**Supplementary Information**

Combination of in situ feeding rate experiments and chemical body burden analysis to assess the influence of micropollutants in wastewater on *Gammarus pulex*

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# Feeding rate inhibition

## Preparation of cages

High-density polyethylene (HDPE) boxes, which measured 5 cm in height and 3.6 cm in diameter were used to build suitable cages for enclosure of single specimen. To ensure steady perfusion, holes of approximately 2 cm were cut in lid and bottom of the boxes, which then were covered with gauze of 900 mm mesh size. Cages were numbered and a number of 25 was fixed to a wire, respectively. Before use, the cages were watered in tab water for 24 h.

## Preparation of leaf discs

Senescent but undecomposed leaves of black alder (*Alnus glutinosa* L. Gaertn.) were collected before leaf fall in autumn and stored at -20°C until used. Leaf discs were prepared on the basis of Bundschuh and Schulz (2011) [1]. Two weeks before each experiment, approximately 50 leaves were thawed and conditioned in aerated artificial pond water (APW) (prepared according to Naylor et al., (1989) [2]) at 15°C ± 1°C. To facilitate and accelerate the establishment of a microbial community on the leaves, naturally conditioned alder leaves from a small creek were added. After 14  d incubation time, 200 leaf discs measuring 2 cm in diameter were cut with a cork borer. Then, the leaf discs were randomised and distributed in pairs to small, pre-weighed and numbered aluminium bowls. The discs were dried at 60°C to constant weight for approximately 24 h and weighed to the nearest 0.01 mg (UMX Comparator, Mettler-Toledo GmbH, Switzerland). The day before the test, the leaf discs were transferred to the numbered cages and were soaked in APW for 24 h.

## Test organisms

One week before each experiment, the test organisms were obtained from a small creek near Aachen, Germany (50°511 N; 6°81 E). The collected gammarids were visually checked for acanthocephalan parasites. Since infected specimen can show abnormal behaviour, these individuals were not used for the experiment. Afterwards, the remaining organisms were kept in an aerated APW at 15°C ± 1°C and a light-dark cycle of 16:8 h. Preconditioned alder leaves were provided as food.

## Data

Table S1: Measured feeding rates in mg/mg gammarid/day per cage (raw data) for 2015.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **October 2015** | | | **December 2015** | | | |
| **W2** | **W3** | **W5** | **W2** | **W3** | **W4** | **W5** |
| 0.318 | 0.076 | 0.4988 | 0.122 | 0.127 | 0.157 | 0.063 |
| 0.340 | 0.281 | 0.4616 | 0.130 | 0.133 | 0.077 | 0.045 |
| 0.202 | 0.483 | 0.3097 | -0.028 | 0.073 | 0.166 | 0.125 |
| 0.202 | 0.017 | 0.4575 | 0.130 | 0.125 | 0.230 | 0.060 |
| 0.364 | 0.428 | 0.3267 | 0.269 | 0.180 | 0.252 | 0.128 |
| 0.326 | 0.256 | 0.2571 | 0.167 | 0.170 | 0.139 | 0.048 |
| 0.389 | 0.269 | 0.0414 | 0.133 | 0.116 | 0.133 | 0.090 |
| 0.410 | 0.181 | 0.2597 | 0.150 | 0.122 | 0.113 | 0.012 |
| 0.584 | 0.128 | 0.2979 | 0.218 | 0.002 | 0.138 | 0.122 |
| 0.358 | 0.021 | 0.2196 | 0.184 | 0.172 | 0.105 | 0.027 |
| 0.223 | 0.025 | 0.2945 | 0.187 | 0.179 | 0.156 | -0.020 |
| 0.236 | 0.175 | 0.4688 | 0.197 | 0.087 | 0.208 | 0.002 |
| 0.182 | 0.158 | 0.3068 | 0.086 | 0.215 | 0.358 | -0.027 |
| 0.150 | 0.493 | 0.6128 | 0.204 | 0.131 | 0.119 | 0.014 |
| 0.750 | 0.001 | 1.0825 | 0.204 | 0.127 |  | 0.013 |
| 0.262 | 0.239 | 0.2645 | 0.136 | 0.165 |  | 0.100 |
| 0.270 | 0.242 | 0.5655 | 0.112 | 0.395 |  | 0.002 |
| 0.170 | 0.300 | 0.2348 | 0.126 | 0.445 |  | -0.029 |
| 0.135 | 0.237 | 0.3838 | 0.130 | 0.159 |  | 0.020 |
| 0.224 | 0.232 | 0.4988 | 0.256 | 0.185 |  | -0.007 |

Table S2: Measured feeding rates in mg/mg gammarid/day per cage (raw data) for 2016.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **January 2016** | | | **July 2016** | | | |
| **W2** | **W3** | **W4** | **W5** | **W2** | **W3** | **W5** |
| -0.098 | 0.070 | 0.212 | 0.246 | 0.156 | 0.239 | 0.261 |
| -0.029 | 0.126 | 0.151 | 0.220 | 0.075 | 0.301 | 0.240 |
| -0.016 | 0.111 | 0.120 | 0.270 | 0.174 | 0.185 | 0.402 |
| 0.148 | 0.065 | 0.215 | 0.288 | 0.123 | 0.014 | 0.549 |
| -0.116 | 0.016 | 0.176 | 0.412 | 0.137 | 0.164 | 0.237 |
| 0.086 | 0.063 | 0.210 | 0.354 | 0.278 | 0.125 | 0.405 |
| 0.114 | 0.292 | 0.405 | 0.111 | 0.121 | 0.162 | 0.218 |
| 0.125 | 0.103 | -0.055 | -0.074 | 0.201 | 0.244 | 0.335 |
| 0.040 | 0.077 | 0.163 | 0.147 |  | 0.252 | 0.355 |
| 0.106 | 0.202 | 0.177 | 0.222 |  | 0.195 | 0.103 |
| 0.053 | 0.214 | 0.126 | 0.316 |  | 0.208 | 0.425 |
| 0.012 | 0.065 | 0.290 | 0.293 |  | 0.063 | 0.343 |
| 0.119 | -0.051 | 0.149 | 0.283 |  | 0.160 | 0.393 |
| -0.007 | 0.277 | 0.301 | 0.245 |  | 0.269 | 0.387 |
| -0.002 | 0.103 | 0.208 | 0.231 |  | 0.134 | 0.440 |
| -0.062 | 0.130 | 0.171 | 0.311 |  | 0.425 |  |
| 0.103 | 0.121 | -0.195 | 0.217 |  | 0.307 |  |
| -0.026 | 0.194 | 0.276 | 0.221 |  | 0.239 |  |
| 0.047 | 0.035 | 0.182 | 0.310 |  | 0.301 |  |
|  | 0.176 | -0.023 | 0.269 |  | 0.185 |  |

Table S3: Measured feeding rates in mg/mg gammarid/day per cage (raw data) for 2017.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **July 2017** | | | | | **August 2017** | | | | |
| **H1** | **H2** | **W2** | **W3** | **W5** | **H1** | **W1** | **W2** | **W3** | **W4** |
| 0.283 | 0.509 | 0.275 | 0.546 | 0.793 | 0.328 | 0.334 | 0.169 | 0.588 | 0.369 |
| 0.327 | 0.554 | 0.212 | 0.403 | 0.460 | 0.590 | -0.088 | 0.204 | 0.413 | 0.384 |
| 0.218 | 0.250 | 0.036 | 0.481 | 0.454 | 0.251 | 0.319 | 0.370 | 0.241 | 0.291 |
| 0.311 | 0.333 | 0.347 | -0.255 | -0.135 | 0.242 | 0.362 | 0.368 | 0.428 | 0.277 |
| 0.185 | 0.272 | 0.627 | 0.108 | 0.536 | 0.163 | 0.388 | 0.263 | 0.042 | 0.423 |
| 0.152 | 0.517 | 0.660 | 0.275 | 0.232 | 0.463 | 0.742 | 0.365 | 0.509 | 0.498 |
| 0.298 | 0.477 | 0.396 | 0.438 | 0.319 | 0.528 | 0.049 | 0.203 | 0.347 | 0.156 |
| 0.421 | 0.322 | -0.233 | 0.481 | 0.526 | 0.287 | 0.217 | 0.377 | 0.346 |  |
| 0.316 | 0.287 | 0.200 | 0.345 | 0.802 | 0.461 | 0.218 | 0.488 | 0.283 |  |
| 0.358 | 0.213 | 0.328 | 0.226 | 0.448 | 0.283 | 0.253 | 0.353 | 3.694 |  |
| 0.338 | 0.242 | 0.391 | 0.329 | 0.254 | 0.247 | 0.330 | 0.378 | 0.685 |  |
| 0.398 | 0.397 | 0.192 | 0.371 | 0.403 | 0.255 | 0.540 | 0.352 | 0.570 |  |
| 0.211 | 0.155 | 0.005 | 0.150 | 0.200 | -0.001 | 0.266 |  | 0.583 |  |
| 0.247 | 0.410 | 0.326 | 0.377 | 0.364 | 0.052 | 0.251 |  | 0.300 |  |
| 0.216 | 0.266 | 0.376 | 0.328 | 0.607 | 0.125 | 0.195 |  | 1.402 |  |
| 0.270 | 0.548 | 0.216 | 0.134 | 0.132 | -0.005 |  |  | 0.238 |  |
| 0.210 | 0.272 | 0.317 | 0.330 | 0.166 |  |  |  | 0.579 |  |
| 0.285 | 0.543 |  | 0.501 |  |  |  |  |  |  |
| 0.201 | 0.328 |  |  |  |  |  |  |  |  |
|  | 0.309 |  |  |  |  |  |  |  |  |

Table S4: Measured feeding rates in mg/mg gammarid/day per cage (raw data) for 2017.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **October 2017** | | | | | |
| **H1** | **H2** | **W2** | **W3** | **W4** | **W5** |
| 0.245 | 0.567 | 0.887 | 0.465 | 0.326 | 0.480 |
| 0.288 | 0.620 | 0.659 | 1.496 | 0.451 | 0.428 |
| 0.416 | 0.689 | 0.837 | 0.711 | 0.432 | 0.610 |
| 0.399 | 0.606 | 0.020 | 0.371 | 0.530 | 0.823 |
| 0.205 | 0.672 | 1.741 | 0.528 | 0.674 | 0.531 |
| 0.263 | 0.255 | 1.014 | 0.434 | 0.462 | 0.572 |
| 0.184 | 0.220 | 0.441 | 0.484 | 0.234 | 0.656 |
| 0.216 | 0.494 | 0.808 | 0.781 | 0.641 | 0.288 |
| 0.319 | 0.345 | 0.588 | 0.682 | 0.542 | -0.166 |
| 0.386 | 0.299 | 0.127 | 0.479 | 1.599 | 0.630 |
| 0.163 | 0.211 | 0.854 | 0.473 | 0.170 | 0.611 |
| 0.216 | 0.385 | 0.902 | 0.442 | 0.358 | 0.789 |
| 0.323 | 0.369 | 1.204 | 0.460 | 0.796 |  |
| 0.299 | 0.195 |  | 0.133 | 0.545 |  |
| 0.217 | 0.305 |  |  |  |  |
| 0.200 | 0.445 |  |  |  |  |
| 0.311 | 0.457 |  |  |  |  |
| 0.414 |  |  |  |  |  |
| 0.365 |  |  |  |  |  |
| 0.203 |  |  |  |  |  |

Table S5: Measured temperatures (°C) at the sampling sites.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **July 2016** | **July 2017** | **August 2017** | **October 2017** |
| **W1** |  |  | 18.4 |  |
| **H1** |  | 16.8 |  | 10.5 |
| **H2** |  | 19.0 |  | 13.7 |
| **W2** | 18.8 | 18.2 |  |  |
| **W3** | 18.3 | 17.7 | 18.0 | 12.0 |
| **W4** |  |  |  | 16.8 |
| **W5** |  |  |  | 15.9 |

## Statistical Analysis

**October 2015**

One Way Analysis of Variance

Normality Test (Shapiro-Wilk) Failed (P < 0,050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group** | **N** | **Missing** | **Median** | **25%** | **75%** |
| W2 | 19 | 0 | 0,27 | 0,202 | 0,364 |
| W3 | 19 | 0 | 0,237 | 0,0765 | 0,281 |
| W5 | 18 | 0 | 0,308 | 0,259 | 0,476 |

H = 8,723 with 2 degrees of freedom. (P = 0,013)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = 0,013)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

All Pairwise Multiple Comparison Procedures (Dunn's Method):

|  |  |  |  |
| --- | --- | --- | --- |
| **Comparison** | **Diff of Ranks** | **Q** | **P<0,05** |
| W5 vs W3 | 15,74 | 2,934 | Yes |
| W5 vs W2 | 6,529 | 1,217 | No |
| W2 vs W3 | 9,211 | 1,741 | No |

**December 2015**

One Way Analysis of Variance

Normality Test (Shapiro-Wilk) Passed (P = 0,150)

Equal Variance Test: Passed (P = 0,787)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group Name** | **N** | **Missing** | **Mean** | **Std Dev** | **SEM** |
| W2 | 16 | 0 | 0,156 | 0,0667 | 0,0167 |
| W3 | 16 | 0 | 0,133 | 0,0506 | 0,0127 |
| W4 | 10 | 0 | 0,151 | 0,0541 | 0,0171 |
| W5 | 16 | 0 | 0,05 | 0,0511 | 0,0128 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Source of Variation** | **DF** | **SS** | **MS** | **F** | **P** |
| **Between Groups** | 3 | 0,111 | 0,0369 | 11,672 | <0,001 |
| **Residual** | 54 | 0,171 | 0,00316 |  |  |
| **Total** | 57 | 0,281 |  |  |  |

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0,001).

Power of performed test with alpha = 0,050: 0,999

All Pairwise Multiple Comparison Procedures (Bonferroni t-test):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Comparison** | **Diff of Means** | **t** | **P** | **P<0,050** |
| W2 vs. W5 | 0,105 | 5,306 | <0,001 | Yes |
| W2 vs. W3 | 0,0228 | 1,148 | 1 | No |
| W2 vs. W4 | 0,00448 | 0,198 | 1 | Do Not Test |
| W4 vs. W5 | 0,101 | 4,456 | <0,001 | Yes |
| W4 vs. W3 | 0,0183 | 0,809 | 1 | Do Not Test |
| W3 vs. W5 | 0,0827 | 4,159 | <0,001 | Yes |

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison.

**January 2016**

One Way Analysis of Variance

Normality Test (Shapiro-Wilk) Failed (P < 0,050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group** | **N** | **Missing** | **Median** | **25%** | **75%** |
| W2 | 19 | 0 | 0,0402 | -0,0264 | 0,106 |
| W3 | 20 | 0 | 0,107 | 0,065 | 0,189 |
| W4 | 20 | 0 | 0,176 | 0,132 | 0,214 |
| W5 | 20 | 0 | 0,257 | 0,22 | 0,306 |

H = 35,029 with 3 degrees of freedom. (P = <0,001)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0,001)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

All Pairwise Multiple Comparison Procedures (Dunn's Method):

|  |  |  |  |
| --- | --- | --- | --- |
| **Comparison** | **Diff of Ranks** | **Q** | **P<0,05** |
| W5 vs W2 | 42,018 | 5,715 | Yes |
| W5 vs W3 | 26,4 | 3,638 | Yes |
| W5 vs W4 | 15,25 | 2,101 | No |
| W4 vs W2 | 26,768 | 3,641 | Yes |
| W4 vs W3 | 11,15 | 1,536 | No |
| W3 vs W2 | 15,618 | 2,124 | No |

**July 2016**

One Way Analysis of Variance

Normality Test (Shapiro-Wilk) Passed (P = 0,873)

Equal Variance Test: Passed (P = 0,241)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group Name** | **N** | **Missing** | **Mean** | **Std Dev** | **SEM** |
| W2 | 8 | 0 | 0,158 | 0,0614 | 0,0217 |
| W3 | 17 | 0 | 0,203 | 0,0971 | 0,0235 |
| W5 | 15 | 0 | 0,34 | 0,111 | 0,0286 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Source of Variation** | **DF** | **SS** | **MS** | **F** | **P** |
| **Between Groups** | 2 | 0,225 | 0,113 | 11,924 | <0,001 |
| **Residual** | 37 | 0,349 | 0,00944 |  |  |
| **Total** | 39 | 0,574 |  |  |  |

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0,001).

Power of performed test with alpha = 0,050: 0,991

All Pairwise Multiple Comparison Procedures (Bonferroni t-test):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Comparison** | **Diff of Means** | **t** | **P** | **P<0,050** |
| **W5 vs. W2** | 0,181 | 4,267 | <0,001 | Yes |
| **W5 vs. W3** | 0,137 | 3,978 | <0,001 | Yes |
| **W3 vs. W2** | 0,0446 | 1,071 | 0,874 | No |

**July 2017**

One Way Analysis of Variance

Normality Test (Shapiro-Wilk) Failed (P < 0,050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group** | **N** | **Missing** | **Median** | **25%** | **75%** |
| H1 | 19 | 0 | 0,283 | 0,211 | 0,327 |
| H2 | 20 | 0 | 0,325 | 0,268 | 0,501 |
| W1 | 19 | 0 | 0,361 | 0,279 | 0,547 |
| W2 | 17 | 0 | 0,317 | 0,196 | 0,383 |
| W3 | 18 | 0 | 0,338 | 0,207 | 0,449 |
| W5 | 17 | 0 | 0,403 | 0,216 | 0,531 |

H = 8,037 with 5 degrees of freedom. (P = 0,154)

The differences in the median values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0,154)

**August 2017**

One Way Analysis of Variance

Normality Test (Shapiro-Wilk) Failed (P < 0,050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group** | **N** | **Missing** | **Median** | **25%** | **75%** |
| H1 | 16 | 0 | 0,253 | 0,135 | 0,428 |
| W1 | 15 | 0 | 0,266 | 0,217 | 0,362 |
| W2 | 12 | 0 | 0,359 | 0,219 | 0,375 |
| W3 | 17 | 0 | 0,428 | 0,292 | 0,585 |
| W4 | 7 | 0 | 0,369 | 0,277 | 0,423 |

H = 9,147 with 4 degrees of freedom. (P = 0,058)

The differences in the median values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0,058).

**October 2017**

One Way Analysis of Variance

Normality Test (Shapiro-Wilk) Failed (P < 0,050)

Test execution ended by user request, ANOVA on Ranks begun

Kruskal-Wallis One Way Analysis of Variance on Ranks

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group** | **N** | **Missing** | **Median** | **25%** | **75%** |
| H1 | 20 | 0 | 0,276 | 0,208 | 0,354 |
| H2 | 17 | 0 | 0,385 | 0,277 | 0,586 |
| W2 | 13 | 0 | 0,837 | 0,515 | 0,958 |
| W3 | 14 | 0 | 0,476 | 0,44 | 0,689 |
| W4 | 14 | 0 | 0,496 | 0,35 | 0,649 |
| W5 | 12 | 0 | 0,591 | 0,441 | 0,65 |

H = 29,066 with 5 degrees of freedom. (P = <0,001)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0,001)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

All Pairwise Multiple Comparison Procedures (Dunn's Method):

|  |  |  |  |
| --- | --- | --- | --- |
| **Comparison** | **Diff of Ranks** | **Q** | **P<0,05** |
| W2 vs H1 | 44,577 | 4,789 | Yes |
| W2 vs H2 | 25,606 | 2,66 | No |
| W2 vs W4 | 15,72 | 1,562 | Do Not Test |
| W2 vs W3 | 12,505 | 1,243 | Do Not Test |
| W2 vs W5 | 10,827 | 1,035 | Do Not Test |
| W5 vs H1 | 33,75 | 3,538 | Yes |
| W5 vs H2 | 14,779 | 1,5 | Do Not Test |
| W5 vs W4 | 4,893 | 0,476 | Do Not Test |
| W5 vs W3 | 1,679 | 0,163 | Do Not Test |
| W3 vs H1 | 32,071 | 3,523 | Yes |
| W3 vs H2 | 13,101 | 1,389 | Do Not Test |
| W3 vs W4 | 3,214 | 0,326 | Do Not Test |
| W4 vs H1 | 28,857 | 3,17 | Yes |
| W4 vs H2 | 9,887 | 1,049 | Do Not Test |
| H2 vs H1 | 18,971 | 2,201 | No |

# Biota analyses

## Extraction

Previous to the extraction all glass ware was cleaned with acetone (HPLC grade), ethyl acetate (HPLC grade), milli-Q water and methanol (gradient-grade). Then, 900 mg of each sample were thawed and transferred to glass centrifugation tubes (Carl Roth GmbH und Co. KG, Germany). 4 mL of a mixture of acetonitrile and milli-Q (1:1, ν/ν), and 1 mL of hexane were added. Using an Ultra-Turrax the samples were homogenised for 60 s and subsequently vortexed for another 60 s. For the first clean-up step, 800 mg of anhydrous MgSO4 and 200 mg of NaCl were added. To avoid agglomeration the mixture was vortexed for 1  min straightaway and centrifuged for 5 min at 4000 g. Afterwards, the hexane phase was removed with a glass pipette and stored in a cleaned amber vial at -20 °C. In order to improve analytical performance a dispersive SPE (dSPE) was conducted as second clean-up step. Therefore, the acetonitrile supernatant was allocated to glass centrifugation tubes containing 50 mg of primary secondary amine (PSA) and 400 mg of anhydrous MgSO4. The mixture was vortexed for 60 s and centrifuged for 5 min at 4000 g. The supernatant was transferred to a cleaned amber vial and MgSO4/PSA residue was extracted for a second time by adding 2 mL of acetonitrile and centrifuging again. Then, the combined supernatants were dried under a N2-stream at room temperature. Dry samples were reconstituted in 500 μL of MeOH, filtered (PTFE syringe filter, 0.45 μm pores, Chromafil) into an amber vial and stored at -20 °C.

## Chemical analysis

For LC-HRMS analysis, a Thermo Ultimate 3000 system coupled to a Thermo QExactive Plus MS was used. The chromatographic separation was done on a Kinetex C18 EVO column (50 x 2.1 mm, 2.6 μm particle size) using a gradient elution with 0.1% of formic acid (eluent A) and methanol containing 0.1% of formic acid (eluent B) at a flow rate of 300 μL/min. After 1 min of 5% B, the fraction of B was linearly increased to 100% within 12 min and 100% B were kept for 11 min. The eluent flow was diverted to waste and the column was rinsed for 2 min using a mixture of isopropanol + acetone 50:50 / eluent B / eluent A (85% / 10% / 5%) to remove hydrophobic matrix constituents from the column. Finally, the column was re-equilibrated to initial conditions for 5.7 min. The injection volume was 5 μL and the column was operated at 40 °C. The heated ESI source and the transfer capillary were both operated at 300 °C, the spray voltage was 3.8 kV (positive mode) or 3.5 kV (negative mode), the sheath gas flow rate was 45 a.u. and the auxiliary gas flow rate 1 a.u. Separate runs were conducted in positive and negative ion mode combining a full scan experiment (100-1000 m/z) at a nominal resolving power of 70000 (referenced to m/z 200) and data-independent MS/MS experiments at a nominal resolving power of 35000. For the latter, they acquired the data using broad isolation windows of about 50 mu (i.e., m/z ranges 97-147, 144-194, 191-241, 238-288, 285-335, 332-382, 379-429, 426-476) and 280 mu (i.e., m/z ranges 460-740, 730-1010), respectively.

## Data

Table S6: Determined internal concentrations in ng/g wet weight of gammarid tissue.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Substance** | **H1** | **W3** | | **W4** | | **W5** | |
|  | **2017** | **2016** | **2017** | **2016** | **2017** | **2016** | **2017** |
| 1H-Benzotriazole | < LOQ | 1.07 | 2.36 | 1.10 | 3.01 | 1.36 | 4.11 |
| 2-Benzothiazolsulfonic acid | < LOQ | 0.25 | < LOQ | 0.20 | < LOQ | 0.24 | < LOQ |
| 4+5-Methyl-1H-benzotriazole | 0.36 | 0.28 | 1.48 | 0.21 | 1.66 | 0.14 | 1.76 |
| 7-Amino-4-methylcoumarin | 0.34 | 1.38 | 0.85 | 0.84 | 0.72 | 0.35 | 0.07 |
| 7-Diethylamino-4-methylcoumarin | < LOQ | 0.08 | < LOQ | < LOQ | < LOQ | < LOQ | < LOQ |
| Carbamazepine | 0.23 | 0.30 | 0.70 | 0.20 | 1.62 | 0.28 | 1.94 |
| Carbendazim | < LOQ | 0.56 | < LOQ | < LOQ | < LOQ | < LOQ | < LOQ |
| Cetirizin | < LOQ | 0.06 | < LOQ | 0.05 | < LOQ | 0.07 | < LOQ |
| Citalopram | 0.15 | 1.29 | 1.43 | 1.27 | 0.70 | 1.64 | 6.45 |
| Clarithromycin | 0.32 | 0.10 | 0.20 | 0.26 | 0.53 | 0.66 | 0.68 |
| Diuron | < LOQ | 0.10 | 0.21 | 0.08 | 0.19 | 0.07 | 0.18 |
| Ethofumesate | 22.2 | 0.89 | 42.2 | 0.52 | 25.4 | 0.09 | 15.93 |
| Hexa(methoxymethyl)melamine | 0.31 | 0.30 | < LOQ | 0.19 | 0.09 | 0.16 | 0.08 |
| Imidacloprid | 0.22 | 2.90 | 2.17 | 1.33 | 1.28 | 1.46 | 3.42 |
| Mirtazapine | < LOQ | 0.18 | < LOQ | 0.24 | < LOQ | 0.26 | < LOQ |
| Pendimethalin | < LOQ | 2.37 | < LOQ | 2.10 | < LOQ | 2.41 | < LOQ |
| Phenylbenzimidazole sulfonic acid | < LOQ | 0.37 | < LOQ | < LOQ | < LOQ | < LOQ | < LOQ |
| Propiconazole | < LOQ | 0.38 | < LOQ | < LOQ | < LOQ | < LOQ | < LOQ |
| Propranolol | < LOQ | < LOQ | < LOQ | 0.00 | < LOQ | 0.13 | < LOQ |
| Roxithromycin | < LOQ | < LOQ | < LOQ | 0.31 | < LOQ | 0.37 | < LOQ |
| Tebuconazole | < LOQ | 6.45 | < LOQ | 4.38 | < LOQ | 3.24 | < LOQ |
| Terbutryn | 0.07 | 0.13 | 0.22 | 0.17 | 0.35 | 0.19 | 0.36 |
| Thiacloprid | 0.25 | 0.31 | 0.49 | 0.28 | 0.34 | 0.41 | 0.28 |
| Tri(butoxyethyl) phosphate | 8.52 | 5.38 | 1.08 | 3.11 | 4.51 | 3.17 | 4.95 |
| Triphenyl phosphate | 1.50 | 2.42 | 1.24 | 0.85 | 0.16 | 0.73 | 0.23 |
| Valsartan | 0.08 | 0.35 | < LOQ | 0.27 | < LOQ | < LOQ | < LOQ |
| Denatonium | 308 | < LOQ | 466 | < LOQ | 168 | < LOQ | 80.8 |

Table S7: LogKow of substances detected in gammarid tissues. For substances where no experimental value was available, the logKow was estimated using EPIsuite.

|  |  |
| --- | --- |
| **Substance** | **LogKOW** |
| 1H-Benzotriazole | 1.2 |
| 2-Benzothiazolsulfonic acid | -0.9 |
| 4+5-Methyl-1H-benzotriazole | 1.7 |
| 7-Amino-4-methylcoumarin | 1.1 |
| 7-Diethylamino-4-methylcoumarin | 3.2 |
| Carbamazepine | 2.5 |
| Carbendazim | 1.5 |
| Cetirizin | 1.7 |
| Citalopram | 3.5 |
| Clarithromycin | 3.2 |
| Diuron | 2.7 |
| Ethofumesate | 2.9 |
| Hexa(methoxymethyl)melamine | 1.6 |
| Imidacloprid | -0.4 |
| Mirtazapine | 2.9 |
| Pendimethalin | 5.2 |
| Phenylbenzimidazole sulfonic acid | -0.2 |
| Propiconazole | 3.7 |
| Propranolol | 3.5 |
| Roxithromycin | 1.7 |
| Tebuconazole | 3.7 |
| Terbutryn | 3.7 |
| Thiacloprid | 1.3 |
| Tri(butoxyethyl) phosphate | 3.8 |
| Triphenyl phosphate | 4.6 |
| Valsartan | 4.0 |

Table S8: Median acute effect concentrations in μg/L for *Gammarus pulex* and *Daphnia magna* after 48 h. EC50 values without reference (\*) were taken from the Indicate Software Version 1.0.0 (UFZ Leipzig).

|  |  |  |  |
| --- | --- | --- | --- |
| **Substances** | **EC50 *G. pulex*** | **EC50 *D. magna*** | **References** |
| 1H-Benzotriazole |  | 15800 | [3] |
| 4+5-Methyl-1H-benzotriazole |  | 8580 | [3] |
| Carbamazepine | 17000 | 70000 | [3], [4] |
| Carbendazim |  | 87.6 | [5] |
| Cetirizin |  | 330000 | [6] |
| Citalopram |  | 20000 | [7] |
| Clarithromycin |  | 25720 (24 h) | [8] |
| Diuron |  | 8400 | \* |
| Ethofumesate |  | 179000 | \* |
| Imidacloprid | 20.59 | 97000 | [3], [9] |
| Pendimethalin |  | 280 | [3] |
| Propiconazole |  | 4900 | \* |
| Propranolol |  | 5531 | [10] |
| Roxithromycin |  | 74300 | [11] |
| Tebuconazole |  | 2790 | [3] |
| Terbutryn |  | 2660 | [3] |
| Thiacloprid | 350 | 88000 | [3], [9] |
| Triphenyl phosphate (TPP) |  | 90 | [12] |
| Valsartan |  | >580 | [13] |

Table S9: Estimated freely dissolved water concentrations (Cfd) in µg/L.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Substances** | **KOW** | **H1** | **W3** | | **W4** | | **W5** | |
| **2017** | **2016** | **2017** | **2016** | **2017** | **2016** | **2017** |
| 1H-Benzotriazole | 27.5 |  | 2.9022 | 6.4030 | 2.9730 | 8.1602 | 3.6895 | 11.1479 |
| 2-Benzothiazolsulfonic acid | 0.1 |  | 178.6740 |  | 146.2615 |  | 177.0533 |  |
| 4+5-Methyl-1H-benzotriazole | 51.3 | 0.5232 | 0.4066 | 2.1521 | 0.3088 | 2.4195 | 0.2069 | 2.5549 |
| 7-Amino-4-methylcoumarin | 13.8 | 1.8199 | 7.4756 | 4.5798 | 4.5563 | 3.8745 | 1.8892 | 0.3810 |
| 7-Diethylamino-4-methylcoumarin | 1659 |  | 0.0036 |  |  |  |  |  |
| Carbamazepine | 282 | 0.0606 | 0.0791 | 0.1847 | 0.0538 | 0.4298 | 0.0736 | 0.5128 |
| Carbendazim | 33.1 |  | 1.2571 |  |  |  |  |  |
| Cetirizin | 50.1 |  | 0.0918 |  | 0.0811 |  | 0.1026 |  |
| Citalopram | 5495 | 0.0020 | 0.0175 | 0.0194 | 0.0172 | 0.0095 | 0.0223 | 0.0875 |
| Clarithromycin | 1445 | 0.0163 | 0.0053 | 0.0103 | 0.0137 | 0.0274 | 0.0341 | 0.0351 |
| Diuron | 478 |  | 0.0149 | 0.0332 | 0.0126 | 0.0298 | 0.0113 | 0.0274 |
| Ethofumesate | 501 | 3.3040 | 0.1332 | 6.2798 | 0.0773 | 3.7746 | 0.0127 | 2.3726 |
| Hexa(methoxymethyl)melamine | 40.7 | 0.5668 | 0.5465 | 0.0000 | 0.3562 | 0.1628 | 0.2890 | 0.1494 |
| Imidacloprid | 3.7 | 4.5119 | 58.3054 | 43.5088 | 26.8038 | 25.6321 | 29.2922 | 68.7519 |
| Mirtazapine | 1072 |  | 0.0127 |  | 0.0168 |  | 0.0180 |  |
| Pendimethalin | 15135 |  | 0.0012 |  | 0.0010 |  | 0.0012 |  |
| Phenylbenzimidazole sulfonic acid | 0.9 |  | 28.7772 |  |  |  |  |  |
| Propiconazole | 5248 |  | 0.0054 |  |  |  |  |  |
| Propranolol | 3020 |  |  |  | 2.9730 |  | 0.0031 |  |
| Roxithromycin | 562 |  |  |  | 0.0409 |  | 0.0488 |  |
| Tebuconazole | 5012 |  | 0.0960 |  | 0.0652 |  | 0.0483 |  |
| Terbutryn | 5495 | 0.0010 | 0.0018 | 0.0030 | 0.0023 | 0.0047 | 0.0025 | 0.0049 |
| Thiacloprid | 213 | 0.0864 | 0.1084 | 0.1697 | 0.0973 | 0.1202 | 0.1441 | 0.0990 |
| Tri(butoxyethyl) phosphate (TBEP) | 589 | 1.0799 | 0.6823 | 0.1375 | 0.3944 | 0.5714 | 0.4015 | 0.6275 |
| Triphenyl phosphate (TPP) | 38905 | 0.0029 | 0.0046 | 0.0024 | 0.0016 | 0.0003 | 0.0014 | 0.0004 |
| Valsartan | 4467 | 0.0013 | 0.0059 |  | 0.0046 |  |  |  |

Table S10: Toxic Units for each compound and sumTUs for sampling sites. A value above -3.0 indicates the occurrence of chronic effects. Calculations for carbamazepin, imidacloprid and thiacloprid are based on EC50 values from *G. pulex*.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Substances** | **H1** | **W3** | | **W4** | | **W5** | | **logTU** | |
| **2017** | **2016** | **2017** | **2016** | **2017** | **2016** | **2017** | **2016** | **2017** |
| 1H-Benzotriazole |  | 1.84E-04 | 4.05E-04 | 1.88E-04 | 5.16E-04 | 2.34E-04 | 7.06E-04 | **-3.22** | **-2.79** |
| 2-Benzothiazolsulfonic acid |  |  |  |  |  |  |  |  |  |
| 4+5-Methyl-1H-benzotriazole | 6.10E-05 | 4.74E-05 | 2.51E-04 | 3.60E-05 | 2.82E-04 | 2.41E-05 | 2.98E-04 | **-3.97** | **-3.05** |
| 7-Amino-4-methylcoumarin |  |  |  |  |  |  |  |  |  |
| 7-Diethylamino-4-methylcoumarin |  |  |  |  |  |  |  |  |  |
| Carbamazepine | 3.57E-06 | 4.66E-06 | 1.09E-05 | 3.17E-06 | 2.53E-05 | 4.33E-06 | 3.02E-05 | **-4.92** | **-4.16** |
| Carbendazim |  | 1.44E-02 |  |  |  |  |  | **-1.84** |  |
| Cetirizin |  | 2.78E-07 |  | 2.46E-07 |  | 3.11E-07 |  | **-6.08** |  |
| Citalopram | 1.01E-07 | 8.76E-07 | 9.72E-07 | 8.62E-07 | 4.76E-07 | 1.11E-06 | 4.38E-06 | **-5.54** | **-5.23** |
| Clarithromycin | 6.34E-07 | 2.05E-07 | 4.01E-07 | 5.31E-07 | 1.07E-06 | 1.33E-06 | 1.36E-06 | **-5.69** | **-5.46** |
| Diuron |  | 1.77E-06 | 3.95E-06 | 1.50E-06 | 3.55E-06 | 1.35E-06 | 3.27E-06 | **-5.34** | **-4.97** |
| Ethofumesate | 1.85E-05 | 7.44E-07 | 3.51E-05 | 4.32E-07 | 2.11E-05 | 7.07E-08 | 1.33E-05 | **-5.90** | **-4.06** |
| Hexa(methoxymethyl)melamine |  |  |  |  |  |  |  |  |  |
| Imidacloprid | 2.19E-01 | 2.83E+00 | 2.11E+00 | 1.30E+00 | 1.24E+00 | 1.42E+00 | 3.34E+00 | **0.74** | **0.84** |
| Mirtazapine |  |  |  |  |  |  |  |  |  |
| Pendimethalin |  | 4.17E-06 |  | 3.69E-06 |  | 4.24E-06 |  | **-4.92** |  |
| Phenylbenzimidazole sulfonic acid |  |  |  |  |  |  |  |  |  |
| Propiconazole |  | 1.10E-06 |  |  |  |  |  | **-5.96** |  |
| Propranolol |  |  |  | 1.88E-04 |  | 5.61E-07 |  | **-3.22** |  |
| Roxithromycin |  |  |  | 5.51E-07 |  | 6.57E-07 |  | **-5.92** |  |
| Tebuconazole |  | 3.34E-05 |  | 2.27E-05 |  | 1.68E-05 |  | **-4.14** |  |
| Terbutryn | 1.42E-07 | 2.51E-07 | 4.21E-07 | 3.28E-07 | 6.68E-07 | 3.58E-07 | 6.91E-07 | **-6.03** | **-5.72** |
| Thiacloprid | 2.47E-04 | 3.10E-04 | 4.85E-04 | 2.78E-04 | 3.44E-04 | 4.12E-04 | 2.83E-04 | **-3.00** | **-2.87** |
| Tri(butoxyethyl) phosphate (TBEP) |  |  |  |  |  |  |  |  |  |
| Triphenyl phosphate (TPP) | 3.20E-05 | 5.16E-05 | 2.63E-05 | 1.81E-05 | 3.30E-06 | 1.57E-05 | 4.97E-06 | **-4.07** | **-4.18** |
| Valsartan |  |  |  |  |  |  |  |  |  |
| **log sumTU** | **-0.66** | **0.45** | **0.33** | **0.11** | **0.10** | **0.15** | **0.52** |

Table S11: Toxic Units for each compound and sumTUs for sampling sites. A value above -3.0 indicates the occurrence of chronic effects. All calculations are based on EC50 values from *D. magna*.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Substances** | **H1** | **W3** | | **W4** | | **W5** | | **logTU** | |
| **2017** | **2016** | **2017** | **2016** | **2017** | **2016** | **2017** | **2016** | **2017** |
| 1H-Benzotriazole |  | 1.84E-04 | 4.05E-04 | 1.88E-04 | 5.16E-04 | 2.34E-04 | 7.06E-04 | **-3.22** | **-2.79** |
| 2-Benzothiazolsulfonic acid |  |  |  |  |  |  |  |  |  |
| 4+5-Methyl-1H-benzotriazole | 6.10E-05 | 4.74E-05 | 2.51E-04 | 3.60E-05 | 2.82E-04 | 2.41E-05 | 2.98E-04 | **-3.97** | **-3.05** |
| 7-Amino-4-methylcoumarin |  |  |  |  |  |  |  |  |  |
| 7-Diethylamino-4-methylcoumarin |  |  |  |  |  |  |  |  |  |
| Carbamazepine | 8.66E-07 | 1.13E-06 | 2.64E-06 | 7.69E-07 | 6.14E-06 | 1.05E-06 | 7.33E-06 | **-5.53** | **-4.77** |
| Carbendazim |  | 1.44E-02 |  |  |  |  |  | **-1.84** |  |
| Cetirizin |  | 2.78E-07 |  | 2.46E-07 |  | 3.11E-07 |  | **-6.08** |  |
| Citalopram | 1.01E-07 | 8.76E-07 | 9.72E-07 | 8.62E-07 | 4.76E-07 | 1.11E-06 | 4.38E-06 | **-5.54** | **-5.23** |
| Clarithromycin | 6.34E-07 | 2.05E-07 | 4.01E-07 | 5.31E-07 | 1.07E-06 | 1.33E-06 | 1.36E-06 | **-5.69** | **-5.46** |
| Diuron |  | 1.77E-06 | 3.95E-06 | 1.50E-06 | 3.55E-06 | 1.35E-06 | 3.27E-06 | **-5.34** | **-4.97** |
| Ethofumesate | 1.85E-05 | 7.44E-07 | 3.51E-05 | 4.32E-07 | 2.11E-05 | 7.07E-08 | 1.33E-05 | **-5.90** | **-4.06** |
| Hexa(methoxymethyl)melamine |  |  |  |  |  |  |  |  |  |
| Imidacloprid | 4.65E-05 | 6.01E-04 | 4.49E-04 | 2.76E-04 | 2.64E-04 | 3.02E-04 | 7.09E-04 | **-2.93** | **-2.83** |
| Mirtazapine |  |  |  |  |  |  |  |  |  |
| Pendimethalin |  | 4.17E-06 |  | 3.69E-06 |  | 4.24E-06 |  | **-4.92** |  |
| Phenylbenzimidazole sulfonic acid |  |  |  |  |  |  |  |  |  |
| Propiconazole |  | 1.10E-06 |  |  |  |  |  | **-5.96** |  |
| Propranolol |  |  |  | 1.88E-04 |  | 5.61E-07 |  | **-3.22** |  |
| Roxithromycin |  |  |  | 5.51E-07 |  | 6.57E-07 |  | **-5.92** |  |
| Tebuconazole |  | 3.34E-05 |  | 2.27E-05 |  | 1.68E-05 |  | **-4.14** |  |
| Terbutryn | 1.42E-07 | 2.51E-07 | 4.21E-07 | 3.28E-07 | 6.68E-07 | 3.58E-07 | 6.91E-07 | **-6.03** | **-5.72** |
| Thiacloprid | 9.82E-07 | 1.23E-06 | 1.93E-06 | 1.11E-06 | 1.37E-06 | 1.64E-06 | 1.12E-06 | **-5.40** | **-5.27** |
| Tri(butoxyethyl) phosphate (TBEP) |  |  |  |  |  |  |  |  |  |
| Triphenyl phosphate (TPP) | 3.20E-05 | 5.16E-05 | 2.63E-05 | 1.81E-05 | 3.30E-06 | 1.57E-05 | 4.97E-06 | **-4.07** | **-4.18** |
| Valsartan |  |  |  |  |  |  |  |  |  |
| **log sumTU** | **-3.79** | **-1.82** | **-2.93** | **0.11** | **-2.96** | **-3.22** | **-2.76** |

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