**Supplementary Materials**

**for**

**The all-day pollinator visits of sunflower inflorescences in *Helianthus annuus* plantations are independent of head orientation: testing a wide-spread hypothesis**

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This file contains the following: Supplementary Tables S1-S16, S17

**Supplementary Table S1**: Average ± standard deviation of the area proportion *Q* of insects trapped by the south-, east- and west-facing sticky vertical surfaces of the 5 sunflower models in the whole period of experiment 1 (5 July - 1 September 2021). In sessions 3. and 4. some photos of models 1-2 and 5, respectively, were non-evaluable, therefore data of these models are lacking.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **session** | **experiment 1**  **(5 July - 1 September 2021)** | **south-facing**  ***Q* (%)** | **east-facing**  ***Q* (%)** | **west-facing**  ***Q* (%)** |
| **1.** | **model 1** | 0.75 | 0.75 | 0.70 |
|  | **model 2** | 0.51 | 0.55 | 0.45 |
|  | **model 3** | 0.59 | 0.56 | 0.65 |
|  | **model 4** | 0.67 | 0.67 | 0.72 |
|  | **model 5** | 0.62 | 1.11 | 1.23 |
| **2.** | **model 1** | 1.50 | 0.82 | 0.84 |
|  | **model 2** | 0.83 | 0.81 | 0.81 |
|  | **model 3** | 1.19 | 0.73 | 0.70 |
|  | **model 4** | 0.94 | 0.70 | 1.09 |
|  | **model 5** | 1.09 | 1.31 | 1.39 |
| **3.** | **model 3** | 1.57 | 1.44 | 2.15 |
|  | **model 4** | 1.21 | 1.54 | 1.55 |
|  | **model 5** | 1.54 | 1.50 | 1.57 |
| **4.** | **model 1** | 1.75 | 0.98 | 1.55 |
|  | **model 2** | 1.14 | 1.21 | 1.73 |
|  | **model 3** | 1.40 | 0.50 | 1.33 |
|  | **model 4** | 0.85 | 0.83 | 2.13 |
| **5.** | **model 1** | 1.41 | 1.23 | 1.12 |
|  | **model 2** | 0.51 | 0.79 | 0.86 |
|  | **model 3** | 0.64 | 0.71 | 0.98 |
|  | **model 4** | 0.67 | 0.58 | 0.66 |
|  | **model 5** | 0.68 | 0.96 | 0.91 |
| **6.** | **model 1** | 1.62 | 2.22 | 2.00 |
|  | **model 2** | 1.14 | 0.90 | 1.96 |
|  | **model 3** | 1.20 | 0.85 | 1.48 |
|  | **model 4** | 0.74 | 1.36 | 1.15 |
|  | **model 5** | 1.38 | 1.40 | 1.38 |
| **7.** | **model 1** | 1.42 | 1.53 | 1.61 |
|  | **model 2** | 1.01 | 1.11 | 1.16 |
|  | **model 3** | 1.29 | 0.38 | 0.88 |
|  | **model 4** | 0.73 | 1.01 | 0.60 |
|  | **model 5** | 1.21 | 0.96 | 0.74 |
| **8.** | **model 1** | 1.38 | 1.53 | 1.72 |
|  | **model 2** | 1.09 | 1.07 | 1.19 |
|  | **model 3** | 0.83 | 0.89 | 1.08 |
|  | **model 4** | 1.02 | 1.37 | 1.14 |
|  | **model 5** | 1.15 | 1.15 | 1.07 |
| **9.** | **model 1** | 2.13 | 1.11 | 2.03 |
|  | **model 2** | 1.03 | 1.60 | 1.05 |
|  | **model 3** | 1.15 | 1.11 | 1.67 |
|  | **model 4** | 0.98 | 1.73 | 1.52 |
|  | **model 5** | 1.77 | 1.45 | 1.16 |
|  | **average** | 1.10 | 1.07 | 1.23 |
|  | **standard deviation** | ±0.37 | ±0.38 | ±0.43 |

**Supplementary Table S2**: Statistical ANOVA analysis of the data in Supplementary Table S1 for the whole period of experiment 1 (5 July - 1 September 2021). The critical significance value is p\* = 0.05, meaning that if p > p\*, then there are no significant differences between the *Q*-values of the south-, east- and west-facing test surfaces.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **source of variation** | **SS** | **df** | **MS** | **F** | **p** | **F-crit** |
| **between groups** | 5.90·10-5 | 2 | 2.95·10-5 | 1.77 | 0.174 | 3.07 |
| **within groups** | 2.05·10-3 | 123 | 1.66·10-5 |  |  |  |
| **total** | 2.11·10-3 | 125 |  |  |  |  |

**Supplementary Table S3**: Average ± standard deviation of the number *N* of insects (= recognized black patches) trapped by the south-, east- and west-facing sticky test surfaces of the 5 sunflower models in the whole period of experiment 1 (5 July - 1 September 2021). In sessions 3. and 4. some photos of models 1-2 and 5, respectively, were non-evaluable, therefore data of these models are lacking.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **session** | **experiment 1**  **(5 July - 1 September 2021)** | **south-facing**  ***N*** | **east-facing**  ***N*** | **west-facing**  ***N*** |
| **1.** | **model 1** | 94 | 82 | 70 |
| **model 2** | 99 | 161 | 83 |
| **model 3** | 144 | 115 | 140 |
| **model 4** | 102 | 72 | 95 |
| **model 5** | 153 | 107 | 149 |
| **2.** | **model 1** | 217 | 142 | 105 |
| **model 2** | 189 | 185 | 233 |
| **model 3** | 233 | 180 | 143 |
| **model 4** | 184 | 289 | 129 |
| **model 5** | 166 | 223 | 290 |
| **3.** | **model 3** | 312 | 242 | 333 |
| **model 4** | 318 | 188 | 276 |
| **model 5** | 330 | 281 | 351 |
| **4.** | **model 1** | 354 | 216 | 394 |
| **model 2** | 442 | 267 | 404 |
| **model 3** | 352 | 205 | 476 |
| **model 4** | 309 | 399 | 515 |
| **5.** | **model 1** | 236 | 224 | 343 |
| **model 2** | 229 | 314 | 252 |
| **model 3** | 215 | 290 | 272 |
| **model 4** | 431 | 380 | 301 |
| **model 5** | 257 | 226 | 377 |
| **6.** | **model 1** | 382 | 353 | 530 |
| **model 2** | 368 | 222 | 633 |
| **model 3** | 487 | 275 | 394 |
| **model 4** | 377 | 637 | 525 |
| **model 5** | 344 | 465 | 535 |
| **7.** | **model 1** | 472 | 218 | 388 |
| **model 2** | 345 | 606 | 557 |
| **model 3** | 435 | 290 | 333 |
| **model 4** | 361 | 388 | 440 |
| **model 5** | 505 | 441 | 430 |
| **8.** | **model 1** | 328 | 348 | 410 |
| **model 2** | 300 | 305 | 358 |
| **model 3** | 429 | 240 | 443 |
| **model 4** | 388 | 308 | 412 |
| **model 5** | 373 | 428 | 445 |
| **9.** | **model 1** | 480 | 395 | 466 |
| **model 2** | 340 | 467 | 442 |
| **model 3** | 334 | 418 | 520 |
| **model 4** | 526 | 462 | 365 |
| **model 5** | 340 | 295 | 503 |
|  | **average** | 316.2 | 294.0 | 353.8 |
|  | **standard deviation** | ± 115.1 | ± 129.4 | ± 146.4 |

**Supplementary Table S4**: Statistical ANOVA analysis of the data in Supplementary Table S3 for the whole period of experiment 1 (5 July - 1 September 2021) with p\* = 0.05. Since p > 0.05, the statistical differences between the groups are not significant, and thus there is no need for Tukey-Kramer post hoc test.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **source of variation** | **SS** | **df** | **MS** | **F** | **p** | **F-crit** |
| **between groups** | 76732.40 | 2.00 | 38366.20 | 2.24 | 0.11 | 3.07 |
| **within groups** | 2107483.93 | 123.00 | 17134.02 |  |  |  |
| **total** | 2184216.33 | 125.00 |  |  |  |  |

**Supplementary Table S5**: Average ± standard deviation of the area proportion *Q* of insects trapped by the east-, south-, west- and north-facing sticky test surfaces of the 5 sunflower models in experiment 2 (1 July - 18 August 2022).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **session** | **experiment 2**  **(1 July - 18 August 2022)** | **east-facing**  ***Q* (%)** | **south-facing**  ***Q* (%)** | **west-facing**  ***Q* (%)** | **north-facing**  ***Q* (%)** |
| **1.** | **model 1** | 0.99 | 0.49 | 0.51 | 0.61 |
| **model 2** | 0.84 | 0.61 | 0.80 | 0.87 |
| **model 3** | 0.73 | 0.39 | 0.53 | 0.93 |
| **model 4** | 0.40 | 0.46 | 0.24 | 0.95 |
| **model 5** | 0.56 | 0.51 | 0.60 | 0.59 |
| **2.** | **model 1** | 0.90 | 1.28 | 0.96 | 1.18 |
| **model 2** | 0.87 | 1.17 | 1.00 | 0.96 |
| **model 3** | 0.99 | 1.10 | 1.01 | 0.71 |
| **model 4** | 0.84 | 1.08 | 1.15 | 1.06 |
| **model 5** | 0.68 | 1.41 | 1.28 | 0.76 |
| **3.** | **model 1** | 1.75 | 1.84 | 1.24 | 1.34 |
| **model 2** | 2.02 | 1.33 | 1.61 | 1.59 |
| **model 3** | 1.84 | 2.02 | 1.48 | 1.38 |
| **model 4** | 1.51 | 1.63 | 1.30 | 2.06 |
| **model 5** | 1.41 | 1.89 | 1.50 | 1.18 |
| **4.** | **model 1** | 1.01 | 1.30 | 1.09 | 1.55 |
| **model 2** | 0.91 | 0.81 | 1.51 | 1.64 |
| **model 3** | 0.98 | 0.78 | 1.10 | 1.60 |
| **model 4** | 1.08 | 0.99 | 1.62 | 2.42 |
| **model 5** | 0.67 | 1.27 | 1.99 | 1.38 |
| **5.** | **model 1** | 0.70 | 1.69 | 1.29 | 1.04 |
| **model 2** | 1.28 | 1.53 | 1.01 | 1.83 |
| **model 3** | 1.33 | 1.23 | 0.86 | 1.56 |
| **model 4** | 1.29 | 2.38 | 1.37 | 1.46 |
| **model 5** | 1.42 | 1.00 | 1.47 | 1.42 |
| **6.** | **model 1** | 1.59 | 1.94 | 2.05 | 1.59 |
| **model 2** | 1.81 | 2.83 | 2.00 | 1.52 |
| **model 3** | 0.94 | 1.31 | 1.25 | 1.68 |
| **model 4** | 1.82 | 1.19 | 1.46 | 1.70 |
| **model 5** | 1.00 | 1.74 | 1.26 | 1.42 |
|  | **average** | 1.14 | 1.31 | 1.22 | 1.33 |
|  | **standard deviation** | ± 0.43 | ± 0.58 | ± 0.43 | ± 0.43 |

**Supplementary Table S6**: Statistical ANOVA analysis of the data in Supplementary Table S5 for experiment 2 (1 July - 18 August 2022) with p\* = 0.05. Since p > 0.05, the statistical differences between the groups are not significant, and thus there is no need for Tukey-Kramer post hoc test.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **source of variation** | **SS** | **df** | **MS** | **F** | **p** | **F-crit** |
| **between groups** | 0.704 | 3.000 | 0.235 | 1.054 | 0.372 | 2.683 |
| **within groups** | 25.818 | 116.000 | 0.223 |  |  |  |
| **total** | 26.521 | 119.000 |  |  |  |  |

**Supplementary Table S7**: Average ± standard deviation of the number *N* of insects (= recognized black patches) trapped by the east-, south-, west- and north-facing sticky vertical surfaces of the 5 sunflower models in experiment 2 (1 July - 18 August 2022).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **session** | **experiment 2**  **(1 July - 18 August 2022)** | **east-facing**  ***N*** | **south-facing**  ***N*** | **west-facing**  ***N*** | **north-facing**  ***N*** |
| **1.** | **model 1** | 147 | 119 | 169 | 186 |
| **model 2** | 182 | 156 | 218 | 237 |
| **model 3** | 176 | 118 | 208 | 265 |
| **model 4** | 103 | 123 | 123 | 249 |
| **model 5** | 114 | 134 | 189 | 218 |
| **2.** | **model 1** | 246 | 339 | 298 | 369 |
| **model 2** | 286 | 317 | 422 | 426 |
| **model 3** | 298 | 313 | 418 | 433 |
| **model 4** | 265 | 352 | 331 | 366 |
| **model 5** | 241 | 445 | 448 | 327 |
| **3.** | **model 1** | 441 | 435 | 480 | 481 |
| **model 2** | 513 | 407 | 722 | 683 |
| **model 3** | 489 | 485 | 569 | 618 |
| **model 4** | 456 | 465 | 492 | 672 |
| **model 5** | 397 | 554 | 611 | 478 |
| **4.** | **model 1** | 370 | 424 | 548 | 587 |
| **model 2** | 379 | 409 | 777 | 677 |
| **model 3** | 388 | 386 | 585 | 744 |
| **model 4** | 406 | 414 | 619 | 706 |
| **model 5** | 286 | 595 | 783 | 560 |
| **5.** | **model 1** | 412 | 733 | 646 | 528 |
| **model 2** | 494 | 654 | 485 | 738 |
| **model 3** | 609 | 545 | 563 | 723 |
| **model 4** | 455 | 501 | 604 | 754 |
| **model 5** | 455 | 459 | 711 | 690 |
| **6.** | **model 1** | 632 | 826 | 851 | 896 |
| **model 2** | 654 | 727 | 828 | 726 |
| **model 3** | 433 | 599 | 588 | 924 |
| **model 4** | 760 | 621 | 712 | 939 |
| **model 5** | 491 | 827 | 630 | 688 |
|  | **average** | 385.9 | 449.4 | 520.9 | 562.9 |
|  | **standard deviation** | ± 163.2 | ± 200.0 | ± 204.6 | ± 217.2 |

**Supplementary Table S8**: Statistical ANOVA analysis of the data in Supplementary Table S7 for experiment 2 (1 July -18 August 2022). Since p < 0.05, there are statistical differences between certain groups, and thus an additional Tukey-Kramer post-hoc test is necessary.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **source of variation** | **SS** | **df** | **MS** | **F** | **p** | **F-crit** |
| **between groups** | 550146.400 | 3.000 | 183382.133 | 4.713 | 0.004 | 2.683 |
| **within groups** | 4513072.800 | 116.000 | 38905.800 |  |  |  |
| **total** | 5063219.200 | 119.000 |  |  |  |  |

**Supplementary Table S9**: Tukey-Kramer post-hoc test of the data in Supplementary Table S7. If D > C, then there is a statistically significant difference between the two test surface groups compared.

|  |  |  |  |
| --- | --- | --- | --- |
| **comparison of**  **differently facing**  **test surfaces** | **D (absolute value of**  **the difference**  **of group averages)** | **C (critical value)** | **significance** |
| east versus south | 63.467 | 132.524 | not significant |
| east versus west | 135.000 | 132.524 | significant |
| east versus north | 177.000 | 132.524 | significant |
| south versus west | 71.533 | 132.524 | not significant |
| south versus north | 113.533 | 132.524 | not significant |
| west versus north | 42.000 | 132.524 | not significant |

**Supplementary Table S10**: Average ± standard deviation (s.d.) of the numbers of insect pollinators (predominantly honeybees, *Apis mellifera* and bumblebees, *Bombus terrestris*) counted on the north-, east-, south- and west-facing sunflower inflorescences during experiment 3 (5-10 July 2023).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **date (July 2023)** | **north-facing** | **east-facing** | **south-facing** | **west-facing** |
| **5.** | *N*sum = 233  *N*average = 7.5  *N*s.d. = ±2.7 | *N*sum = 189  *N*average = 6.1  *N*s.d. = ±2.6 | *N*sum = 204  *N*average = 6.6  *N*s.d. = ±3.1 | *N*sum = 198  *N*average = 6.4  *N*s.d. = ±2.3 |
| **7.** | *N*sum = 258  *N*average = 8.6  *N*s.d. = ±2.1 | *N*sum = 238  *N*average = 7.9  *N*s.d. = ±2.8 | *N*sum = 267  *N*average = 8.9  *N*s.d. = ±2.2 | *N*sum = 263  *N*average = 8.8  *N*s.d. = ±3.0 |
| **8.** | *N*sum = 244  *N*average = 7.9  *N*s.d. = ±2.6 | *N*sum = 255  *N*average = 8.2  *N*s.d. = ±2.8 | *N*sum = 253  *N*average = 8.2  *N*s.d. = ±3.1 | *N*sum = 241  *N*average = 7.8  *N*s.d. = ±3.0 |
| **9.** | *N*sum = 269  *N*average = 8.7  *N*s.d. = ±2.8 | *N*sum = 229  *N*average = 7.4  *N*s.d. = ±2.9 | *N*sum = 218  *N*average = 7.0  *N*s.d. = ±2.6 | *N*sum = 224  *N*average = 7.2  *N*s.d. = ±2.9 |
| **10.** | *N*sum = 167  *N*average = 5.4  *N*s.d. = ±3.1 | *N*sum = 187  *N*average = 6.0  *N*s.d. = ±2.7 | *N*sum = 189  *N*average = 6.1  *N*s.d. = ±2.3 | *N*sum = 166  *N*average = 5.4  *N*s.d. = ±2.7 |
| **total**  **(5.-10.)** | *N*sum = 1171  *N*average = 234.2  *N*s.d. = ±40.0 | *N*sum = 1098  *N*average = 219.6  *N*s.d. = ±30.3 | *N*sum = 1131  *N*average = 226.2  *N*s.d. = ±32.9 | *N*sum = 1092  *N*average = 218.4  *N*s.d. = ±37.7 |

**Supplementary Table S11**: Statistical ANOVA analysis of the numbers of insect pollinators counted between sunrise and sunset on the 10 north-facing, 10 east-facing, 10 south-facing and 10 west-facing sunflower inflorescences on **5 July 2023** in experiment 3 (Supplementary Table 10, Figure 6). Result: differences are **not significant**. SS: sum of squares, df: degree of freedom, MS: mean square, F: F-value of Fisher’s test, p: significance value (significant if p < 0.05), F-crit: critical value of Fisher’s test.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| groups | count | sum | average | variance |
| north | 31 | 233 | 7.5161 | 7.0581 |
| east | 31 | 189 | 6.0968 | 6.8237 |
| south | 31 | 204 | 6.5806 | 9.7183 |
| west | 31 | 198 | 6.3871 | 5.3785 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| source of variation | SS | df | MS | F | p | F-crit |
| between groups | 35.0323 | 3 | 11.6774 | 1.6119 | 0.1902 | 2.6802 |
| within groups | 869.3548 | 120 | 7.2446 |  |  |  |
| total | 904.3871 | 123 |  |  |  |  |

**Supplementary Table S12**: Statistical ANOVA analysis of the numbers of insect pollinators counted between sunrise and sunset on the 10 north-facing, 10 east-facing, 10 south-facing and 10 west-facing sunflower inflorescences on **7 July 2023** in experiment 3 (Supplementary Table 10, Figure 6). Result: differences are **not significant**. SS: sum of squares, df: degree of freedom, MS: mean square, F: F-value of Fisher’s test, p: significance value (significant if p < 0.05), F-crit: critical value of Fisher’s test.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| groups | count | sum | average | variance |
| north | 30 | 258 | 8.6 | 4.3862 |
| east | 30 | 238 | 7.9333 | 7.8575 |
| south | 30 | 267 | 8.9 | 4.9207 |
| west | 30 | 263 | 8.7667 | 9.2885 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| source of variation | SS | df | MS | F | p | F-crit |
| between groups | 16.5667 | 3 | 5.5222 | 0.8350 | 0.4773 | 2.6828 |
| within groups | 767.1333 | 116 | 6.6132 |  |  |  |
| total | 783.7 | 119 |  |  |  |  |

**Supplementary Table S13**: Statistical ANOVA analysis of the numbers of insect pollinators counted between sunrise and sunset on the 10 north-facing, 10 east-facing, 10 south-facing and 10 west-facing sunflower inflorescences on **8 July 2023** in experiment 3 (Supplementary Table 10, Figure 6). Result: differences are **not significant**. SS: sum of squares, df: degree of freedom, MS: mean square, F: F-value of Fisher’s test, p: significance value (significant if p < 0.05), F-crit: critical value of Fisher’s test.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| groups | count | sum | average | variance |
| north | 31 | 244 | 7.8710 | 6.5828 |
| east | 31 | 255 | 8.2258 | 7.8473 |
| south | 31 | 253 | 8.1613 | 9.4731 |
| west | 31 | 241 | 7.7742 | 8.8473 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| source of variation | SS | df | MS | F | p | F-crit |
| between groups | 4.4758 | 3 | 1.4919 | 0.1822 | 0.9083 | 2.6802 |
| within groups | 982.5161 | 120 | 8.1876 |  |  |  |
| total | 986.9919 | 123 |  |  |  |  |

**Supplementary Table S14**: Statistical ANOVA analysis of the numbers of insect pollinators counted between sunrise and sunset on the 10 north-facing, 10 east-facing, 10 south-facing and 10 west-facing sunflower inflorescences on **9 July 2023** in experiment 3 (Supplementary Table 10, Figure 6). Result: differences are **not significant**. SS: sum of squares, df: degree of freedom, MS: mean square, F: F-value of Fisher’s test, p: significance value (significant if p < 0.05), F-crit: critical value of Fisher’s test.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| groups | count | sum | average | variance |
| north | 31 | 269 | 8.6774 | 8.0258 |
| east | 31 | 229 | 7.3871 | 8.4452 |
| south | 31 | 218 | 7.0323 | 6.5656 |
| west | 31 | 224 | 7.2258 | 8.5806 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| source of variation | SS | df | MS | F | p | F-crit |
| between groups | 51.6774 | 3 | 17.2258 | 2.1793 | 0.0940 | 2.6802 |
| within groups | 948.5161 | 120 | 7.9043 |  |  |  |
| total | 1000.1935 | 123 |  |  |  |  |

**Supplementary Table S15**: Statistical ANOVA analysis of the numbers of insect pollinators counted between sunrise and sunset on the 10 north-facing, 10 east-facing, 10 south-facing and 10 west-facing sunflower inflorescences on **10 July 2023** in experiment 3 (Supplementary Table 10, Figure 6). Result: differences are **not significant**. SS: sum of squares, df: degree of freedom, MS: mean square, F: F-value of Fisher’s test, p: significance value (significant if p < 0.05), F-crit: critical value of Fisher’s test.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| groups | count | sum | average | variance |
| north | 31 | 167 | 5.3871 | 9.8452 |
| east | 31 | 187 | 6.0323 | 7.4323 |
| south | 31 | 189 | 6.0968 | 5.2903 |
| west | 31 | 166 | 5.3548 | 7.3699 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| source of variation | SS | df | MS | F | p | F-crit |
| between groups | 14.9919 | 3 | 4.9973 | 0.6677 | 0.5735 | 2.6802 |
| within groups | 898.1290 | 120 | 7.4844 |  |  |  |
| total | 913.1210 | 123 |  |  |  |  |

**Supplementary Table S16**: Statistical ANOVA analysis of the total numbers of insect pollinators counted between sunrise and sunset on the 10 north-facing, 10 east-facing, 10 south-facing and 10 west-facing sunflower inflorescences on **5, 7, 8, 9 and 10 July 2023** in experiment 3 (Supplementary Table 10, Figure 6). Result: differences are **not significant**. SS: sum of squares, df: degree of freedom, MS: mean square, F: F-value of Fisher’s test, p: significance value (significant if p < 0.05), F-crit: critical value of Fisher’s test.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| groups | count | sum | average | variance |
| north | 5 | 1171 | 234.2 | 1597.7 |
| east | 5 | 1098 | 219.6 | 919.8 |
| south | 5 | 1131 | 226.2 | 1081.7 |
| west | 5 | 1092 | 218.4 | 1423.3 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| source of variation | SS | df | MS | F | p | F-crit |
| between groups | 790.8 | 3 | 263.6 | 0.2099 | 0.8880 | 3.2389 |
| within groups | 20090 | 16 | 1255.625 |  |  |  |
| total | 20880.8 | 19 |  |  |  |  |

**Supplementary Table S17**: Sum (Σ), average (<>) and standard deviation (±) of the number *N* of pollinators versus time of day *t* (= local summer time = UTC + 2 h) counted on the 10, 10, 10, and 10 real sunflower inflorescences facing north, east, south and west in experiment 3. 1.: 5 July 2023, 2.: 7 July 2023, 3.: 8 July 2023, 4.: 9 July 2023, 5.: 10 July 2023.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| time of day *t*  8:00 | 1. | 2. | 3. | 4. | 5. | sum  Σ | average  <> | standard deviation  ± |
| North | 5 | 7 | 9 | 8 | 7 | 36 | 7.20 | 1.48 |
| East | 4 | 6 | 8 | 9 | 12 | 39 | 7.80 | 3.03 |
| South | 1 | 3 | 4 | 2 | 9 | 19 | 3.80 | 3.11 |
| West | 4 | 2 | 1 | 2 | 5 | 14 | 2.80 | 1.64 |
| 8:20 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 4 | 5 | 5 | 7 | 14 | 35 | 7.00 | 4.06 |
| East | 4 | 6 | 9 | 11 | 10 | 40 | 8.00 | 2.92 |
| South | 5 | 10 | 2 | 2 | 8 | 27 | 5.40 | 3.58 |
| West | 2 | 7 | 8 | 7 | 8 | 32 | 6.40 | 2.51 |
| 8:40 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 10 | 7 | 12 | 8 | 8 | 45 | 9.00 | 2.00 |
| East | 6 | 7 | 8 | 15 | 9 | 45 | 9.00 | 3.54 |
| South | 6 | 5 | 10 | 6 | 3 | 30 | 6.00 | 2.55 |
| West | 6 | 6 | 11 | 6 | 7 | 36 | 7.20 | 2.17 |
| 9:00 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 9 | 9 | 8 | 12 | 8 | 46 | 9.20 | 1.64 |
| East | 5 | 11 | 11 | 10 | 8 | 45 | 9.00 | 2.55 |
| South | 10 | 6 | 10 | 7 | 7 | 40 | 8.00 | 1.87 |
| West | 9 | 7 | 10 | 13 | 11 | 50 | 10.00 | 2.24 |
| 9:20 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 10 | 8 | 6 | 14 | 9 | 47 | 9.40 | 2.97 |
| East | 7 | 11 | 14 | 9 | 9 | 50 | 10.00 | 2.65 |
| South | 11 | 11 | 11 | 7 | 10 | 50 | 10.00 | 1.73 |
| West | 2 | 11 | 16 | 8 | 10 | 47 | 9.40 | 5.08 |
| 9:40 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 11 | 9 | 8 | 5 | 8 | 41 | 8.20 | 2.17 |
| East | 7 | 5 | 8 | 11 | 7 | 38 | 7.60 | 2.19 |
| South | 6 | 10 | 14 | 9 | 10 | 49 | 9.80 | 2.86 |
| West | 6 | 11 | 9 | 6 | 9 | 41 | 8.20 | 2.17 |
| 10:00 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 14 | 11 | 8 | 13 | 13 | 59 | 11.80 | 2.39 |
| East | 4 | 11 | 8 | 10 | 7 | 40 | 8.00 | 2.74 |
| South | 9 | 13 | 9 | 13 | 12 | 56 | 11.20 | 2.05 |
| West | 5 | 6 | 7 | 9 | 4 | 31 | 6.20 | 1.92 |
| 10:20 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 8 | 9 | 5 | 9 | 7 | 38 | 7.60 | 1.67 |
| East | 6 | 10 | 12 | 7 | 7 | 42 | 8.40 | 2.51 |
| South | 7 | 7 | 5 | 9 | 8 | 36 | 7.20 | 1.48 |
| West | 5 | 16 | 6 | 11 | 8 | 46 | 9.20 | 4.44 |
| 10:40 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 5 | 8 | 15 | 9 | 5 | 42 | 8.40 | 4.10 |
| East | 5 | 6 | 11 | 11 | 7 | 40 | 8.00 | 2.83 |
| South | 7 | 9 | 14 | 11 | 6 | 47 | 9.40 | 3.21 |
| West | 5 | 9 | 8 | 8 | 7 | 37 | 7.40 | 1.52 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 11:00 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 8 | 6 | 6 | 8 | 5 | 33 | 6.60 | 1.34 |
| East | 9 | 5 | 10 | 5 | 4 | 33 | 6.60 | 2.70 |
| South | 12 | 10 | 8 | 2 | 3 | 35 | 7.00 | 4.36 |
| West | 7 | 6 | 7 | 9 | 8 | 37 | 7.40 | 1.14 |
| 11:20 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 7 | 6 | 5 | 7 | 3 | 28 | 5.60 | 1.67 |
| East | 9 | 11 | 5 | 5 | 7 | 37 | 7.40 | 2.61 |
| South | 4 | 11 | 7 | 7 | 6 | 35 | 7.00 | 2.55 |
| West | 9 | 8 | 6 | 9 | 3 | 35 | 7.00 | 2.55 |
| 11:40 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 10 | 9 | 6 | 10 | 5 | 40 | 8.00 | 2.35 |
| East | 8 | 10 | 13 | 9 | 3 | 43 | 8.60 | 3.65 |
| South | 6 | 7 | 10 | 6 | 4 | 33 | 6.60 | 2.19 |
| West | 9 | 12 | 4 | 7 | 8 | 40 | 8.00 | 2.92 |
| 12:00 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 8 | 10 | 5 | 5 | 6 | 34 | 6.80 | 2.17 |
| East | 6 | 7 | 8 | 9 | 8 | 38 | 7.60 | 1.14 |
| South | 8 | 5 | 6 | 6 | 5 | 30 | 6.00 | 1.22 |
| West | 9 | 8 | 5 | 4 | 10 | 36 | 7.20 | 2.59 |
| 12:20 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 8 | 5 | 5 | 7 | 3 | 28 | 5.60 | 1.95 |
| East | 14 | 7 | 5 | 6 | 9 | 41 | 8.20 | 3.56 |
| South | 14 | 12 | 8 | 8 | 4 | 46 | 9.20 | 3.90 |
| West | 8 | 14 | 8 | 8 | 3 | 41 | 8.20 | 3.90 |
| 12:40 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 10 | 8 | 11 | 4 | 4 | 37 | 7.40 | 3.29 |
| East | 4 | 9 | 9 | 7 | 7 | 36 | 7.20 | 2.05 |
| South | 5 | 11 | 5 | 6 | 7 | 34 | 6.80 | 2.49 |
| West | 5 | 3 | 10 | 9 | 5 | 32 | 6.40 | 2.97 |
| 13:00 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 4 | 9 | 7 | 14 | 2 | 36 | 7.20 | 4.66 |
| East | 10 | 6 | 9 | 10 | 1 | 36 | 7.20 | 3.83 |
| South | 4 | 10 | 6 | 7 | 7 | 34 | 6.80 | 2.17 |
| West | 8 | 6 | 9 | 2 | 4 | 29 | 5.80 | 2.86 |
| 13:20 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 10 | 9 | 6 | 14 | 2 | 41 | 8.20 | 4.49 |
| East | 8 | 9 | 8 | 9 | 4 | 38 | 7.60 | 2.07 |
| South | 1 | 11 | 9 | 9 | 7 | 37 | 7.40 | 3.85 |
| West | 8 | 10 | 7 | 12 | 6 | 43 | 8.60 | 2.41 |
| 13:40 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 4 | 7 | 7 | 11 | 4 | 33 | 6.60 | 2.88 |
| East | 8 | 5 | 10 | 7 | 2 | 32 | 6.40 | 3.05 |
| South | 7 | 7 | 7 | 6 | 3 | 30 | 6.00 | 1.73 |
| West | 7 | 10 | 11 | 10 | 4 | 42 | 8.40 | 2.88 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 14:00 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 11 | 10 | 5 | 11 | 7 | 44 | 8.80 | 2.68 |
| East | 2 | 10 | 3 | 7 | 7 | 29 | 5.80 | 3.27 |
| South | 6 | 7 | 9 | 7 | 6 | 35 | 7.00 | 1.22 |
| West | 5 | 8 | 3 | 10 | 4 | 30 | 6.00 | 2.92 |
| 14:20 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 7 | 8 | 10 | 12 | 3 | 40 | 8.00 | 3.39 |
| East | 9 | 7 | 6 | 3 | 7 | 32 | 6.40 | 2.19 |
| South | 10 | 8 | 10 | 8 | 7 | 43 | 8.60 | 1.34 |
| West | 6 | 9 | 13 | 5 | 5 | 38 | 7.60 | 3.44 |
| 14:40 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 7 | 14 | 11 | 9 | 3 | 44 | 8.80 | 4.15 |
| East | 8 | 3 | 9 | 7 | 6 | 33 | 6.60 | 2.30 |
| South | 11 | 9 | 9 | 4 | 7 | 40 | 8.00 | 2.65 |
| West | 7 | 8 | 7 | 6 | 3 | 31 | 6.20 | 1.92 |
| 15:00 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 6 | 7 | 11 | 7 | 7 | 38 | 7.60 | 1.95 |
| East | 7 | 16 | 9 | 2 | 6 | 40 | 8.00 | 5.15 |
| South | 10 | 8 | 9 | 8 | 4 | 39 | 7.80 | 2.28 |
| West | 8 | 13 | 6 | 6 | 2 | 35 | 7.00 | 4.00 |
| 15:20 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 11 | 11 | 11 | 7 | 6 | 46 | 9.20 | 2.49 |
| East | 6 | 6 | 3 | 3 | 2 | 20 | 4.00 | 1.87 |
| South | 6 | 11 | 11 | 8 | 7 | 43 | 8.60 | 2.30 |
| West | 6 | 8 | 12 | 7 | 3 | 36 | 7.20 | 3.27 |
| 15:40 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 7 | 12 | 6 | 10 | 0 | 35 | 7.00 | 4.58 |
| East | 3 | 6 | 5 | 5 | 2 | 21 | 4.20 | 1.64 |
| South | 3 | 8 | 7 | 5 | 4 | 27 | 5.40 | 2.07 |
| West | 13 | 13 | 6 | 3 | 2 | 37 | 7.40 | 5.32 |
| 16:00 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 9 | 8 | 11 | 8 | 4 | 40 | 8.00 | 2.55 |
| East | 3 | 4 | 11 | 4 | 6 | 28 | 5.60 | 3.21 |
| South | 6 | 9 | 6 | 9 | 4 | 34 | 6.80 | 2.17 |
| West | 7 | 10 | 10 | 7 | 2 | 36 | 7.20 | 3.27 |
| 16:20 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 6 | 9 | 7 | 4 | 7 | 33 | 6.60 | 1.82 |
| East | 2 | 6 | 11 | 4 | 4 | 27 | 5.40 | 3.44 |
| South | 4 | 5 | 6 | 10 | 4 | 29 | 5.80 | 2.49 |
| West | 7 | 8 | 7 | 9 | 8 | 39 | 7.80 | 0.84 |
| 16:40 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 5 | 11 | 6 | 6 | 5 | 33 | 6.60 | 2.51 |
| East | 5 | 8 | 5 | 4 | 9 | 31 | 6.20 | 2.17 |
| South | 5 | 11 | 16 | 4 | 7 | 43 | 8.60 | 4.93 |
| West | 7 | 6 | 8 | 7 | 5 | 33 | 6.60 | 1.14 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 17:00 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 5 | 6 | 9 | 7 | 2 | 29 | 5.80 | 2.59 |
| East | 5 | 8 | 8 | 7 | 7 | 35 | 7.00 | 1.22 |
| South | 4 | 12 | 6 | 6 | 6 | 34 | 6.80 | 3.03 |
| West | 5 | 10 | 7 | 3 | 5 | 30 | 6.00 | 2.65 |
| 17:20 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 6 | 7 | 8 | 8 | 2 | 31 | 6.20 | 2.49 |
| East | 4 | 12 | 6 | 8 | 2 | 32 | 6.40 | 3.85 |
| South | 3 | 9 | 7 | 10 | 4 | 33 | 6.60 | 3.05 |
| West | 6 | 9 | 7 | 3 | 2 | 27 | 5.40 | 2.88 |
| 17:40 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 3 | 11 | 7 | 8 | 2 | 31 | 6.20 | 3.70 |
| East | 4 | 9 | 9 | 7 | 4 | 33 | 6.60 | 2.51 |
| South | 7 | 8 | 4 | 9 | 3 | 31 | 6.20 | 2.59 |
| West | 5 | 9 | 6 | 6 | 3 | 29 | 5.80 | 2.17 |
| 18:00 | 1. | 2. | 3. | 4. | 5. | Σ | <> | ± |
| North | 5 | 9 | 8 | 7 | 6 | 35 | 7.00 | 1.58 |
| East | 7 | 7 | 4 | 8 | 4 | 30 | 6.00 | 1.87 |
| South | 6 | 7 | 8 | 7 | 7 | 35 | 7.00 | 0.71 |
| West | 2 | 2 | 6 | 12 | 2 | 24 | 4.80 | 4.38 |