Table S1. Primer validation. Efficiency, slope and R² values for housekeeping and target genes obtained in validation relative to the standard curve. Models were made up using Primer 3 and BLAST software.

| Gene   | Efficiency (%) | R²   |
|--------|----------------|------|
| **Hive bees** | | |
| **TARGETS** | | |
| ABAECIN | 100.412 | 0.987 |
| CYP6BD1 | 109.38 | 0.959 |
| CYP6AS2 | 107.558 | 0.836 |
| CYP6AS3 | 98.541 | 0.923 |
| CYP6AS4 | 106.517 | 0.836 |
| CYP9Q3 | 102.235 | 0.966 |
| **HOUSEKEEPING** | | |
| RPL8 | 104.382 | 0.754 |
| **Larvae** | | |
| **TARGETS** | | |
| ABAECIN | 104.319 | 0.987 |
| CYP6BD1 | 106.031 | 0.981 |
| CYP6AS2 | 109.929 | 0.876 |
| CYP6AS3 | 100.650 | 0.975 |
| CYP6AS4 | 109.188 | 0.929 |
| CYP9Q3 | 99.05 | 0.876 |
| **HOUSEKEEPING** | | |
| RPL8 | 92.918 | 0.929 |
Table S2. Colony activity. Statistics of Wilcoxon paired test for comparisons between applications moments. Statistics of Friedman rank sum test for comparisons between plots. Significant differences in bold.

| Comparisons                        | Test          | Statistic          | 95 percent confidence interval | p value |
|------------------------------------|---------------|--------------------|-------------------------------|---------|
| Between pre and post herbicide application | Wilcoxon      | \( V=289, \) estimate=40.898 | 28 - 52.5                    | <0.001  |
| Between plots                       | Friedman      | \( \chi^2=0.143, \) df=2 |                              | 0.931   |

### Pollen foragers’ incoming rate

| Comparisons                        | Test          | Statistic          | p value |
|------------------------------------|---------------|--------------------|---------|
| Between pre and post herbicide application | Wilcoxon      | \( V=253, \) estimate=11.999 | 9 - 15 | <0.001  |
| Between plots                       | Friedman      | \( \chi^2=8.044, \) df=2 |               | 0.018   |
| Plot A - Plot B                     | Conover post hoc |                |               | <0.001  |
| Plot A - Plot C                     | Conover post hoc |                |               | 0.24    |
| Plot B - Plot C                     | Conover post hoc |                |               | <0.001  |

### Ratio Pollen/Total incoming rate

| Comparisons                        | Test          | Statistic          | p value |
|------------------------------------|---------------|--------------------|---------|
| Between pre and post herbicide application | Wilcoxon      | \( V=280, \) estimate=0.133 | 0.087 - 0.181 | <0.001  |
| Between plots                       | Friedman      | \( \chi^2=9.805, \) df=2 |               | 0.007   |
| Plot A - Plot B                     | Conover post hoc |                |               | <0.001  |
| Plot A - Plot C                     | Conover post hoc |                |               | 0.31    |
| Plot B - Plot C                     | Conover post hoc |                |               | <0.001  |
Table S3. Relative gene expression. Statistics of Wilcoxon paired test for comparisons between herbicides applications moments. Statistics of Friedman rank sum test for comparisons between plots. Significant differences in bold.

| Gene   | Comparisons                                      | Test     | Statistic                        | 95 percent confidence interval | p value |
|--------|--------------------------------------------------|----------|----------------------------------|--------------------------------|---------|
| **Hive bees** |                                                |          |                                  |                                |         |
| ABAECIN | Between pre and post herbicide application      | Wilcoxon | V=36, estimate= -0.105           | -2.537 - 1.550                 | 0.814   |
|         | Between plots                                   | Friedman | $\chi^2=0$, df=2                |                                 | 1       |
| CYP6BD1 | Between pre and post herbicide application      | Wilcoxon | V=24, estimate= -0.194           | -2.681 - 0.447                 | 0.424   |
|         | Between plots                                   | Friedman | $\chi^2=4.75$, df=2             |                                 | 0.093   |
| CYP6AS2 | Between pre and post herbicide application      | Wilcoxon | V=56, estimate=0.862            | -0.835 - 3.286                 | 0.204   |
|         | Between plots                                   | Friedman | $\chi^2=1.75$, df=2             |                                 | 0.417   |
| CYP6AS3 | Between pre and post herbicide application      | Wilcoxon | V=37, estimate= -0.194           | -1.971 - 9.829                 | 0.875   |
|         | Between plots                                   | Friedman | $\chi^2=1$, df=2                |                                 | 0.606   |
| CYP6AS4 | Between pre and post herbicide application      | Wilcoxon | V=29, estimate= -0.559           | -6.344 - 2.000                 | 0.470   |
|         | Between plots                                   | Friedman | $\chi^2=9.25$, df=2             |                                 | 0.01    |
|         | Plot A - Plot B                                 | Conover post hoc  |                                 | <0.001                          |         |
|         | Plot A - Plot C                                 | Conover post hoc  |                                 | <0.001                          |         |
|         | Plot B - Plot C                                 | Conover post hoc  |                                 | 0.618                           |         |
| CYP9Q3  | Between pre and post herbicide application      | Wilcoxon | V=20, estimate= -0.033           | -1.522 - 3.083                 | 0.248   |
|         | Between plots                                   | Friedman | $\chi^2=9.75$, df=2             |                                 | 0.008   |
|         | Plot A - Plot B                                 | Conover post hoc  |                                 | <0.001                          |         |
|         | Plot A - Plot C                                 | Conover post hoc  |                                 | 0.140                           |         |
|         | Plot B - Plot C                                 | Conover post hoc  |                                 | <0.001                          |         |
| **Larvae** |                                                |          |                                  |                                |         |
| ABAECIN | Between pre and post herbicide application      | Wilcoxon | V=39, estimate= -0.075           | -2.267 - 1.731                 | 1       |
|         | Between plots                                   | Friedman | $\chi^2=0.25$, df=2             |                                 | 0.882   |
| CYP6BD1 | Between pre and post herbicide application      | Wilcoxon | V=66, estimate=1.451            | 0.017 - 5.939                  | 0.034   |
|         | Between plots                                   | Friedman | $\chi^2=0.25$, df=2             |                                 | 0.882   |
### Table S4. Correlation between relative gene expressions of hive bees after herbicide application.

Tau, z values and p values obtained from Kendall’s rank correlation test. Significant differences in bold.

| Correlated genes | tau   | z value | p value |
|------------------|-------|---------|---------|
| ABAECIN-CYP6BD1  | 0.292 | 1.309   | 0.191   |
| ABAECIN-CYP6AS2  | 0.321 | 1.443   | 0.149   |
| ABAECIN-CYP6AS3  | -0.076| -0.344  | 0.731   |
| ABAECIN-CYP6AS4  | 0.015 | 0.069   | 0.945   |
| ABAECIN-CYP9Q3   | 0.107 | 0.481   | 0.630   |
| CYP6BD1 - CYP6AS2| 0.779 | 3.506   | <0.001  |
| CYP6BD1 - CYP6AS3| 0.259 | 1.169   | 0.2426  |
| CYP6BD1 - CYP6AS4| 0.657 | 2.956   | 0.003   |
| CYP6BD1 - CYP9Q3 | 0.748 | 3.368   | <0.001  |
| CYP6AS2 - CYP6AS3| 0.303 | 1.433   | 0.197   |
| CYP6AS2 - CYP6AS4| 0.515 | 2.501   | 0.021   |
| CYP6AS2 - CYP9Q3 | 0.667 | 3.155   | 0.002   |
| CYP6AS3 - CYP6AS4| 0    | 0.033   | 1       |
| CYP6AS3 - CYP9Q3 | 0.152 | 0.538   | 0.5452  |
| CYP6AS4 - CYP9Q3 | 0.848 | 4.132   | <0.001  |
Table S5. Correlation between relative gene expressions of larvae after herbicide application. Tau, z values and p values obtained from Kendall’s rank correlation test. Significant differences in bold.

| Correlated genes         | tau  | z value | p value |
|--------------------------|------|---------|---------|
| ABAECIN-CYP6BD1          | 0.242| 1.041   | 0.311   |
| ABAECIN-CYP6AS2          | -0.168| -0.756  | 0.450   |
| ABAECIN-CYP6AS3          | 0.273| 1.240   | 0.250   |
| ABAECIN-CYP6AS4          | 0.164| 0.714   | 0.475   |
| ABAECIN-CYP9Q3           | 0.382| 1.718   | 0.086   |
| CYP6BD1 - CYP6AS2        | 0.076| 0.344   | 0.731   |
| CYP6BD1 - CYP6AS3        | 0.424| 1.847   | 0.063   |
| CYP6BD1 - CYP6AS4        | 0.428| 1.857   | 0.063   |
| CYP6BD1 - CYP9Q3         | 0.290| 1.306   | 0.191   |
| CYP6AS2 - CYP6AS3        | 0.351| 1.581   | 0.113   |
| CYP6AS2 - CYP6AS4        | 0.249| 1.074   | 0.283   |
| CYP6AS2 - CYP9Q3         | -0.246| -1.102  | 0.270   |
| CYP6AS3 - CYP6AS4        | 0.461| 2       | 0.046   |
| CYP6AS3 - CYP9Q3         | 0.015| 0.069   | 0.945   |
| CYP6AS4 - CYP9Q3         | 0.348| 1.503   | 0.133   |

Table S6. Correlation between relative expressions of the same biomarker gene in hive bees (HB) and larvae (L), after herbicide application. Tau, z values and p values obtained from Kendall’s rank correlation test. Significant differences in bold.

| Correlated genes         | tau  | z value | p value |
|--------------------------|------|---------|---------|
| ABAECIN HB – ABAECIN L   | 0.198| 0.894   | 0.371   |
| CYP6BD1 HB – CYP6BD1 L   | 0.046| 0.206   | 0.837   |
| CYP6AS2 HB – CYP6AS2 L   | -0.321| -1.443  | 0.149   |
| CYP6AS3 HB – CYP6AS3 L   | -0.091| 0.430   | 0.737   |
| CYP6AS4 HB – CYP6AS4 L   | 0.132| 0.571   | 0.568   |
| CYP9Q3 HB – CYP9Q3 L     | 0.504| 2.268   | 0.023   |
Table S7. Correlation between colony activity rates and hive bees’ relative gene expressions. Tau, z values and p values obtained from Kendall’s rank correlation. Significant differences in bold.

| Correlated variables                  | tau   | z value | p value |
|--------------------------------------|-------|---------|---------|
| Total incoming rate- ABAECIN         | 0.099 | 0.671   | 0.502   |
| Total incoming rate-CYP9Q3           | -0.153| -1.024  | 0.306   |
| Total incoming rate-CYP6BD1          | -0.073| 0.497   | 0.619   |
| Total incoming rate-CYP6AS2          | 0.080 | 0.546   | 0.585   |
| Total incoming rate-CYP6AS3          | 0.077 | 0.522   | 0.602   |
| Total incoming rate-CYP6AS4          | 0.077 | 0.522   | 0.602   |
| Pollen foragers’ incoming rate- ABAECIN | 0.273 | 1.759   | 0.078   |
| Pollen foragers’ incoming rate- CYP9Q3 | 0.037 | 0.234   | 0.815   |
| Pollen foragers’ incoming rate- CYP6BD1 | -0.004| -0.026  | 0.979   |
| Pollen foragers’ incoming rate- CYP6AS2 | 0.328 | 2.121   | 0.034   |
| Pollen foragers’ incoming rate- CYP6AS3 | 0.124 | 0.802   | 0.422   |
| Pollen foragers’ incoming rate- CYP6AS4 | 0.349 | 2.251   | 0.024   |
| Ratio Pollen/Total incoming rate- ABAECIN | 0.369 | 2.402   | 0.016   |
| Ratio Pollen/Total incoming rate- CYP9Q3 | 0.057 | 0.363   | 0.716   |
| Ratio Pollen/Total incoming rate- CYP6BD1 | -0.008| 0.052   | 0.959   |
| Ratio Pollen/Total incoming rate- CYP6AS2 | 0.242 | 1.575   | 0.115   |
| Ratio Pollen/Total incoming rate- CYP6AS3 | 0.079 | 0.516   | 0.605   |
| Ratio Pollen/Total incoming rate- CYP6AS4 | 0.206 | 1.342   | 0.179   |

Table S8. Importance of components for principal component analysis (PCA). Standard deviation, proportion of variance and cumulative proportion for each principal component.

|                     | PC1       | PC2       | PC3       | PC4       | PC5       | PC6       |
|---------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Hive bees           |           |           |           |           |           |           |
| Standard deviation  | 1.681     | 1.093     | 1.055     | 0.894     | 0.245     | 0.089     |
| Proportion of Variance | 0.471    | 0.199     | 0.185     | 0.133     | 0.010     | 0.001     |
| Cumulative Proportion | 0.471    | 0.670     | 0.856     | 0.989     | 0.999     | 1.000     |

|                     | PC1       | PC2       | PC3       | PC4       | PC5       | PC6       |
|---------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Larvae              |           |           |           |           |           |           |
| Standard deviation  | 1.516     | 1.356     | 0.998     | 0.808     | 0.415     | 0.204     |
| Proportion of Variance | 0.383    | 0.306     | 0.166     | 0.109     | 0.029     | 0.007     |
| Cumulative Proportion | 0.383    | 0.689     | 0.855     | 0.964     | 0.993     | 1.000     |
Table S9. Contribution of relative gene expressions after herbicide application for the variability in each principal component, for hive bees and larvae.

| Gene      | PC1   | PC2    | PC3   | PC4   | PC5   | PC6   |
|-----------|-------|--------|-------|-------|-------|-------|
| 
| **Hive bees** |       |        |       |       |       |       |
| ABAECIN   | 0.096 | -0.077 | 0.760 | -0.636 | 0.034 | 0.020 |
| CYP6BD1   | -0.559 | -0.221 | -0.091 | -0.128 | 0.777 | -0.103 |
| CYP6AS2   | -0.179 | -0.795 | -0.271 | -0.278 | -0.430 | 0.025 |
| CYP6AS3   | 0.138 | 0.394 | -0.571 | -0.706 | 0.032 | 0.022 |
| CYP6AS4   | -0.567 | 0.255 | 0.075 | -0.016 | -0.230 | 0.745 |
| CYP9Q3    | -0.553 | 0.305 | 0.092 | -0.051 | -0.396 | -0.658 |

| Gene      | PC1   | PC2    | PC3   | PC4   | PC5   | PC6   |
|-----------|-------|--------|-------|-------|-------|-------|
| 
| **Larvae** |       |        |       |       |       |       |
| ABAECIN   | 0.069 | -0.102 | 0.982 | -0.116 | -0.070 | 0.054 |
| CYP6BD1   | 0.148 | 0.688 | 0.031 | 0.027 | -0.664 | -0.249 |
| CYP6AS2   | -0.536 | 0.044 | -0.080 | -0.690 | -0.257 | 0.403 |
| CYP6AS3   | -0.521 | 0.136 | 0.102 | 0.701 | -0.108 | 0.443 |
| CYP6AS4   | -0.624 | 0.172 | 0.117 | -0.033 | 0.302 | -0.689 |
| CYP9Q3    | 0.157 | 0.683 | 0.071 | -0.132 | 0.620 | 0.319 |