

# Exposure of wild mammals to glyphosate, AMPA, and glufosinate: a case for “emerging organic contaminants”?

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### *Text A1: Molecular identification of small mammal species*

Total genomic DNA was extracted from 10-25 mg of ear tissue using the DNeasy Blood and Tissue kit (Qiagen, Courtaboeuf, France) according to the manufacturer's recommendations (pp 28-30, version 07/2006). Each sample was processed independently in an automated manner using the QIAcube robot (Qiagen). The DNA concentration was then measured using a NanoVue Plus spectrophotometer (Biochrom). The DNA extracts were stored at -20 °C until DNA amplification.

All of the DNA extracts were then amplified into an approximately 900 bp-long fragment (excluding primers) of the *cytochrome b* gene. We used the primers CytB Uni fw 5' – TCATCMTGATGAAAYTTYGG – 3' and CytB Uni rev 5' – ACTGGYTGDCCBCCRATTCA – 3' published in Schlegel et al. (2011). Amplifications were performed in 50 µL reactions containing 1× HotStart Taq Master Mix (Qiagen), 0.32 µM of each primer, 0.5 ng/µL of bovine serum albumin, 0.75 mM of MgCl<sub>2</sub>, and 5 µL of extracted DNA (10-70 ng/µL). The PCR program consisted of an activation step of 15 min at 95 °C, followed by 40 cycles of denaturation at 94 °C during 30 s, annealing at 53 °C during 45 s, and extension at 72 °C during 1 min. A final extension was performed at 72 °C for 10 min. Amplification reactions were performed using an Eppendorf Mastercycler DNA Engine.

The PCR products were separated and visualized using the QIAxcel device and a QIAxcel DNA Screening kit (Qiagen). The amplified products were purified using the Illustra GFX PCR DNA and Gel Band Purification Kit (GE Healthcare) according to the manufacturer's instructions. Direct sequencing of the PCR products was performed with an automated sequencer (Applied Biosystems Seqstudio Genetic Analyzer). All of the samples were sequenced with the primers employed for the PCR reactions. The obtained DNA sequences were submitted to GenBank via the BLAST algorithm (<http://blast.ncbi.nlm.nih.gov/Blast.cgi>). A query sequence was then assigned to a given species when identity and coverage matched the database sequence with a threshold of at least 99% for only one species.

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*Text A2: Reagents and procedures used for the chemical analyses of glyphosate, AMPA and glufosinate*

**Chemicals and Reagents**

Methanol Pesti-S grade, acetonitrile, ammonium acetate and water ULC-MS grade were purchased from Biosolve (Dieuze, France). Sodium dodecyl sulfate, Fmoc chloride, sodium tetraborate decahydrate and glyphosate, glufosinate ammonium, aminomethylphosphonic acid and glyphosate-1,2-<sup>13</sup>C<sub>2</sub>,<sup>15</sup>N standards were purchased from Sigma Aldrich (Diegem, Belgium).

**Sample preparation**

To differentiate compounds biologically incorporated into hair from chemicals externally deposited on the hair surface due to contaminated air or dust, the samples were decontaminated with sodium dodecyl sulfate (SDS) solution and methanol (Duca et al. 2014). This procedure was developed to be as “universal” as possible, and was tested on a large panel of chemicals with different physicochemical properties including rather hydrophilic chemicals. The two steps (SDS and methanol) were found to be the best compromise to remove both lipophilic and hydrophilic chemicals from hair surface. Importantly, SDS solution being an aqueous solution (5% SDS / 95% water), it is therefore well adapted to remove hydrophilic compounds such as GLU, GLY and AMPA.

Note that in other studies where hair samples were washed prior to analyses of GLY, Hooper et al. (2022) decontaminated hair of bats using ultrapure (MilliQ) water and subsequently isopropanol, and Alvarez et al. (2022) used dichloromethane twice to wash human hair samples.

**Analysis of glyphosate, glufosinate and AMPA in hair**

After decontamination, the samples (50 mg) were spiked with 5 µL of internal standard solution at 1 mg/L, and 1 mL of water was added before overnight extraction at 40 °C with 350 rpm agitation. The supernatants were evaporated to dryness at 50 °C under N<sub>2</sub> flow, and 100 µL of borate buffer and Fmoc-Cl were added before derivatization and injection into the LC-MS/MS Waters system Acquity UPLC H-class system equipped with a Waters Acquity BEH C18 column (100 × 2.1 mm, 1.7 µm particle

size) and with a binary mobile phase consisting of ammonium acetate 10mM in water (A) and acetonitrile (B). The flow rate was initially set at 0.4mL/min with 98% A and 2% B and reached 2% A and 98 B after 6 min. From 6.0 to 9min the column was re-equilibrated to 98% A and 2% B. The UPLC system was coupled to Waters Xevo TQ-S triple quadrupole mass spectrometer. With each analytical run, quality controls consisting of hair samples supplemented at several concentrations (0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, and 100 pg/mg) were used to control for possible sensitivity drift, and a blank sample (sample without the target chemicals) was used to verify possible cross-contamination. Since field samples were not available in sufficient amount to conduct method validation, it has to be conducted on blank samples from laboratory animals supplemented with standards. The slopes of the calibration curves were 13.56, 6.31 and 10.68 for GLU, GLY and AMPA respectively. The corresponding  $R^2$  values were all > 0.998.

The concentrations are expressed as pg/mg hair. The limits of quantification (LOQ) and lowest detected values (Minimum) are presented in Table 1. The LOQ was determined as the lowest concentration level presenting variability and accuracy < 25%. The estimation of the limit of detection (LOD, the lowest concentration of a substance that can be reliably detected by the analytical method) can be done through various experimental and computational approaches, and choices must be made according to the type and the objective of the analytical method (Evard et al. 2016b, 2016a). We did not apply specific experiments and calculations to compute the LOD in this study owing to several reasons: (1) the purpose of the study was not focused on an analytical method development and validation; (2) high performance and resolution of current instrumentation and modes hamper the use of methods based on signal-to-noise to estimate the LOD; (3) the analyses were not run within a framework requiring a specific guideline to be followed; and (4) no critical decision has to be based on the LOD. As described above, the analytics were based on up-to-date protocols and materials and followed the general principles of metrology (such as inclusion of blank samples and over 5 calibration or quality control levels, among others). The accuracy and sensitivity of the method were not fully computed but the inclusion of blanks and pretty low

concentrations in standards (i.e. 0.1 and 0.2 pg/mg) limits the potential for bias towards false positive. All values above the lowest analytical detected value were included as “detects” contrary to “nondetects”. Importantly, only one concentration was reported below the lowest concentration in quality controls (the minimum GLY concentration, see Table 1). All reported concentration values, involving values between the LOQ and the lowest detected value, were included as continuous data. The use of concentrations below the LOQ has been shown to be a suitable method preferable to the absence of data, which shows better efficiency in terms of bias and precision than several other established methods (Keizer et al. 2015).

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*Text A3: Approaches of reverse dosimetry to assess the risk for deleterious effects in small mammals*

In this part of the work, reverse dosimetry approaches have been applied to estimate the daily dose intake of small mammals from the concentrations of glyphosate (GLY), AMPA or glufosinate (GLUF) measured in hair, and several types of data that may be useful for applying dose reconstruction processes have been used. Concentrations in mammal body fluids and hair, residues in viscera and body burden in small mammals, and toxicokinetics in small mammal blood have been collected from the literature. Several approaches of back-calculations were thus applied depending on the type of input data and the different approaches were computed under several assumptions in cases with a lack of available data.

For GLY, four different approaches have been applied on the basis of data about (1) concentrations in human urine and hair (Alvarez et al. 2022), (2) body burden in rats 7 days after dose administration (Brewster, 1991), (3) toxicokinetics in rat blood (Anadón et al. 2009; Kim et al. 2023), (4) residues of GLY in the viscera and body of wild small mammals in a field study (Newton et al. 1984), and (5) equations for fast-elimination chemicals that relate concentrations in hair in rats and the level of exposure, taking pharmacokinetics into account (Faÿs et al. 2023). For GLUF, one approach could be proposed on the basis of toxicokinetics in rat blood (Joint FAO/WHO Meeting on Pesticide Residues (JMPR) et al. 2012). The body weights of small mammals were obtained from actual morphometrics measured in our experiment by weighing individuals in which residues of GLY, AMPA and GLUF were measured (Sup Info Annex 2). Data concerning urinary excretion percentage of GLY were obtained in documents released by the EFSA and recent reviews (Connolly et al. 2020; EFSA 2015a; Peillex and Pelletier 2020). The concentrations of GLY in the viscera and body reported in Newton et al. (1984) for shrews (carnivores), deermice (omnivores) and voles (herbivores) were used separately according to diet preference to compute reverse dosimetry in shrews (carnivores), wood mice, house mice and bank voles (omnivores), and common voles (herbivores), respectively. The food intake of the



different species was computed using the mean food intake of the different items provided by Crocker et al. (2002). The mean food intake of arthropods and cereal seeds provided for the wood mouse has been used for the wood mouse and the house mouse; the mean food intake of arthropods and earthworms provided for the common shrew has been used for the greater white-toothed shrew; and the mean food intake of grasses and forbs provided for the field vole has been used for the common vole (Crocker et al. 2002). The assumptions that had to be made to allow the calculations were that the distribution was equivalent between body parts and hair, that the concentration in hair was equivalent to the concentration in plasma/blood and proportional to the administered dose, and that the concentration in viscera reflected the concentration in the diet. These assumptions, if not verified, might, however, be considered acceptable according to current knowledge about GLY pharmacokinetics. It is known that *“absorbed GLY is poorly metabolised, widely distributed in the body, does not undergo enterohepatic circulation and is rapidly eliminated”* (EFSA 2015a). Like GLY, GLUF is distributed ubiquitously in the body rapidly after administration and is mostly excreted in faeces and urine (Joint FAO/WHO Meeting on Pesticide Residues (JMPR) et al. 2012). Chemicals are mostly incorporated into living hair bulb cells from the bloodstream, and residue concentrations in hair are representative of the internal dose during the time of hair sample growth (Appenzeller et al. 2017; Faÿs et al. 2023). In a field study where GLY was aerially applied at 3.3 kg a.s./ha in a forest, the concentrations measured in the remainder of small mammal bodies (without viscera) were of the same order of magnitude as the maximum concentrations measured here in hair; owing that in the EU the maximum field application of GLY in cropped fields is comparable (4.32 g a.s./ha) (Newton et al. 1984). Newton et al. (1984) considered concentrations in viscera as reflecting intake and reported that *“GLY in the viscera of herbivores was roughly equal to or somewhat below concentrations found in litter and ground cover”*.

The dose of GLY was compared with five toxicological thresholds. Three of these thresholds were regulatory thresholds: the short-term dietary NOEL (no observed effect level, 150 mg active substance/kg body weight), the chronic 21 day NOAEL, which has the same value as the reproductive

NOAEL (no observed adverse effect level, 351 mg a.s./kg bw/d), and the long-term NOAEL (maternal and developmental NOAEL, which is the same than long-term NOAEL for terrestrial vertebrates, 50 mg a.s./kg bw/d) (EFSA, 2015a; PPDB, <http://sitem.herts.ac.uk/>). The No Mortality Dose to the Oregon vole (NOAEL Acute toxicity (Intraperitoneal), 450 mg a.s./kg bw) was also used to consider a wild species (McComb et al. 2008). Some more recent publications highlighted that the harmful effects of GLY were detected below regulatory limits (e.g. within the spectrum of acceptable daily intake) (Cai et al. 2017; Clair et al. 2012; Mesnage et al. 2015). We therefore added a “chronic low-dose” limit, with a value of 5 mg a.s./kg bw/d obtained from studies showing effects on reproductive development, endocrine disruption, maternal behaviour, neuroplasticity and the gut microbiota in rats (Dechartres et al. 2019; Romano et al. 2010).

The dose of GLUF was compared to four available toxicological thresholds: the acute oral LD50 (median lethal dose; 416 mg/kg bw), the short-term dietary NOEL (64 mg a.s./kg bw), the chronic 21 days NOAEL (6.3 mg a.s./kg bw/d) and the long-term NOAEL (2 mg a.s./kg bw/d) (Joint FAO/WHO Meeting on Pesticide Residues (JMPR) et al. 2012; PPDB, <http://sitem.herts.ac.uk/>).

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*Text A4: Statistical outputs of the Tarone-Ware tests*

```
> twoSampleLinearRankTestCensored(x = TAB$GLY, x.censored =
TAB$GLY.censored,
+ y = TAB$AMPA, y.censored =
TAB$AMPA.censored,
+ test = "tarone-ware")
Results of Hypothesis Test
Based on Censored Data
-----
Null Hypothesis: Fy(t) = Fx(t)
Alternative Hypothesis: Fy(t) != Fx(t) for at least one t
Test Name: Two-Sample Linear Rank Test:
Tarone-Ware Test
with Hypergeometric Variance
Censoring Side: left
Censoring Level(s): x = 0.018
y = 0.24
Data: x = TAB$GLY
y = TAB$AMPA
Censoring Variable: x = TAB$GLY.censored
y = TAB$AMPA.censored
Sample Sizes: nx = 61
ny = 61
Percent Censored: x = 36.1%
y = 49.2%
Test Statistics: nu = 58.055344
var.nu = 1504.925791
z = 1.496527
P-value: 0.1345163
```

```
> twoSampleLinearRankTestCensored(x = TAB$GLY, x.censored =
TAB$GLY.censored,
+ y = TAB$GLUF, y.censored =
TAB$GLUF.censored,
+ test = "tarone-ware")
Results of Hypothesis Test
Based on Censored Data
-----
Null Hypothesis: Fy(t) = Fx(t)
Alternative Hypothesis: Fy(t) != Fx(t) for at least one t
Test Name: Two-Sample Linear Rank Test:
Tarone-Ware Test
with Hypergeometric Variance
Censoring Side: left
Censoring Level(s): x = 0.018
y = 1.161
Data: x = TAB$GLY
y = TAB$GLUF
Censoring Variable: x = TAB$GLY.censored
y = TAB$GLUF.censored
Sample Sizes: nx = 61
ny = 61
Percent Censored: x = 36.1%
y = 55.7%
Test Statistics: nu = 13.9088437
var.nu = 1304.2735588
```

P-value: z = 0.3851294  
0.7001415

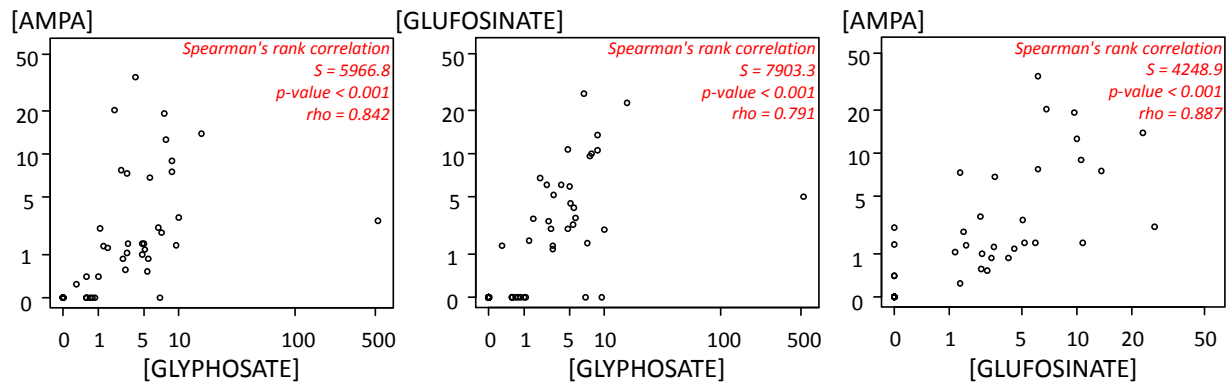
```
> twoSampleLinearRankTestCensored(x = TAB$AMPA, x.censored =  
TAB$AMPA.censored,  
+ y = TAB$GLUF, y.censored =  
TAB$GLUF.censored,  
+ test = "tarone-ware")
```

Results of Hypothesis Test  
Based on Censored Data  
-----

Null Hypothesis:	$F_y(t) = F_x(t)$
Alternative Hypothesis:	$F_y(t) \neq F_x(t)$ for at least one t
Test Name:	Two-Sample Linear Rank Test: Tarone-Ware Test with Hypergeometric Variance
Censoring Side:	left
Censoring Level(s):	x = 0.24 y = 1.161
Data:	x = TAB\$AMPA y = TAB\$GLUF
Censoring Variable:	x = TAB\$AMPA.censored y = TAB\$GLUF.censored
Sample Sizes:	nx = 61 ny = 61
Percent Censored:	x = 49.2% y = 55.7%
Test Statistics:	nu = -33.2689131 var.nu = 1197.6199535 z = -0.9613446
P-value:	0.3363789

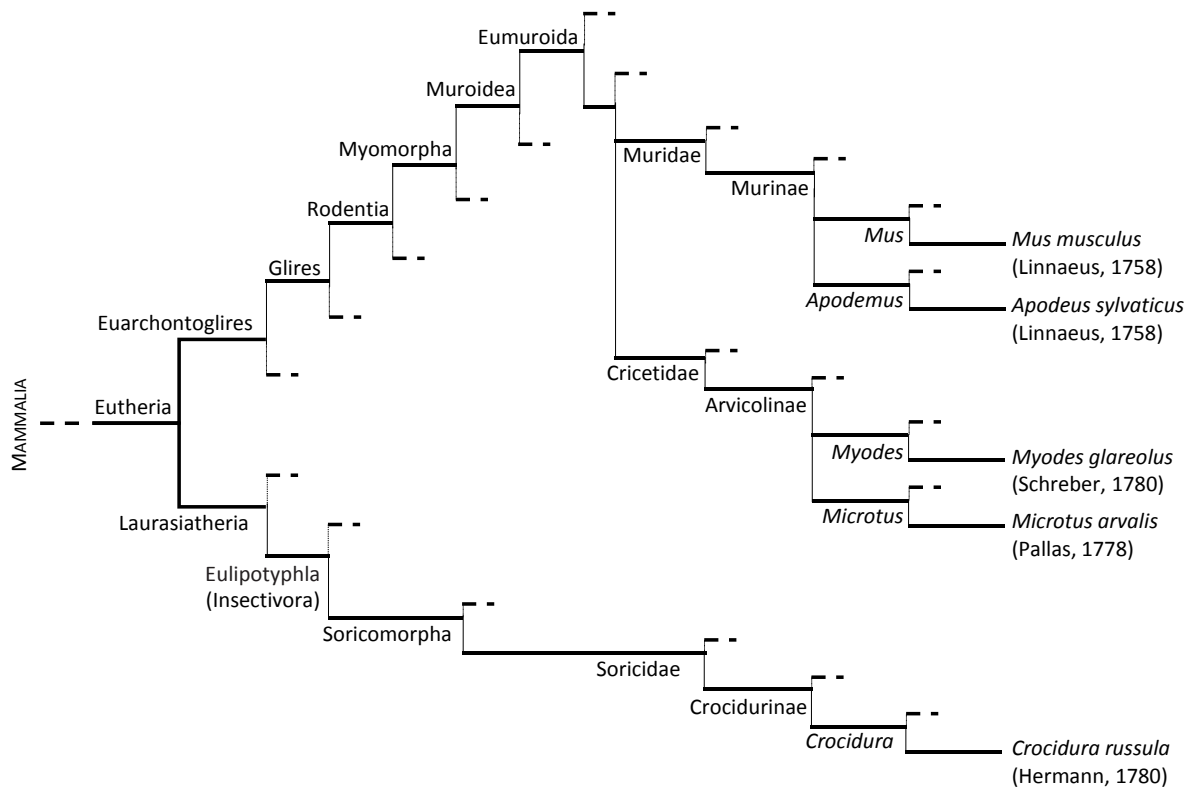
**Figure A1. Correlations between the concentrations of glyphosate, AMPA, and glufosinate in small mammal hair.**

The concentrations are expressed in pg/mg. Nondetects are set to 0.



**Figure A2. Simplified phylogenetic tree of the rodents and shrews included in the study.**

Adapted from (Brace et al. 2016; Springer 2004; Swanson et al. 2019).



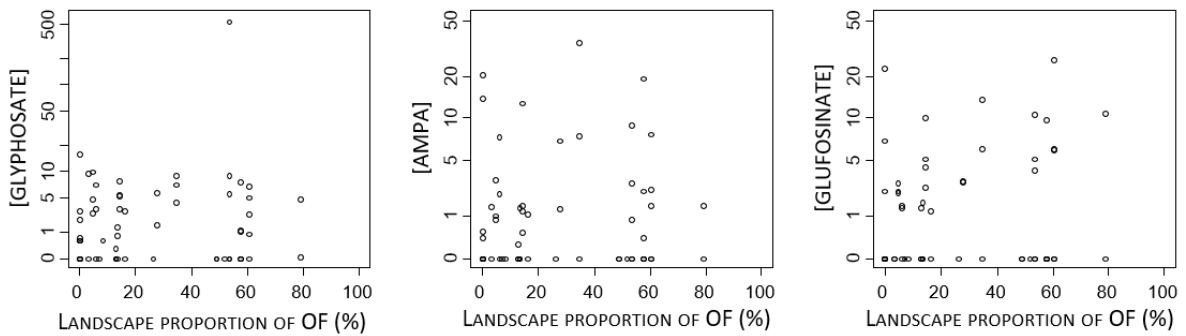
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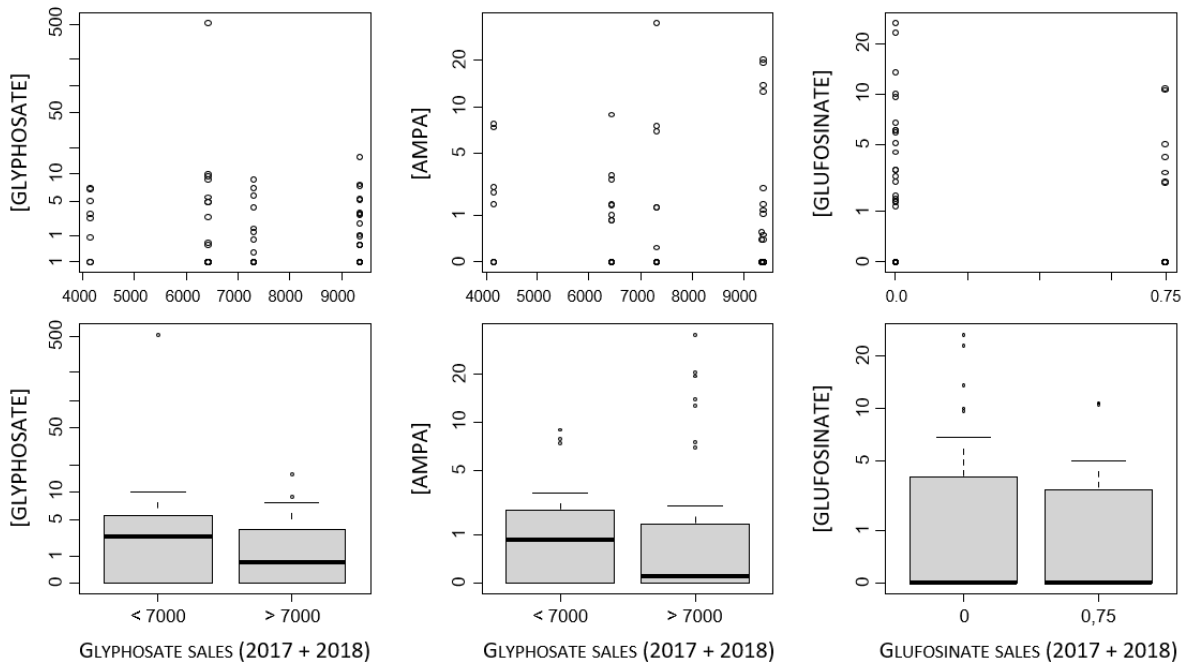
**Figure A3. Concentrations of glyphosate, AMPA, and glufosinate in the hair of small mammals with nondetects set to 0 according to the proportion of organic farming in the landscape as a continuous factor (a) and to the proxy of treatment intensity at township scale as a continuous factor and as a categorical factor (b).**

The concentrations are expressed in pg/mg. Nondetects are set to 0. Statistics were performed via the Wilcoxon-Mann-Whitney test or the Kruskal-Wallis test depending on the number of levels of the factor of concern and Spearman's rank correlation test for continuous factors. No significant differences were found.

**a) PROPORTION OF ORGANIC FARMING (OF) IN LANDSCAPE as a continuous factor**



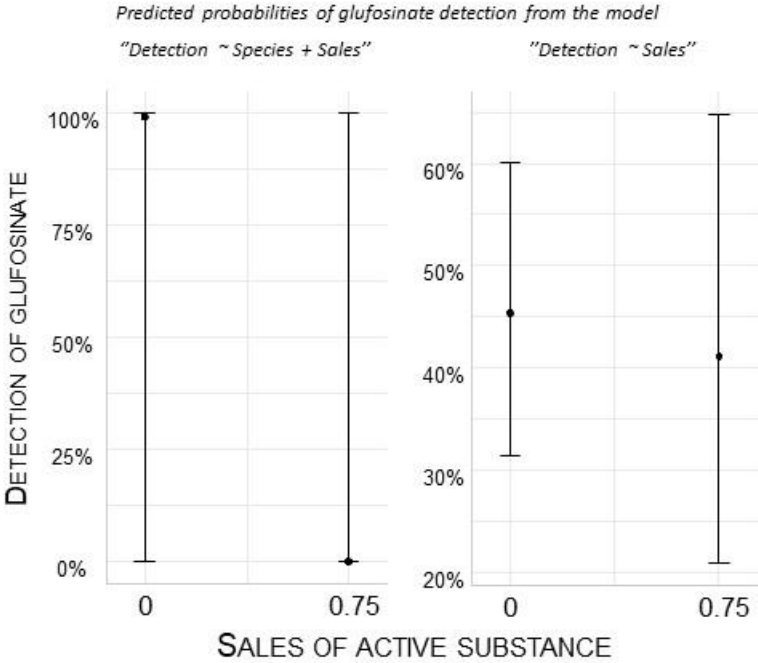
**b) SALES OF ACTIVE SUBSTANCE IN THE TOWNSHIP as a continuous factor and by category**





**Figure A4. Probabilities of detection of glufosinate in the hair of small mammals according to the sales of the active substance at the township scale.**

The predicted probabilities of detection were obtained from the statistical binomial models "Detection ~ species + sales"(left panel) and "Detection ~ sales" (right panel).



**Table A1. Overview of sample size.**

Abbreviations: OF=Organic farming, CF=Conventional farming, NT=Not targeted by treatments, T=Targeted by treatments, AS=Active substance.

Habitat	Species	Wood mouse <i>Apodemus sylvaticus</i>	Greater white-toothed shrew <i>Crocidura russula</i>	Common vole <i>Microtus arvalis</i>	Bank vole <i>Myodes glareolus</i>	House mouse <i>Mus musculus</i>	Total
<b>Farming</b>							
<b>Cereal</b>							
	CF	5	2	7		1	15
	OF/CF	4		1			5
	OF			1		1	2
	Total	9	2	9		2	<b>22</b>
<b>Hedgerow or woodlot</b>							
	CF	7	7	2	10		26
	OF/CF		3	1	1		5
	OF	2	2	4			8
	Total	9	12	7	11		<b>39</b>
Total CF		12	9	9	10	1	<b>41</b>
Total OF/CF		4	3	2	1		<b>10</b>
Total OF		2	2	5		1	<b>10</b>
Total « NT »		9	12	8	11	1	<b>41</b>
Total « T »		9	2	8		1	<b>20</b>
<b>Landscape OF proportion</b>							
	0-50%	11	9	8	11	1	<b>40</b>
	50-100%	7	5	8		1	<b>21</b>
<b>AS sales GLY</b>							
	< 7000	6	4	11	2	2	<b>25</b>
	> 7000	12	10	5	9		<b>36</b>
<b>AS sales GLUF</b>							
	0	15	11	7	11		<b>44</b>
	0.75	3	3	9		2	<b>17</b>
<b>Total</b>		<b>18</b>	<b>14</b>	<b>16</b>	<b>11</b>	<b>2</b>	<b>61</b>

**Table A2. Statistical outputs of binomial GLMs used to investigate the influence of explanatory factors on the detection frequencies of glyphosate, AMPA, and glufosinate in the hair of small mammals.**

The binomial models were computed as “Detection ~ Species” and “Detection ~ Species + Habitat or Farming or Target treatment or Landscape OF proportion or AS sales”. \* alternative model with the factor “glufosinate sales” alone without the factor “species”. Abbreviations: OF=Organic Farming, CF=Conventional farming, Apsy=Apodemus sylvaticus (Wood mouse), Crru=Crocidura russula (Greater white-toothed shrew), Miar=Microtus arvalis (Common vole), Mumu=Mus musculus (House mouse), Mygl=Myodes glareolus (Bank vole), NT=Not targeted, T=Targeted, AS=Active substance, p=p-value. Significant p-values are indicated in bold.

Factor	Levels	n	GLYPHOSATE				AMPA				GLUFOSINATE									
			Deviance	Df	p	Odds Ratio	95% CI (lower, upper)	p	Deviance	Df	p	Odds Ratio	95% CI (lower, upper)	p	Deviance	Df	p	Odds Ratio	95% CI (lower, upper)	p
Species			20.484	56	<b>&lt;0.001</b>				32.464	56	<b>&lt;0.001</b>				39.079	56	<b>&lt;0.001</b>			
Apsy	18				Reference	---	---				Reference	---	---				Reference	---	---	
Crru	14				2.00	(0.48, 8.76)	0.344				0.58	(0.07, 3.55)	0.571				0.62	(0.03, 7.14)	0.700	
Miar	16				30.0	(4.48, 612)	<b>0.003</b>				24.5	(4.56, 208)	<b>&lt;0.001</b>				34.7	(6.05, 321)	<b>&lt;0.001</b>	
Mumu	2				2.00	(0.07, 56.9)	0.644				3.50	(0.12, 103)	0.411				8.00	(0.25, 273)	0.200	
Mygl	11				20.0	(2.86, 414)	<b>0.010</b>				35.0	(4.73, 753)	<b>0.003</b>				80.0	(9.16, 1999)	<b>&lt;0.001</b>	
Habitat			0.191	55				0.018	55	0.892				0.182	55	0.669				
Cereal	22				0.662	Reference	---	---			Reference	---	---				Reference	---	---	
Hedgerows	39				0.71	(0.14, 3.31)	0.663				1.12	(0.22, 6.59)	0.893				1.50	(0.24, 12.3)	0.673	
Farming			3.273	54	0.195			3.364	54	0.186				1.496	54	0.473				
OF	10				Reference	---	---				Reference	---	---				Reference	---	---	
OF/CF	10				6.98	(0.57, 217)	0.169				12.7	(0.79, 4745)	0.102				5.83	(0.35, 133)	0.200	
CF	41				6.96	(0.84, 174)	0.119				6.35	(0.65, 172)	0.161				2.49	(0.30, 27.1)	0.400	
Treatment			0.000	55	0.999			0.030	55	0.863				0.016	55	0.900				
NT	41				Reference	---	---				Reference	---	---				Reference	---	---	
T	20				1.00	(0.22, 4.47)	0.999				1.15	(0.23, 5.63)	0.863				0.90	(0.14, 5.12)	0.900	
Landscape OF			0.331	55	0.565			0.031	55	0.860				0.013	55	0.908				
0-50%	40				Reference	---	---				Reference	---	---				Reference	---	---	
50-100%	21				0.67	(0.16, 2.60)	0.568				1.14	(0.24, 5.18)	0.860				0.91	(0.15, 4.88)	0.908	
AS sales			0.009	55	0.925			1.257	55	0.262				5.266	55	<b>0.022</b>				
														(0.091)*	(59)*	(0.763)*				
Low category	25				Reference	---	---				Reference	---	---				Reference	---	---	
High category	36				1.07	(0.26, 4.58)	0.925				2.66	(0.51, 21.9)	0.289				0.00	NA	> 0.900	
																	(0.84)*	(0.26, 2.59)*	(0.800)*	

**Table A3. Statistical outputs of the GLMs used to investigate the influence of explanatory factors on the concentrations of glyphosate, AMPA, and glufosinate in the hair of small mammals.**

The models were computed as “log(concentration) ~ Species” and “log(concentration) ~ Species + Habitat or Farming or Target treatment or Landscape OF proportion or AS sales”. Abbreviations: OF=Organic Farming, CF=Conventional farming, Apsy=Apodemus sylvaticus (Wood mouse), Crru=Crocidura russula (Greater white-toothed shrew),

Miar=*Microtus arvalis* (Common vole), Mumu=*Mus musculus* (House mouse), Mygl=*Myodes glareolus* (Bank vole), NT=Not targeted, T=Targeted, AS=Active substance, p=p-value. Significant p-values are indicated in bold.

Factor	GLYPHOSATE										AMPA						GLUFOSINATE											
	Levels	Factor			Model			Levels			F	Df	p	R <sup>2</sup>	R <sup>2</sup> <sub>Adj</sub>	Estimate	SE	p	F	Df	p	R <sup>2</sup>	R <sup>2</sup> <sub>Adj</sub>	Estimate	SE	p		
		n	F	Df	p	R <sup>2</sup>	R <sup>2</sup> <sub>Adj</sub>	Estimate	SE	p																	F	Df
Species		1.643	4	0.186	0.162	0.162	0.063				1.110	4	0.373	0.146	0.146	0.014				1.008	4	0.425	0.155	0.155	0.002			
	Apsy	6						Reference	---	---							Reference	---	---						Reference	---	---	
	Crru	7						-0.840	0.815	0.310							-0.322	1.09	0.770						-1.58	1.06	0.150	
	Miar	15						0.723	0.707	0.314							1.08	0.715	0.142						-0.546	0.657	0.415	
	Mumu	1						0.729	1.58	0.648							0.333	1.41	0.815						0.310	1.06	0.773	
	Mygl	10						0.701	0.756	0.360							1.06	0.746	0.169						-0.819	0.670	0.235	
Habitat		4.37	1	<b>0.044</b>	0.098	0.260	0.148				0.750	1	0.395	0.025	0.171	0.005				2.759	1	0.112	0.098	0.253	0.075			
	Cereal	14						Reference	---	---							Reference	---	---						Reference	---	---	
	Hedgerows	25						1.20	0.572	<b>0.044</b>							-0.521	0.602	0.395						-0.716	0.431	0.112	
Farming		0.017	2	0.983	0.001	0.162	0.006				0.725	2	0.495	0.049	0.195	0.000				0.087	2	0.917	0.007	0.162	0.000			
	OF	5						Reference	---	---							Reference	---	---						Reference	---	---	
	OF/CF	6						-0.184	1.05	0.861							0.800	0.988	0.426						-0.194	0.750	0.799	
	CF	28						-0.146	0.890	0.871							0.022	0.838	0.979						-0.252	0.606	0.682	
Treatment		0.232	1	0.633	0.006	0.168	0.042				0.750	1	0.395	0.025	0.171	0.005				2.759	1	0.112	0.098	0.253	0.075			
	NT	27						Reference	---	---							Reference	---	---						Reference	---	---	
	T	12						-0.289	0.600	0.633							0.521	0.602	0.395						0.716	0.431	0.112	
Landscape OF		0.151	1	0.700	0.004	0.166	0.039				0.754	1	0.393	0.025	0.171	0.005				3.454	1	0.077	0.119	0.274	0.101			
	0-50%	27						Reference	---	---							Reference	---	---						Reference	---	---	
	50-100%	12						0.227	0.582	0.700							0.496	0.570	0.393						0.790	0.425	0.077	
AS sales		0.104	1	0.749	0.003	0.165	0.038				0.595	1	0.448	0.020	0.166	0.000				0.884	1	0.358	0.034	0.189	0.000			
	Low category	17						Reference	---	---							Reference	---	---						Reference	---	---	
	High category	22						-0.172	0.535	0.749							0.416	0.539	0.448						-0.454	0.483	0.358	

