal personalities has received much attention in recent years. This emerging field has shown that consistent behavioural differences among individuals are

common in animals (Réale *et al.* 2007). These differences are sometimes correlated across different behavioural contexts, forming behavioural syndromes (Sih, Bell & Johnson 2004; Sih *et al.* 2004). Behavioural differences have important implications for ecological and evolutionary dynamics since they affect individual fitness and can have cascading effects on animal communities by shaping the magnitude and direction of species interactions (Sih *et al.* 2012; Wolf & Weissing 2012). In addition, behavioural differences

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provide a framework to study how individuals cope with increasing anthropogenic activities (Sih *et al.* 2010). Human-induced environmental changes challenge species to respond adaptively to those novel conditions. The effects of these changes may vary depending on the behavioural phenotype being considered. Some personality types perform better in human-disturbed environments (Martin & Réale 2008; Madden & Whiteside 2013), and the overall architecture of behavioural syndromes can differ between populations with varying degrees of anthropogenic pressures (Miranda *et al.* 2013; Royauté, Buddle & Vincent 2014). In addition, certain classes of anthropogenic changes (e.g. urban noise, pollutants) may amplify or attenuate behavioural and physiological variation (Killen *et al.* 2013).

Pesticides used in agriculture are important stressors for animals. These compounds are often wide-spectrum and are linked to declines in populations of seed dispersers (Krebs *et al.* 1999; Donald, Green & Heath 2001), pollinators (Brittain *et al.* 2010) and biocontrol agents (Geiger *et al.* 2010). Most pesticides degrade rapidly after spraying, and organisms are frequently exposed to pesticide residues, which cause changes in physiology and behaviour, rather than to doses causing direct mortality (reviewed in Desneux, Decourtye & Delpuech 2007).

While our knowledge of the effects of sublethal exposure to pesticides on behaviour has increased rapidly, individual differences remain poorly accounted for in ecotoxicological assays (Montiglio & Royauté 2014). Current practices tend to report shifts in average behaviour post-exposure rather than focusing on how behavioural expression of individuals may change through pre- and post-exposure phases. Stated another way, current studies ignore potential effects that may be due to personality differences. Most studies focus on unique traits rather than using the multidimensional approach favoured by behavioural syndrome studies.

Studying how personality differences and correlations among personality traits vary under exposure to pesticides addresses a significant gap in our knowledge of the consequences of pesticide exposure on non-targeted organisms. It is important to understand if differences in aggressive, bold or exploratory behaviours remain consistent when individuals are exposed to pesticide stress. These effects can be particularly relevant for predator species with regulating effects on the population dynamics of prey species. In an agroecological context, certain behavioural phenotypes may participate more actively in biocontrol (e.g. active and voracious individuals) and a decoupling of these differences through pesticide exposure may limit their contribution to pest control.

Spiders (Araneae) are an ideal taxon to study the interaction between behavioural variation and pesticide exposure. Spiders are abundant in many agroecosystems and provide important pest regulation services (Carter & Rypstra 1995). They are sensitive to pesticides (Pekar 2012) and their personality traits and behavioural syndromes are well-documented (Pruitt & Riechert 2012). We used the

jumping spider *Eris militaris* (Araneae: Salticidae) as a model taxon in this research. This species is commonly found in apple orchards and is easily reared under laboratory conditions. Previous work indicated differences in syndrome structure when comparing insecticide-free and insecticide-exposed populations, most notably regarding the strength of an activity-voracity syndrome (Royauté, Buddle & Vincent 2014). Here, we expand on this work by testing how direct exposure to an insecticide can impact personality traits and their syndromes. We focus on traits related to activity and prey capture behaviours because these traits are frequently correlated in spiders with important consequences for individuals' survival and fitness (Pruitt, Riechert & Jones 2008; Pruitt & Krauel 2010).

Our objective was to test whether sublethal exposure to an organophosphate insecticide can alter personality, either by affecting the consistency of behavioural traits or by affecting the strength of correlation between traits. We tested several hypotheses by which sublethal exposure to insecticides is expected to alter the expression of personality traits and their correlations. First, insecticidal exposure may affect patterns of repeatability, a measure of the extent of personality differences (Fig. 1a). Such differences may occur because (i) insecticide-exposed individuals become more similar (collapse of behavioural differences hypothesis); (ii) personality differences are amplified after insecticidal exposure (amplification of behavioural differences hypothesis); or (iii) each individual becomes more variable after exposure (variability increase hypothesis). Second, insecticidal exposure may affect patterns of correlation between behavioural traits and either reduce (syndrome collapse hypothesis) or amplify (syndrome amplification hypothesis) the magnitude of behavioural correlations (Fig. 1b).

Materials and methods

SPIDER COLLECTION AND REARING

Juvenile *E. militaris* were collected from three populations in habitats where insecticide exposure is expected to be low. The first site was an apple orchard managed without insecticidal applications since its implementation 20 years ago (Agriculture and Agri-Food Canada experimental farm in Frelighsburg, QC, 45.0462°W, -72.8565°N). The other sites were shrubby areas located near the McGill Morgan Arboretum (Ste Anne de Bellevue, QC, 45.440185°W, -73.946893°N) and the Pin Rigide Ecological Reserve (Saint-Chrysostome, QC, 45.111657°W, -73.876557°N). Spiders were collected haphazardly by beating the foliage of trees and brought to the laboratory. We also included laboratory-reared specimens (F1) collected in the apple orchard site. Juveniles were reared to adults in cylindrical containers (760 mL Plastipak®, Plastipak Holdings Inc., Plymouth, MI, USA) that included a plastic plant to mimic natural conditions (Carducci & Jakob 2000) and a small plastic straw retreat ($L = 2.5$ cm, $\varnothing = 1.2$ cm). They were kept at 24 °C and 40% humidity, under a 16L:8D photoperiod. Water was provided *ad lib* using dental cotton inserted in an Eppendorf tube. Spiders were fed weekly with a mixed diet of cabbage looper larvae (*Trichoplusia ni*), two species of adult fruit flies of different sizes (*Drosophila melanogaster* and *Drosophila hydei*) and juvenile domestic crickets (*Acheta domestica*).

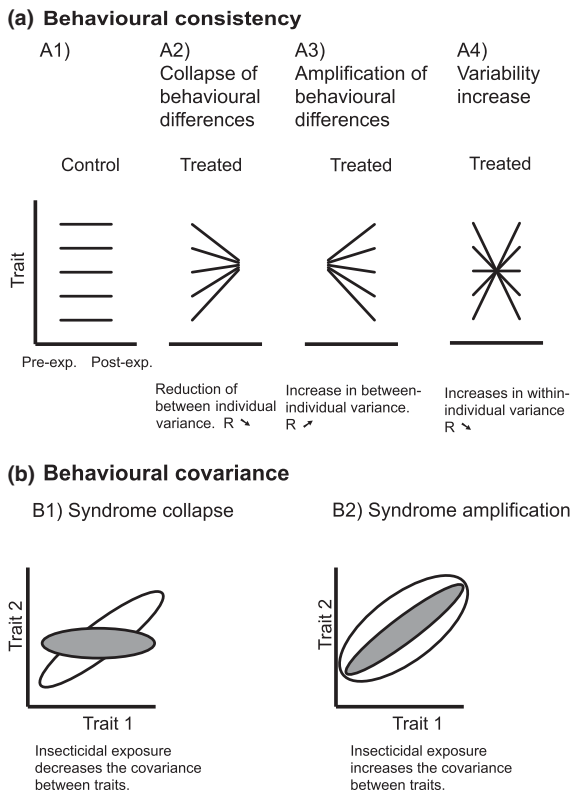


Fig. 1. Different scenarios explaining how sublethal insecticidal exposure may alter patterns of behavioural consistency (a) and covariance (b). (a) All lines represent a single individual measured before and after exposure to an insecticide. A1 indicates a control case where behavioural repeatability (R) is unchanged in the absence of insecticidal exposure. A2 and A3 represent cases where insecticidal exposure causes repeatability to decrease either by shifting individuals towards the population mean (behavioural differences collapse) or by amplifying individual differences (behavioural differences amplification). A4 describes a case where insecticidal exposure increases the behavioural variability of each individual (variability increase). (b) Ellipses indicate the strength of correlation between two behavioural traits in presence (grey ellipses) and absence of insecticidal exposure (white ellipses). Insecticidal exposure may either decrease (B1, syndrome collapse scenario) or amplify (B2, syndrome amplification scenario) behavioural correlations.

BEHAVIOURAL TESTS

We tested 176 adult individuals for behavioural correlations (Arboretum population – females: $n = 15$, males: $n = 7$; apple orchard population – females: $n = 42$, males: $n = 51$; laboratory-reared population – females: $n = 33$, males: $n = 14$; Pin Rigide population – females: $n = 9$, males: $n = 5$). We used a repeated measure design that allowed us to simultaneously compare effects of insecticides on differences in average behavioural values between treatments as well as investigating effects on behavioural variations at between and within-individual levels. We processed the spiders through the behavioural tests with up to 16 individuals at a time (minimum 8). In order to standardize satiety, we offered spiders one adult fruit fly (*D. hydei*) during the week preceding the tests and one adult *D. melanogaster* 12 h prior to the tests. We then recorded spiders' behaviour using open-field and prey capture tests performed before and after exposure to the insecticide (hereafter referred to as pre and post-exposure phases). We consistently

conducted behavioural tests in the same order, with the open-field conducted from 8.30 to 11.00, and prey capture from 14.00 to 16.00. At the end of the first day of testing, we exposed spiders to a sublethal dose of the organophosphate phosmet for 24 h using the procedure described in Appendix S1 (Supporting information). Phosmet was selected as it is a widely-used, broad-spectrum insecticide which mode of toxicity, inhibition of acetylcholinesterase, activity, is well-documented (Mineau 1991). The sublethal dose we used was in the range of field concentrations and was therefore ecologically relevant for our experiment (~ 1 ppm) (Pettis *et al.* 2013).

Half of the spiders were introduced in test tubes containing the sublethal dose and the other half were introduced in control tubes (control group: $n = 81$, insecticide-treated group: $n = 95$). After 24 h exposure, we reintroduced spiders in their containers, offered them one *D. melanogaster*. Because sublethal effects of insecticides are often short-lived and reversible (Desneux, Decourtye & Delpuech 2007), we repeated the behavioural tests immediately on the following day (inter-test interval: 48 h). In the insecticide-treated group, two individuals (out of 95) died, while in the control group, one individual (out of 81) died. We took mass and body-size measurements on 151 individuals. Spiders were weighed immediately after the prey capture test at pre- and post-exposure phases. Body mass (± 0.1 mg) was determined using a Sartorius TE214S scale. We used cephalothorax width (± 0.001 mm) as a proxy for body size and measured using a WILD MMS 225 digital length measuring set. Body-condition was estimated as a residual index (following Jakob, Marshall & Uetz 1996). All tests were videotaped using a Canon Vixia HF200 camera (Canon Inc., Tokyo, Japan). To remove traces of conspecific cues, we cleaned test arenas with 70% ethanol and air-dried them for 120 s between trials. We used video playback with the software The Observer XT (Noldus Information Technology, Wageningen, The Netherlands) to acquire the parameters related to activity and prey capture.

OPEN-FIELD TEST

We used a wooden open-field arena of 30×30 cm divided in 5×5 cm quadrats for the open-field test (Carducci & Jakob 2000). The arena was subdivided in three zones: a central zone (four quadrats), an intermediate zone (12 quadrats) and an edge zone (20 quadrats). We let each spider rest for 120 s in a 5 cc syringe before we released it at the centre of the arena. We started recording as soon as the spider entered one of the four central quadrats. During 300 s, we recorded the latency to exit the first quadrat (s), the total number of quadrats visited, the number of unique quadrats visited, the number of quadrats visited during the first minute of the test and the number of quadrats visited in each zone of the arena.

PREY CAPTURE TEST

We introduced each spider in a 9 cm Petri dish and left it to rest for 120 s. At the end of the resting period, we inserted an adult *D. hydei* into the Petri dish through a hole on its side using a buccal aspirator. Due to a technical problem during the rearing of *D. hydei*, we used the smaller prey species *D. melanogaster* for a subset of 42 individuals. As none of the observed behaviours differed significantly depending on fly species ($P > 0.3$), this variable was removed from subsequent analyses. Spiders were given a duration of 600 s to capture the prey. We recorded the latencies to detect (defined as the first orientation towards the prey) and capture the prey, as well as the average time performing visual and active tracking of the prey. We defined visual tracking as instances where the spider oriented its cephalothorax towards the prey and visually followed the prey at a distance. Active tracking was defined as a fast forward motion towards the prey, often

concluded by a capture attempt. The test was stopped as soon as the spider captured the prey or when the 600 s duration was reached. The fly was removed from the spider by probing it with the tip of a small brush in order to keep satiety consistent between tests. We assigned a capture latency value of 600 s for spiders that failed to capture the prey. Proportion of capture success did not differ between treatments (Fisher exact test, $P = 0.25$).

STATISTICAL ANALYSES

We conducted all analyses with R, version 3.0.0 for Macintosh (R Core Team 2013). We used the Bayesian package MCMCglmm (Hadfield 2010) for mixed modelling analyses and lavaan (Rosseel 2012) for structural equations modelling analyses. Prior to all analyses, count data (e.g. number quadrats travelled, number of attacks on prey) were square-root transformed and continuous data (e.g. detection and capture latencies) were $\ln(x + 1)$ -transformed to conform with the assumption of normality.

EXPLORATORY ANALYSIS

We used structural equation modelling in the exploratory analysis described in Appendix S1 (Supporting information) to identify the behavioural variables that were the best indicators of activity and prey capture. For activity, the variables selected as best indicators were the total activity (total number of quadrats explored), the surface explored (number of unique quadrats explored) and the edge activity (number of edge quadrats visited). For prey capture, those variables were the latency to detect and capture the prey as well as the amount of active and visual tracking performed by the spider (Appendix S1, Table S1, Fig. S1, Supporting information). We hereafter collectively refer to these seven variables as behavioural traits.

EFFECT OF INSECTICIDAL EXPOSURE ON AVERAGE BEHAVIOUR

In order to investigate the effects of insecticidal treatments on the expression of average behaviour, we performed Bayesian univariate linear mixed models on each behavioural trait selected through the previous exploratory analyses (Appendix S2a, Supporting information). Fixed effects included population, sex and the interaction between treatment and test phase. Individuals were included as random effects to account for repeated measures. Our hypothesis was that sublethal effects on behaviours would occur only in the post-exposure phase and would be detected through a significant treatment \times test interaction. We reported the posterior mode for each fixed effect estimates along with their 95% credible intervals (CI).

EFFECT OF INSECTICIDAL EXPOSURE ON BEHAVIOURAL REPEATABILITY

Repeatability is commonly used as a measure of the extent of individual differences in behaviour, and is defined as the ratio of between-individual variance over the total phenotypic variance: $R = V_{BI}/(V_{BI} + V_{WI})$, where the phenotypic variance V_P is expressed as $V_P = V_{BI} + V_{WI}$ (V_{BI} : between-individual variance, V_{WI} : residual or within-individual variance). We used Bayesian univariate mixed models to compare behavioural repeatability between treatments and sex (Appendix S2a, Supporting information). Individuals were included as random effects. Significant fixed effects selected through the above analyses (i.e. population and sex) were included to avoid over confident estimates of repeatability (Nakagawa & Schielzeth 2010; Westneat *et al.* 2011). All

behavioural variables were expressed as standard deviation units to facilitate convergence. We report the posterior mode and 95% credible intervals for repeatability as well as the effect size for the difference in repeatability between treatments: ΔR (defined as $R_{\text{insecticide-treated}} - R_{\text{control}}$). To further test which component of the phenotypic variance most influenced differences in repeatability, we calculated ΔV_{BI} and ΔV_{WI} (defined as $V_{\text{insecticide-treated}} - V_{\text{control}}$). We based inference on overlap of the 95% CIs with zero.

EFFECT OF INSECTICIDAL EXPOSURE ON BEHAVIOURAL CORRELATIONS

To test whether sublethal insecticide exposure would affect patterns of trait covariance at between and within-individual levels, we performed Bayesian multi-response mixed models on each treatment group separately (Appendix S2b). We assessed the magnitude of between (r_{BI}) and within-individual (r_{WI}) correlation based on the posterior mode of its estimate and used the 95% credible intervals and the percentage of estimates excluding zero as a measure of the precision of the estimates. We then performed Mantel's test on each 'slice' of the posterior correlation matrices to test for overall differences in correlation structure between treatments. We also report the average difference in pairwise correlation between treatments, Δr , to provide a qualitative assessment of the magnitude of the difference in correlation between treatments. This value was calculated as the average of $r_{\text{insecticide-treated}} - r_{\text{control}}$. This is appropriate since correlation estimates for each treatment come from separate models. We based statistical inference on the following scale: $0 < |\Delta r| < 0.2$, no to low effect; $0.2 < |\Delta r| < 0.5$, medium effect; $|\Delta r| > 0.5$, strong effect (Nakagawa & Cuthill 2007).

Results

EFFECTS ON AVERAGE BEHAVIOURS

We found no evidence for an effect of phosmet on average behaviour between control and treated groups. Estimates of the treatment \times test phase interaction were < 1 and showed substantial overlap of their CIs with zero (Table S3, Supporting information). Other sources of variation such as sex for activity traits and population for prey capture traits had significant effects and were included as fixed effects in all subsequent models to provide unbiased estimates of repeatability and behavioural correlations.

EFFECTS ON BEHAVIOURAL VARIANCE

Repeatability of behavioural traits ranged from 0.07 to 0.68 with strong differences detected between treatments and sex (Fig. 2, Tables S4 and S5). Trait repeatability decreased by an average of 23% in the insecticide-exposed group, as indicated by the average difference in repeatability among treatments, (posterior mode [95% CI], $\Delta R = -0.23$ [-0.48; 0.07], negative values indicates lower repeatability in the insecticide-treated group). Males showed a pronounced decline in the repeatability of all activity traits in the insecticide-treated group (Fig. 2, Table S5). In contrast, prey capture repeatability was primarily affected in females.

Males showed stronger evidence for a variability increase scenario than a collapse in behavioural difference.

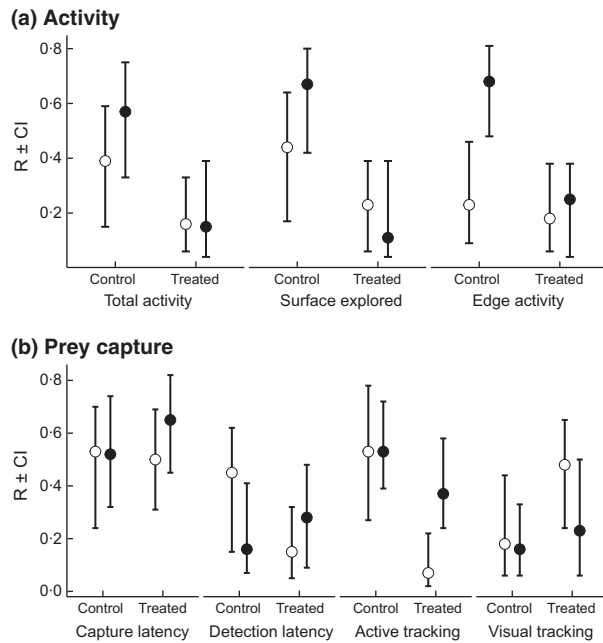


Fig. 2. Extent of personality differences (i.e. repeatability) compared across control and insecticide-treated individuals and sex (females: white circles, males: dark circles) for (a) activity and (b) prey capture traits. Values represent posterior modes \pm 95% credible interval.

Between-individual variance decreased simultaneously with an increase in within-individual variance but the magnitude of the effect was stronger for the within-individual variance component (posterior mode range, $\Delta V_{BI} = [-0.37; -0.41]$; $\Delta V_{WI} = [0.45; 0.95]$). Insecticide-treated females followed both the variability increase and behavioural difference amplification scenarios depending on the prey capture trait considered. Females exposed to the insecticide increased their within-individual variation in active tracking ($\Delta V_{BI} = 0.07 [-0.10; 0.58]$; $\Delta V_{WI} = 2.46 [1.66; 3.21]$), while increasing their between-individual variation in visual tracking ($\Delta V_{BI} = 0.27 [-0.02; 0.79]$; $\Delta V_{WI} = 0.09 [-0.32; 0.39]$) (Fig. 3).

EFFECTS ON BEHAVIOURAL CORRELATIONS

We found strong sex-specific differences in the way behavioural correlations responded to insecticide exposure (Fig 4). Females exposed to the insecticide showed the most evidence of a collapse of the activity-prey capture syndrome (Fig. 1b) (Mantel test r [95% CI] indicating the overall correlation between behavioural correlation matrices of the control and insecticide-treated groups, females – between-individuals: $r = 0.31 [-0.08; 0.77]$, within-individuals: $r = 0.77 [0.57; 0.92]$; males – between-individuals: $r = 0.59 [0.12; 0.88]$, within-individuals: $r = 0.78 [0.53; 0.93]$).

The decrease in between-individual correlations in insecticide-exposed females was mostly the result of a weakening of correlations between activity and prey capture traits. Females that were more active on average tended to

have higher capture latencies and spend a higher proportion of their time actively pursuing prey. Such tendencies were not noticed in the insecticide-treated group (total activity-capture latency: $r_{BI} = 0.33 [-0.08; 0.63]$, $\Delta r_{BI} = -0.29$; total activity-active tracking: $r_{BI} = 0.40 [-0.11; 0.62]$, $\Delta r_{BI} = -0.34$). Investigation of pair-wise differences in correlation estimates also indicated a sign inversion of certain within-individual correlations (Table S6) (total activity-active tracking: $r_{WI} = -0.28 [-0.55; 0.05]$, $\Delta r_{WI} = 0.46$; edge activity-active tracking: $r_{WI} = -0.27 [-0.50; 0.08]$, $\Delta r_{WI} = 0.43$). In the absence of insecticide exposure, females who increased their activity in between test phases lowered the amount of time spent actively pursuing prey, while insecticide-exposed females showed the reverse trend.

Males did not show evidence of a collapse of the activity-prey capture syndrome as a result of insecticide exposure. They did show, however, subtle changes in between-individual correlations among activity traits, suggesting insecticide exposure changed the way males explored their environment. Control individuals that traveled further into the arena also tended to explore a greater surface and this pattern weakened in insecticide-treated males (total activity-surface explored: $r_{BI} = 0.73 [0.43; 0.84]$, $\Delta r_{BI} = -0.29$; total activity-edge activity: control, $r_{BI} = 0.73 [0.41; 0.82]$, $\Delta r_{BI} = -0.27$). Contrary with females, we did not notice any notable difference in patterns of behavioural correlations at the within-individual level ($\Delta r_{WI} \leq 0.20$).

Discussion

Our objective was to test sublethal insecticidal exposure as a potential disrupter of personality expression in the jumping spider *E. militaris*. By exposing spiders to an ecologically relevant concentration of insecticide, we found that sublethal effects can occur at the individual level even in the absence of a population-wide shift in average behaviour. We detected substantial differences in repeatability and in the correlation between personality traits expressed among insecticide-exposed and non-exposed groups. We also found that sex had a strong influence on which specific traits or correlation was most likely to be altered, suggesting males and females differ in the way they cope with insecticide exposure.

SEX-SPECIFIC DIFFERENCES IN INDIVIDUAL RESPONSE TO INSECTICIDE EXPOSURE

Our study shows that sublethal exposure to an insecticide produces complex effects on the expression of personality traits and their correlations. Previous work conducted with *E. militaris*, showed evidence that populations from insecticide-free and insecticide-treated apple orchards differed in the overall architecture of their behavioural syndromes (Royauté, Buddle & Vincent 2014). In the present study, we were able to investigate these results further by directly manipulating individuals' insecticide exposure level. As a

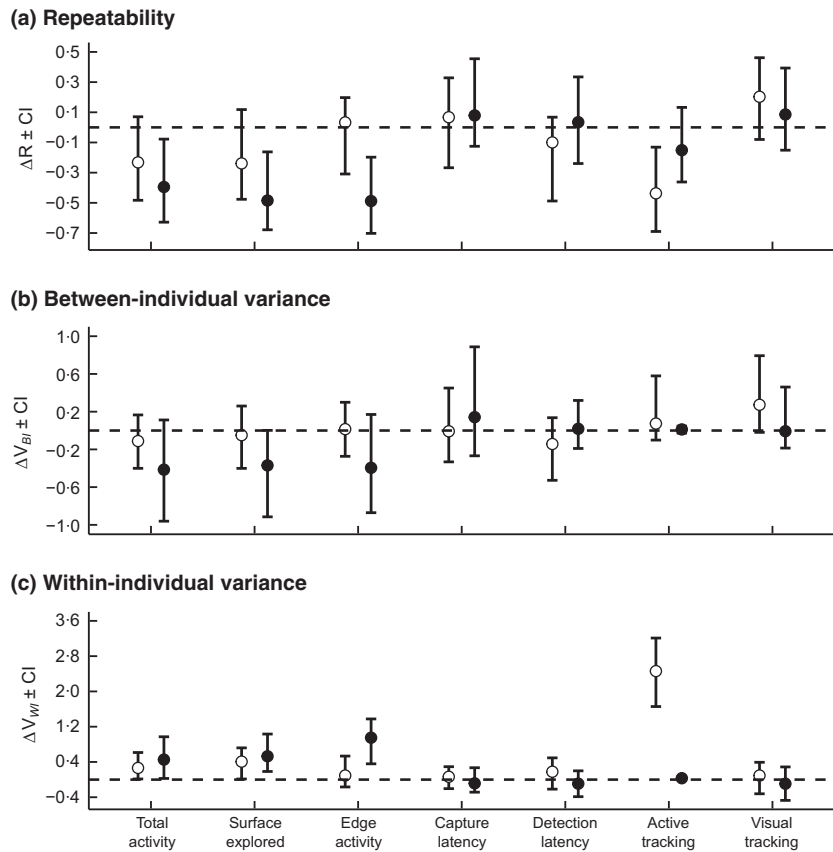


Fig. 3. Difference in repeatability (a), between (b) and within-individual variance components (c) compared across treatment groups and sex (females: white circles, males: dark circles). Values represent posterior modes $\pm 95\%$ credible interval and are expressed as deviation from the control group (i.e. positive values indicate an increase in variance in the insecticide-treated group relative to the control).

result, the repeatability of personality traits declined by an average of 23% in the insecticide-exposed group, and these differences were mostly mediated by an increase in within-individual variance, thus supporting the variability increase hypothesis.

Interestingly, while alterations of behavioural repeatability between treatments occurred for five out of the seven traits considered, males and females showed important differences in which type of trait was most affected and in which direction. Females showed strongest differences in the repeatability of prey capture behaviours between treatments, with insecticidal exposure either increasing an individual's variability (i.e. active tracking) or amplifying between-individual differences (i.e. visual tracking). Males, in contrast, showed an increased variability for all activity traits while prey capture traits were largely unaffected. These sex-specific differences were also maintained when investigating how behavioural correlations responded to insecticide exposure. We found more support for a collapse of the activity-prey capture syndrome in females than in males. Inactive females were quicker to capture prey in the absence of insecticide exposure, a tendency no longer expressed in the treated group. Males did not show evidence for such an activity-prey capture syndrome, even in the control group, but showed a decrease in correlation strength among all activity traits. Taken together, our results suggest that insecticide-exposed individuals showed a strong departure from their personality tendencies. In other words, an active spider becoming 'under the

influence' of insecticides may no longer behave as active as it would otherwise. These effects were expressed differently among sexes as insecticide exposure was more likely to cause changes in female hunting strategies while male exploration was altered irrespectively of prey capture.

Several mechanisms are likely to contribute to these patterns. Personality traits are underpinned by a variety of physiological mechanisms, including differences in metabolic rates, immune responses and wiring of neuroendocrine pathways (Sih, Bell & Johnson 2004; Careau *et al.* 2008; Niemelä *et al.* 2012). Since organophosphates disrupt the activity of acetylcholinesterase, differences in acetylcholine receptor density among individuals would likely affect the sensitivity of individual to a given insecticide dose. Another possibility could be that some individuals experience reduced immune function as a result of insecticide exposure (Desneux, Decourtye & Delpuech 2007). This could result in changes in energy budgets and ultimately alter the energy allocation priorities of individuals.

The sublethal toxicity of organophosphate on beneficial arthropods has been found to affect many behaviours related to mobility and locomotion, with sexual differences reported in some cases (Tietjen & Cady 2007; Hanna & Hanna 2013). However, such studies tend to focus on shifts in average behavioural or physiological response. In contrast, our results suggest that sublethal effects may still be present even when population-wide behavioural shifts remain undetected. This result could have important

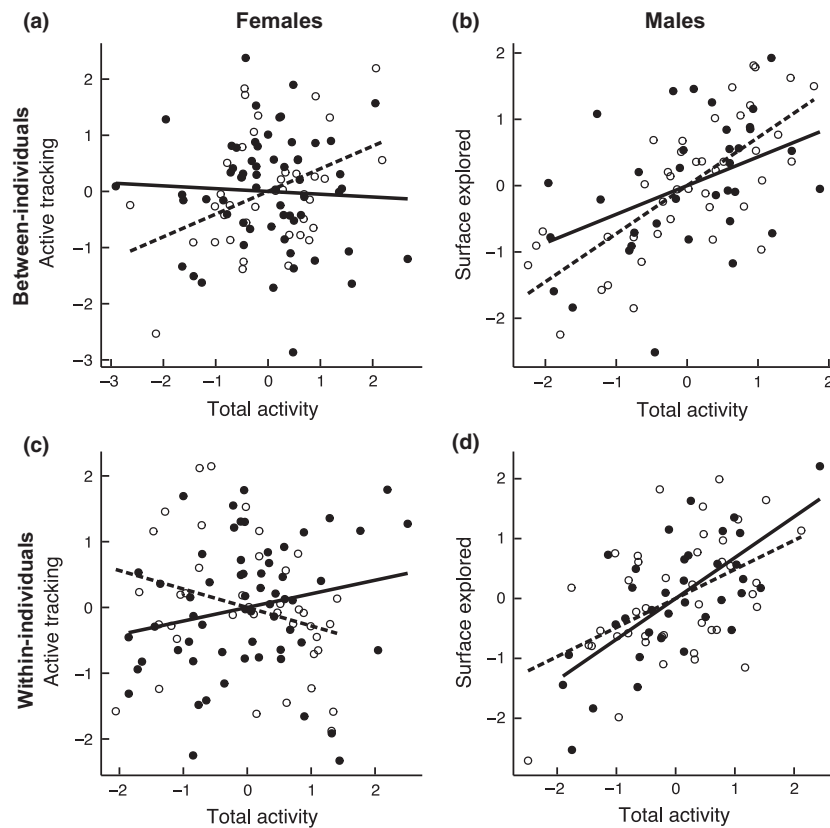


Fig. 4. Difference in behavioural correlations between control (white circles) and treated groups (black circles) for between (a,b) and within-individual levels (c,d). Plots represent pairwise correlation with highest difference in correlation estimates between treatments (Δr) and sex (females: a,c, males: b,d). Values were simulated from the correlation matrices obtained through multivariate mixed models. Lines represent least square regressions for control (dotted lines) and insecticide-treated groups (solid lines).

repercussions on evolutionary and ecological processes, which we outline below.

EVOLUTIONARY AND ECOLOGICAL IMPLICATIONS

Personality traits are often adaptive and are related to individual differences in physiology, life-history trajectories and fitness (Koolhaas *et al.* 1999; Dingemanse & Réale 2005; Réale *et al.* 2010). By reducing the amount of personality differences expressed in certain traits, sublethal exposure to insecticides can cause insidious effects on an individual's fitness, even in absence of a population-wide response. For example, by altering exploration and foraging strategies, insecticidal exposure could affect an individual's capacity to capture prey or to disperse into suitable habitats. In many spider species, prey capture efficiency is part of a broader 'aggression syndrome' involving aggressive tendencies against conspecific and antipredator tendencies (Riechert & Hedrick 1993; Johnson & Sih 2005, 2007; Pruitt, Riechert & Jones 2008; reviewed in Pruitt & Riechert 2012). Such 'packages' of traits often share similar physiological underpinnings (Sih *et al.* 2004). Any insecticide compound affecting behavioural differences in one trait is likely to profoundly affect all related traits. Ultimately, such alterations may result in changes in an individual's life-history strategy.

Individual-level effects could also precede population-wide effects, especially in the case of chronic exposure. This scenario is most likely if individuals differ in their sensitivity to the insecticide. More sensitive individuals would

experience behavioural shifts sooner than the rest of the population and thus experience reduced fitness. Therefore, monitoring effects of insecticides on trait variance may provide a better estimate of early disruption of behavioural traits.

By uncoupling behaviours related to activity and prey capture in arthropod predators, insecticides exposure may cause cascading effects on prey-population dynamics. Personality differences are known to influence the strength of trophic cascades as certain individuals can contribute more strongly to the top-down control of prey species (Griffen, Toscano & Gatto 2012; Toscano & Griffen 2014). In agricultural landscapes frequently exposed to insecticides, effects on the overall architecture of personality differences may therefore reduce the environmental services provided by biocontrol agents.

TOWARDS AN ECOTOXICOLOGY OF INDIVIDUAL DIFFERENCES

Ecotoxicological studies focusing on effects of contaminants on behavioural differences remain scarce and have been mostly restricted to aquatic systems. For example, exposure to heavy metals can decrease the repeatability of critical swimming speed in fathead minnows (Kolok, Plaisance & Abdelghani 1998), and exposure to anxiolytic drugs resulted in the emergence of correlations between previously uncorrelated personality traits in perch (Brodin *et al.* 2013). Change in personality expression resulting from contaminant exposure is most likely a widespread phenomenon

occurring in multiple types of ecosystems independently of contaminant class. Yet, these types of effects remain widely understudied in terrestrial systems (but see Morales *et al.* 2013 for a recent example).

Our study addresses a significant gap in our knowledge by revealing the complex ways by which multiple behavioural functions can be altered by insecticide exposure. We suggest that, whenever possible, longitudinal studies should be implemented to monitor the effects of insecticides over time at the individual level. While longitudinal studies have been included with great effect in the past, they typically treat repeated measures on individuals as a nuisance parameter (e.g. Gill & Raine 2014). We favour a more integrative approach where effects of contaminants on both average and (co)variance among behaviours can be fully explored. We believe such an approach will expand our understanding of how sublethal effects of insecticides and other types of contaminants operate and will generate more robust predictions for population persistence.

Finally, we investigated only one dose of a very specific compound. In field conditions, sublethal effects may be even more severe. For example, insecticidal exposure and accumulation may be mediated by personality differences. Individuals with higher activity may explore larger areas and be more frequently in contact with insecticide residues. An important way forward is to consider that personality differences may affect insecticide exposure and accumulation, and the received insecticide dose may in turn affect personality expression in a feedback loop (Montiglio & Royauté 2014). It is also important to consider the interactions between multiple insecticidal compounds, since different insecticides are used to control different types of pests. Such 'cocktails' often act in synergy, having drastically different effects than exposure to each compound separately (Kortenkamp 2007). These types of interaction can be extended to study various classes of anthropogenic contaminants and model different paths of effects, allowing better predictions of the consequences of exposure to anthropogenic contaminants.

Our results point to several key conclusions, relevant to both basic and applied perspectives. First, assessing the effects of insecticides solely on differences in average behaviour between insecticide-exposed and control groups is somewhat limited, as it cannot account for effects at the individual level and thus risk underestimating the toxicity of these compounds. Second, using the multivariate approach favoured by behavioural syndromes studies can generate considerable more insights into the specific ways behaviours are altered by insecticide stress. Finally, our results can be applied in bioassay procedures by incorporating behavioural variation in dose-response ecotoxicological studies. Our research calls attention on a poorly studied source of behavioural variation: the presence of neurotoxic insecticides in the environment and shows that these compounds can significantly affect personality expression in an important arthropod predator.

Acknowledgements

We thank Monique Audette, Gay Grunner and Mary Pavlik for access to field sites. Martin Ballot, Laurianne Besnard, Caroline Charrier, Anne Danthony, Pierre Lemoine and Benoît Valle assisted in data collection and spider rearing. We also thank Mélanie Dammhahn, Ned Dochtermann, P.-O. Montiglio, members of Chris Buddle's laboratory and NDSU Biological Sciences graduate students for helpful comments on earlier versions of this article. We thank Dr. Charles Fox, the handling editor and two anonymous reviewers for their thoughtful comments. Funding was provided in part by the National Science and Engineering Council of Canada (NSERC Discovery Grant to CMB), Agriculture and Agri-food Canada (CV) and McGill University (Margaret DuPorte Fellowship to RR).

Data accessibility

Data deposited in the Dryad Digital Repository: <http://dx.doi.org/10.5061/dryad.4s90s>, (Royauté, Buddle & Vincent 2015).

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Received 27 July 2014; accepted 15 January 2015

Handling Editor: Dana Hawley

Supporting Information

Additional Supporting information may be found in the online version of this article:

Appendix S1. Determination of a sublethal dose of phosmet.

Appendix S2. Model specifications for exploratory analyses of activity and prey capture behaviours.

Appendix S3. Model specifications for comparing repeatability and behavioural correlations across treatments.

Fig. S1. Results of the exploratory analysis for activity and prey capture.

Table S1. Between and within-individual correlations for activity and prey capture variables.

Table S2. Correlation of behavioural traits with body condition and body-size.

Table S3. Effect of insecticidal exposure and other sources of variation on behavioural traits.

Table S4. Between (V_{BI}) and within-individual (V_{WI}) variance components compared across treatments.

Table S5. Repeatability of behavioural traits compared between sex and treatments.

Table S6. Between and within-individual correlations of behavioural traits compared across treatment groups.

EPA proposes stricter restricted-use pesticide certification standards

Thursday, Aug 6, 2015 @ 1:43pm By EP News Wire Reports



The U.S. Environmental Protection Agency (EPA) introduced a draft regulation on Wednesday that would put stricter limits on those certified to use “restricted-use” pesticides, with the goal of increased supervision and oversight and greater consistency across the states.

Restricted-use pesticides require special handling and are not available to the general public. Anyone who wants to use them must be a certified applicator or working under the direct supervision of one. The proposed regulation would further restrict the use to those 18 years or older, and make the standards for certification stricter. It also would require renewal every three years.

These revisions also would make it easier for companies that operate in several states, as the current system requires them to demonstrate safe usage of the pesticides to each state agency to garner state-specific licenses.

“We are committed to keeping our communities safe, protecting our environment, and protecting workers and their families,” EPA Assistant Administrator for the Office of Chemical Safety and Pollution Prevention Jim Jones said. “By improving training and certification, those who apply these restricted-use pesticides will have better knowledge and ability to use these pesticides safely.”

- See more at: <http://epnewswire.com/stories/510631983-epa-proposes-strict-restricted-use-pesticide-certification-standards#sthash.Kr72JoxN.dpuf>

EPA seeks public comment on new pesticide risk assessment guidance document

[Wednesday, Aug 5, 2015 @ 4:44pm](#) By EP News Wire Reports



The Environmental Protection Agency (EPA) is seeking public comment on a drafted document that would guide the screening level analysis of pesticide chemicals to judge their toxicity, according to a release issued on July 30.

The guidance document, “Pesticide Cumulative Risk Assessment: Framework for Screening Analysis,” gives information on how the EPA screens available data to determine which pesticide groups may be toxic -- presenting what it calls a cumulative risk -- and therefore require further testing. The guidance document stands to make the EPA’s screening process more efficient, allowing the agency to efficiently prioritize its assessments.

According to the Federal Food, Drug and Cosmetic Act, the EPA must consider available information on the cumulative effects of pesticides that have a common mechanism of toxicity in an efficient use of resources, which this guidance document seeks to allow. Previously, these assessments were resource intensive and required scientific analysis of large data sets.

In its release, the EPA included an example copy of the assessment for abamectin and emamectin benzoate, which were determined to share a similar toxicological profile, and therefore could present an aggregate risk, meaning one derived from exposure to the same chemical in multiple pathways. Using conservative exposure assumptions, the agency developed a screening level cumulative analysis.

The public comment period for this document will close on Aug. 28, 2015.

EPA testimony statements are available at www.epa.gov.

- See more at: <http://epnewswire.com/stories/510631803-epa-seeks-public-comment-on#sthash.UrU1tWeA.dpuf>

Blueberries sprayed or unsprayed? Consider pollinators, field workers (<http://bangordailynews.com/2015/08/13/opinion/blueberries-sprayed-or-unsprayed-consider-the-pollinators-and-people-in-the-field/>)

By Jody Spear, Special to the BDN

Posted Aug. 13, 2015, at 9:59 a.m.

Do you eat blueberries from the commercial market, sprayed with pesticides, or do you pay a premium for unsprayed, organic berries?

The annual commercial blueberry harvest is upon us, and a question framed in this way would prompt inquiring-minded consumers to learn what pesticides (http://www.google.com/url?q=http%3A%2F%2Fwww.beyondpesticides.org%2Fgateway%2Findex.php&sa=D&sz=1&usg=AFQjCNEzwwqsm3xgK_m_-GjvAhAKLYvoAuA) have been applied to blueberry crops to kill insects, weeds and fungal disease, and what specific health hazards accompany them. The barrage of chemicals begins in April and continues into the fall with regular spraying of fungicides, herbicides and insecticides, saturating fields for maximum yield of berries — an agribusiness commodity that in no sense is “wild.” Every year, people who live, work and play around the barrens and drive on roadways along them are sickened during that time, as the poisons inevitably drift.

If you ask growers what they are using to eradicate, for example, insect pests (<http://www.google.com/url?q=http%3A%2F%2Fumaine.edu%2Fblueberries%2Ffactsheets%2Finsects%2F209-insect-control-guide-for-wild-blueberries%2F&sa=D&sz=1&usg=AFQjCNEyEsukXGQl9TZ4NFzAhCanR6NoQ>) — and, yes, they do have to tell you — they likely will give brand names for compounds that include phosmet (Imidan), zeta-cypermethrin (Mustang Max), carbaryl (Sevin) and imidacloprid (Admire). You then can look them up on an index at BeyondPesticides.org (<http://www.google.com/url?q=http%3A%2F%2Fwww.beyondpesticides.org%2F&sa=D&sz=1&usg=AFQjCNGJy12A2aI3t8U4xv8IjtKYq3ITZA>) and find that the four examples cited — all designed to attack the nervous system — fall into the following classes, respectively: organophosphates, synthetic pyrethroids, carbamates and neonicotinoids. The last of these, a group of systemic insecticides (http://www.google.com/url?q=http%3A%2F%2Fwww.disasterinthemaking.com%2Fabout_the_author.html&sa=D&sz=1&usg=AFQjCNGQ7nFNZRWBW6ru2nLeY-Cj2jXDBg), is implicated in Colony Collapse Disorder, leading to disastrous losses of the bees on which we depend to pollinate food crops.

Also systemic, meaning it is in every cell of the plant and cannot be washed off, is cyantraniliprole (Exirel), recently added to UMaine Cooperative Extension’s blueberry pesticides list. Its EPA approval earlier this year is being challenged in a lawsuit brought by the Center for Biological Diversity (http://www.google.com/url?q=http%3A%2F%2Fwww.biologicaldiversity.org%2Fnews%2Fpress_releases%2F2014%2Fpesticides-03-24-2014.html&sa=D&sz=1&usg=AFQjCNGS7imjmIdqBZSMoIgvWTKv9xZmSA) and other groups because provisions of the Endangered Species Act were ignored in the registration process. Similar to other insecticides, this new one kills fish, bees, birds and butterflies, as well as the target pest. We must protest the use of yet another systemic pesticide in Maine.

When growers disclose the herbicides (<http://www.google.com/url?q=http%3A%2F%2Fumaine.edu%2Fblueberries%2Ffactsheets%2Fweeds%2F236-weed-management-in-wild-blueberry-fields%2F&sa=D&sz=1&usg=AFQjCNExKR3KV5hm19CD6vIp8eGGcxrNeQ>) they are blanketing over the barrens to eliminate every last goldenrod, sweet fern and bunchberry, you will be able to investigate further and learn that hexazinone (Velossa, Velpar) and diuron (Parrot, Karmex) are a continuing threat to groundwater and wells in Maine — though other countries have banned them because of their persistence and mobility in soil and water and because they pose endocrine-disrupting and cancer threats. These chemicals are too toxic for widespread use on “weeds” that instead can be managed by hand-pulling and mulching or can be left alone to provide essential food sources for native bees. Herbicide spraying sets off a deadly cascade: resistant weeds requiring more applications of still more lethal chemicals. The same is true for insects, which build immunity after repeated sprayings.

Monsanto, Dow and other chemical manufacturers will insist their products are safe, having been approved by EPA. But you need only look at the label for a given pesticide to see “danger” and warnings: “Do not apply near water,” “Do not apply when bees are foraging,” “Do not allow spray to touch berries.” All cautions routinely are disregarded, and “emergency” exemptions are issued regularly by state regulators for unapproved chemicals (http://www.google.com/url?q=http%3A%2F%2Fwww.mofga.org%2FPrograms%2FPublicPolicyInitiatives%2FPesticidesAction%2FPesticidesQuiz%2Ftabid%2F527%2FDefault.aspx&sa=D&sntz=1&usg=AFQjCNEEOV_Iev3UCYMCcaZZtAHSpHkvXg).

Several protections we have fought for in recent years — a notification registry (<http://www.google.com/url?q=http%3A%2F%2Fwww.mofga.org%2FPublications%2FMaineOrganicFarmerGardener%2FSummer1998%2FTisherEditorial%2Ftabid%2F2;sa=D&sntz=1&usg=AFQjCNGkcbf2IBAYSaHcdHukaADCIVrhQ>) and a ban on aerial and airblast spraying, for example — have been denied in Augusta. Until those initiatives are back on track, the best options left to consumers are filing complaints with local and state authorities — health departments and the pesticide-control board (<http://www.google.com/url?q=http%3A%2F%2Fwww.maine.gov%2Fdacf%2Fphp%2Fpesticides%2Findex.shtm&sa=D&sntz=1&usg=AFQjCNHQVd5eAJYVyTvnWIQ-fBuhCiUtTQ>) — whenever pesticide poisoning leads to medical problems, transient or long term; passing ordinances, town by town, restricting agricultural pesticide applications; and buying only unsprayed produce.

Organic blueberries — a rich source of antioxidants, as long as they are organic — are a healthy alternative to commercial berries with dozens of toxic chemicals sprayed on them. So the question comes down to personal health and protection of bees, birds, fish and butterflies. Is that not more important than expanding the profit margins of a few blueberry barons and crop dusters?

Jody Spear is an editor and writer who lives in Harborside.

<http://bangordailynews.com/2015/08/13/opinion/blueberries-sprayed-or-unsprayed-consider-the-pollinators-and-people-in-the-field/> (<http://bangordailynews.com/2015/08/13/opinion/blueberries-sprayed-or-unsprayed-consider-the-pollinators-and-people-in-the-field/>) printed on August 20, 2015

Maine asking residents to sign up to dispose of pesticides

 pressherald.com/2015/08/16/maine-asking-residents-to-sign-up-to-dispose-of-pesticides/

The Associated Press

AUGUSTA — Maine officials are asking residents to sign up for a program to safely dispose of banned pesticides and unusable chemicals.

The program is free and available to owners of homes and family-owned farms and greenhouses. Residents must [register](#) by Sept. 25. Collection sites are set for Presque Isle, Bangor, Augusta and Portland in October.

Search photos available for purchase: [Photo Store](#) →

The Maine Department of Agriculture, Conservation and Forestry's Board of Pesticides Control and the Maine Department of Environmental Protection are running the program. Conservation department Commissioner Walt Whitcomb says the program is important to keep potentially harmful chemicals from contaminating land and water resources, such as drinking water.

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Connections

Free disposal of banned, unusable pesticides offered



[Connections](#) | Thursday, August 13, 2015

AUGUSTA — This October, the Maine Department of Agriculture, Conservation and Forestry's Board of Pesticides Control will team up with the Maine Department of Environmental Protection to help Mainers dispose of banned pesticides or unusable pesticides.

This free disposal program is open to homeowners, family-owned farms and greenhouses. Collection will occur at sites located in Presque Isle, Bangor, Augusta and Portland. To qualify, people must register by Sept. 25.

Gov. Paul R. LePage is urging Mainers to take advantage of this opportunity to protect the environment and save money through this once a year collection event that highlights cooperation between government agencies. "This is an opportunity for Mainers to dispose of unusable pesticides properly and at no expense," said Governor LePage. "Through consolidated collections at four central locations and the use of in-house resources and expertise, disposal costs are reduced to about \$2 per pound. That is a great value for Maine taxpayers lowers costs and helps protect the environment."

It's not unusual for homes and farms to have unintentional hazardous waste — banned pesticides or pesticides that have become caked, frozen, or otherwise rendered unusable — sitting around in basements, garages, or barns. These chemicals can be difficult and expensive to dispose of; DACF Commissioner Walt Whitcomb stressed the importance of proper disposal of banned or unwanted pesticides.

"It's important for the protection of public, wildlife, and environmental health that these products are dealt with properly and not thrown in the trash or down the drain, where they can contaminate land and water resources, including drinking water," said Commissioner Whitcomb.

"People holding these chemicals should contact the BPC as soon as possible to register for the October collection."

“Providing Maine residents with an easy and no cost solution to properly dispose of pesticides gives Mainers the unique opportunity to make a positive impact on our environment and public health,” said Maine DEP Commissioner Patricia Aho. “The collection events cover the State and are held in Presque Isle, Bangor, Augusta and Portland, providing accessible methods of collection and future disposal.”

The collected chemicals go to out-of-state disposal facilities licensed by the federal Environmental Protection Agency where they are incinerated or reprocessed.

Registration is mandatory — drop-ins are not permitted.

FMI, register: <http://www.thinkfirstspraylast.org>, or call 207-287-2731.

FMI: <http://www.thinkfirstspraylast.org>, <http://www.maine.gov/dep>.

409 High Street - P.O. Box 1171 - Ellsworth, ME 04605 - Phone: 207-667-0002 Fax: 207-667-0627



Mainers Urged to Sign Up for Free Disposal of Banned, Unusable Pesticides

August 13th, 2015 | by Kimberly Gaudin

AUGUSTA — This October, the Maine Department of Agriculture, Conservation and Forestry (DACF) Board of Pesticides Control (BPC) will team up with the Maine Department of Environmental Protection (DEP) to help Mainers dispose of banned pesticides or unusable pesticides.

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events cover the State and are held in Presque Isle, Bangor, Augusta and Portland, providing accessible methods of collection and future disposal.”

The collected chemicals go to out-of-state disposal facilities licensed by the federal Environmental Protection Agency where they are incinerated or reprocessed.

Registration by September 25, 2015, is mandatory—drop-ins are not permitted. To register, get details, and learn important information about the temporary storage and transportation of obsolete pesticides, go to the BPC Web site at <http://www.thinkfirstspraylast.org> or call 207-287-2731.

The Maine Obsolete Pesticides Collection Program, jointly sponsored by the BPC and DEP, and paid for entirely through pesticide product registration fees, has kept more than 90 tons of pesticides out of the waste stream since its start in 1982.

For more information on the Maine Board of Pesticides Control, go to: <http://www.thinkfirstspraylast.org> (<http://www.thinkfirstspraylast.org>)
For more information on the Maine Department of Environmental Protection, go to: <http://www.maine.gov/dep> (<http://www.maine.gov/dep>)

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