# Supplementary Material

Table S1. Identification of cuticular hydrocarbons of female *Polistes satan* (RT: Retention Time; RI: Retention Index; ions).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | compound | RT | RI | ions |
| 1 | Unknown 1 | 11.01 | 2137 | 55, 69, 79, 264, 282 |
| 2 | C23:1 | 12.73 | 2275 | 57, 83, 97, 322 |
| 3 | n-C23 | 13.08 | 2300 | 324 |
| 4 | 3-MeC23 | 14.16 | 2372 | 56/57, 308/309 |
| 5 | n-C24 | 14.59 | 2400 | 338 |
| 6 | C25:1 | 15.78 | 2472 | 57, 83, 97, 111, 350 |
| 7 | n-C25 | 16.26 | 2500 | 352 |
| 8 | 13-, 11-MeC25 | 16.84 | 2533 | 13-: 196/197; 11-: 138/169, 224/225 |
| 9 | 3-MeC25 | 17.55 | 2572 | 56/57, 336/337 |
| 10 | n-C26 | 18.06 | 2600 | 366 |
| 11 | 13-, 12-MeC26 | 18.65 | 2632 | 13-: 196/197, 210/211; 12-: 182/183, 224/225 |
| 12 | 4-MeC26 | 19.13 | 2657 | 70/71, 336/337 |
| 13 | 3-MeC26 | 19.43 | 2672 | 56/57, 350/351  |
| 14 | C27 | 19.97 | 2700 | 380 |
| 15 | 5-MeC27 | 20.91 | 2748 | 84/85, 336/337 |
| 16 | 11,15-diMeC27 | 21.04 | 2755 | 168, 186, 239, 267 |
| 17 | 3-MeC27 | 21.42 | 2774 | 365 |
| 18 | 14-, 13-MeC28 | 22.51 | 2830 | 14-: 210/211, 224/225; 13-: 196/197, 238/239 |
| 19 | 5-MeC28 | 23.04 | 2856 | 84/85, 350/351 |
| 20 | 3-MeC28 | 23.37 | 2872 | 379 |
| 21 | 4,14-, 4,16-diMeC28 | 23.63 | 2885 | 4,14-: 379, 224/225, 70; 4,16-: 379,253,70, 196 |
| 22 | n-C29 | 23.92 | 2900 | 408 |
| 23 | 15-, 13-MeC29 | 24.54 | 2930 | 15-: 224/225; 13-: 196/197, 252/253 |
| 24 | 7-MeC29 | 24.71 | 2939 | 112/113, 336/337 |
| 25 | 13,17-diMeC29 | 24.95 | 2951 | 196, 267 |
| 26 | 3-MeC29 | 25.39 | 2973 | 393 |
| 27 | n-C30  | 25.94 | 3000 | 422 |
| 28 | 15-, 14-, 13-, 11-MeC30 | 26.49 | 3028 | 15-: 224/225, 238/239; 14-: 210/211, 252/253; 13-: 196/197, 266/267; 11-: 168/169, 294/295  |
| 29 | 13,17-diMeC31 | 26.90 | 3049 | 281, 267, 196, 210 |
| 30 | Unknown 2 | 26.97 | 3053 | 85, 155, 196, 267 |
| 31 | 4-MeC30 | 27.04 | 3056 | 70/71, 392/393 |
| 32 | Unknown 3 | 27.77 | 3094 | 386 |
| 33 | n-C31 | 27.90 | 3100 | 436 |
| 34 | 15-, 13-, 11-MeC31  | 28.51 | 3131 | 15-: 224/225, 252/253; 13-: 196/197, 280/281; 11-: 168/169, 308/3098 |
| 35 | 13,17-diMeC31 | 28.87 | 3148 | 295, 267, 196, 224 |
| 36 | 3-MeC31 | 29.35 | 3172 | 421 |
| 37 | 13-, 12-, 11-MeC32  | 30.43 | 3226 | 13-: 196/197, 294/295; 12-: 182/183, 308/309; 11-: 168/169, 322/323 |
| 38 | 13,17-diMeC32 | 30.80 | 3244 | 196, 267, 309, 238 |
| 39 | 12,16-diMeC32 | 30.89 | 3249 | 323, 253, 182, 252 |
| 40 | 13-, 11-MeC33 | 32.36 | 3324 | 13-: 196/197, 308/309; 11-: 168/169, 336/337 |
| 41 | 13,17-diMeC33 | 32.71 | 3342 | 196, 252, 267, 323 |
| 42 | 15,19-diMeC33 | 32.79 | 3346 | 224, 295 |
| 43 | 9,x-diMeC33 | 33.18 | 3367 | 140, 211, 252, 323 |
| 44 | 13-, 12-MeC34 | 34.24 | 3423 | 13-: 196/197, 322/323; 12-: 182/183, 336/337 |
| 45 | 12,16-diMeC34 | 34.65 | 3446 | 351, 253, 182, 280 |
| 46 | 13-MeC35 | 36.08 | 3523 | 196/197, 336/337 |
| 47 | 13,17-diMeC35 | 36.47 | 3544 | 351, 267, 196, 280 |
| 48 | Unknown 4 | 36.75 | 3559 | 168, 239, 252, 393 |
| 49 | 13-MeC37 | 39.65 | 3721 | 196/197, 364/365 |
| 50 | 11,15-diMeC37 | 40.03 | 3743 | 407, 239, 168, 336 |
| 51 | 13-meC39 | 43.12 | 3921 | 196/197, 392/393 |
| 52 | 11,15-diMeC39 | 43.54 | 3942 | 435, 239, 168, 364 |
| 53 | 12,24-diMeC40 | 45.52 | 4044 | 435, 365, 182, 252 |
| 54 | 13-MeC41 | 47.40 | 4140 | 196/197, 420/421 |
| 55 | Unknown 5 | 47.85 | 4163 | 196, 267, 364, 436 |
| 56 | Unknown 6 | 51.86 | 4363 | 196, 464 |

Table S2. Compounds on the cuticle that were most characteristic for dominant breeding females in *Polistes satan* based on the t ratio test statistic, listed from the highest to lowest fold difference, which was measured as the difference in log2 transformed relative abundance between dominant females (n = 4) and workers (n =12). In this table, only compounds with a mean fold difference ≥ 1.5 were retained. The compounds in bold were available to us and therefore were used in the blend on the bioassays.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | compound | contrast | fold\_difference | t.ratio | p.value |  | Q avg | Q sd | W avg | W sd |
| 3 | n-C23 | Q - W | 3.39 | 2.26 | 0.04 | \* | 0.20 | 0.08 | 0.11 | 0.21 |
| 9 | 3-MeC25 | Q - W | 1.86 | 2.12 | 0.05 |  | 0.57 | 0.06 | 0.35 | 0.16 |
| 13 | 3-MeC26 | Q - W | 1.73 | 4.03 | 0.00 | \* | 0.15 | 0.04 | 0.08 | 0.02 |
| 5 | n-C24 | Q - W | 1.73 | 2.35 | 0.04 | \* | 0.06 | 0.02 | 0.03 | 0.02 |
| 17 | 3-MeC27 | Q - W | 1.71 | 4.05 | 0.00 | \* | 22.21 | 1.60 | 14.16 | 3.05 |
| 4 | 3-MeC23 | Q - W | 1.62 | 2.27 | 0.04 | \* | 0.06 | 0.02 | 0.04 | 0.02 |
| 7 | n-C25 | Q - W | 1.60 | 2.04 | 0.06 |  | 1.38 | 0.55 | 0.87 | 0.40 |
| 33 | n-C31 | Q - W | 1.50 | 2.72 | 0.02 | \* | 0.93 | 0.32 | 0.59 | 0.09 |
| 10 | n-C26 | Q - W | 1.38 | 1.47 | 0.16 |  | 0.26 | 0.10 | 0.18 | 0.08 |
| 12 | 4-MeC26 | Q - W | 1.36 | 2.36 | 0.03 | \* | 0.08 | 0.01 | 0.06 | 0.01 |
| 15 | 5-MeC27 | Q - W | 1.35 | 3.23 | 0.01 | \* | 0.34 | 0.07 | 0.27 | 0.05 |
| 20 | 3-MeC28 | Q - W | 1.33 | 3.70 | 0.00 | \* | 0.72 | 0.08 | 0.53 | 0.08 |
| 14 | C27 | Q - W | 1.25 | 1.40 | 0.18 |  | 7.17 | 2.24 | 5.71 | 1.53 |
| 22 | n-C29 | Q - W | 1.24 | 1.73 | 0.11 |  | 8.06 | 2.07 | 6.43 | 1.13 |
| 26 | 3-MeC29 | Q - W | 1.23 | 1.94 | 0.07 |  | 9.17 | 0.61 | 7.57 | 1.57 |
| 56 | Unknown 6 | Q - W | 1.19 | 0.37 | 0.71 |  | 0.13 | 0.09 | 0.11 | 0.06 |
| 46 | 13-MeC35 | Q - W | 1.14 | 1.35 | 0.20 |  | 1.07 | 0.23 | 0.99 | 0.22 |
| 19 | 5-MeC28 | Q - W | 1.14 | 0.94 | 0.36 |  | 1.41 | 0.04 | 1.38 | 0.28 |
| 50 | 11,15-diMeC37 | Q - W | 1.08 | 0.78 | 0.45 |  | 0.51 | 0.11 | 0.46 | 0.08 |
| 41 | 13,17-diMeC33 | Q - W | 1.01 | 0.08 | 0.94 |  | 2.02 | 0.74 | 2.87 | 1.04 |
| 44 | 13-, 12-MeC34 | Q - W | 1.01 | 0.07 | 0.94 |  | 0.25 | 0.06 | 0.24 | 0.04 |
| 27 | n-C30 | Q - W | 0.96 | -0.51 | 0.62 |  | 1.54 | 0.28 | 1.50 | 0.32 |
| 40 | 13-, 11-MeC33 | Q - W | 0.96 | -0.38 | 0.71 |  | 3.59 | 0.76 | 3.71 | 0.56 |
| 49 | 13-MeC37 | Q - W | 0.94 | -0.28 | 0.78 |  | 0.28 | 0.04 | 0.33 | 0.19 |
| 8 | 13-, 11-MeC25 | Q - W | 0.93 | -0.60 | 0.56 |  | 0.46 | 0.14 | 0.47 | 0.09 |
| 11 | 13-, 12-MeC26 | Q - W | 0.89 | -1.33 | 0.21 |  | 0.20 | 0.05 | 0.21 | 0.03 |
| 37 | 13-, 12-, 11-MeC32  | Q - W | 0.89 | -0.99 | 0.34 |  | 0.58 | 0.13 | 0.63 | 0.15 |
| 32 | Unknown 3 | Q - W | 0.87 | -0.45 | 0.66 |  | 0.13 | 0.06 | 0.15 | 0.16 |
| 47 | 13,17-diMeC35 | Q - W | 0.86 | -1.13 | 0.28 |  | 1.27 | 0.17 | 1.59 | 0.37 |
| 36 | 3-MeC31 | Q - W | 0.86 | -1.82 | 0.09 |  | 0.25 | 0.03 | 0.29 | 0.04 |
| 28 | 15-, 14-, 13-, 11-MeC30 | Q - W | 0.85 | -2.28 | 0.04 | \* | 1.08 | 0.20 | 1.27 | 0.17 |
| 18 | 14-, 13-MeC28 | Q - W | 0.84 | -3.10 | 0.01 | \* | 1.68 | 0.29 | 2.06 | 0.19 |
| 31 | 4-MeC30 | Q - W | 0.83 | -1.77 | 0.10 |  | 0.22 | 0.05 | 0.26 | 0.04 |
| 42 | 15,19-diMeC33 | Q - W | 0.82 | -1.33 | 0.21 |  | 4.03 | 0.77 | 5.34 | 1.24 |
| 34 | 15-, 13-, 11-MeC31  | Q - W | 0.82 | -1.66 | 0.12 |  | 4.88 | 0.68 | 6.06 | 1.63 |
| 53 | 12,24-diMeC40 | Q - W | 0.81 | -1.13 | 0.28 |  | 0.16 | 0.05 | 0.20 | 0.06 |
| 38 | 13,17-diMeC32 | Q - W | 0.81 | -1.64 | 0.13 |  | 0.19 | 0.04 | 0.30 | 0.08 |
| 30 | Unknown 2 | Q - W | 0.81 | -1.54 | 0.15 |  | 0.14 | 0.04 | 0.18 | 0.05 |
| 39 | 12,16-diMeC32 | Q - W | 0.80 | -1.67 | 0.12 |  | 0.45 | 0.12 | 0.58 | 0.12 |
| 35 | 13,17-diMeC31b | Q - W | 0.80 | -2.18 | 0.05 |  | 1.46 | 0.39 | 2.37 | 0.66 |
| 43 | 9,x-diMeC33 | Q - W | 0.79 | -1.26 | 0.23 |  | 0.41 | 0.08 | 0.55 | 0.14 |
| 25 | 13,17-diMeC29 | Q - W | 0.78 | -3.06 | 0.01 | \* | 4.93 | 0.55 | 7.15 | 1.29 |
| 16 | 11,15-diMeC27 | Q - W | 0.78 | -1.64 | 0.13 |  | 0.52 | 0.08 | 0.85 | 0.30 |
| 45 | 12,16-diMeC34 | Q - W | 0.76 | -2.60 | 0.02 | \* | 0.24 | 0.05 | 0.32 | 0.05 |
| 21 | 4,14-, 4,16-diMeC28 | Q - W | 0.76 | -2.25 | 0.04 | \* | 0.10 | 0.02 | 0.11 | 0.03 |
| 48 | Unknown 4 | Q - W | 0.75 | -2.13 | 0.05 |  | 0.12 | 0.02 | 0.16 | 0.04 |
| 23 | 15-, 13-MeC29 | Q - W | 0.74 | -2.74 | 0.02 | \* | 12.92 | 2.61 | 17.45 | 3.44 |
| 24 | 7-MeC29 | Q - W | 0.72 | -1.66 | 0.12 |  | 0.07 | 0.02 | 0.10 | 0.05 |
| 29 | 13,17-diMeC31 | Q - W | 0.71 | -3.07 | 0.01 | \* | 0.17 | 0.04 | 0.30 | 0.08 |
| 52 | 11,15-diMeC39 | Q - W | 0.64 | -1.99 | 0.07 |  | 0.24 | 0.10 | 0.33 | 0.24 |
| 54 | 13-MeC41 | Q - W | 0.64 | -1.94 | 0.08 |  | 0.08 | 0.01 | 0.12 | 0.09 |
| 51 | 13-meC39 | Q - W | 0.63 | -1.15 | 0.27 |  | 0.09 | 0.03 | 0.21 | 0.36 |
| 1 | Unknown 1 | Q - W | 0.60 | -0.97 | 0.35 |  | 0.02 | 0.02 | 0.09 | 0.14 |
| 55 | Unknown 5  | Q - W | 0.51 | -3.98 | 0.00 | \* | 0.71 | 0.20 | 1.41 | 0.46 |
| 6 | C25:1 | Q - W | 0.45 | -1.25 | 0.24 |  | 0.03 | 0.01 | 0.15 | 0.31 |
| 2 | C23:1 | Q - W | 0.42 | -1.12 | 0.28 |  | 0.02 | 0.01 | 0.20 | 0.44 |

Table S3. Dissection data, per colony size, caste (0 for subordinate females workers and 1 for dominant females), treatment (blend of hydrocarbons, control with pentane and queenright), condition of spermatheca (0 for empty and 1 for full of sperm) and condition of ovaries (0 for inactivated and 1 for activated ovaries).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | colony\_size | caste | treatment | spermatheca | developed | nr\_males |
| Nest\_17 | 10 | 0 | Blend | 1 | 0 | 6 |
| Nest\_17 | 10 | 0 | Blend | 1 | 1 | 6 |
| Nest\_17 | 10 | 0 | Blend | 0 | 0 | 6 |
| Nest\_17 | 10 | 0 | Blend | 1 | 0 | 6 |
| Nest\_17 | 10 | 0 | Blend | 1 | 0 | 6 |
| Nest\_17 | 10 | 0 | Blend | 1 | 0 | 6 |
| Nest\_17 | 10 | 0 | Blend | 1 | 1 | 6 |
| Nest\_17 | 10 | 0 | Blend | 0 | 0 | 6 |
| Nest\_17 | 10 | 0 | Blend | 1 | 0 | 6 |
| Nest\_17 | 10 | 0 | Blend | 1 | 1 | 6 |
| Nest\_17 | 10 | 0 | Blend | 1 | 0 | 6 |
| Nest\_14 | 11 | 0 | Blend | 1 | 1 | 0 |
| Nest\_14 | 11 | 0 | Blend | 1 | 1 | 0 |
| Nest\_14 | 11 | 0 | Blend | 1 | 1 | 0 |
| Nest\_14 | 11 | 0 | Blend | 0 | 0 | 0 |
| Nest\_14 | 11 | 0 | Blend | 1 | 1 | 0 |
| Nest\_14 | 11 | 0 | Blend | 1 | 1 | 0 |
| Nest\_14 | 11 | 0 | Blend | 1 | 0 | 0 |
| Nest\_14 | 11 | 0 | Blend | 1 | 1 | 0 |
| Nest\_14 | 11 | 0 | Blend | 1 | 0 | 0 |
| Nest\_14 | 11 | 0 | Blend | 1 | 0 | 0 |
| Nest\_14 | 11 | 0 | Blend | 1 | 1 | 0 |
| Nest\_21 | 12 | 0 | Blend | 0 | 1 | 0 |
| Nest\_21 | 12 | 0 | Blend | 0 | 0 | 0 |
| Nest\_21 | 12 | 0 | Blend | 1 | 1 | 0 |
| Nest\_21 | 12 | 0 | Blend | 1 | 1 | 0 |
| Nest\_21 | 12 | 0 | Blend | 0 | 0 | 0 |
| Nest\_21 | 12 | 0 | Blend | 0 | 0 | 0 |
| Nest\_21 | 12 | 0 | Blend | 1 | 0 | 0 |
| Nest\_21 | 12 | 0 | Blend | 0 | 1 | 0 |
| Nest\_21 | 12 | 0 | Blend | 0 | 0 | 0 |
| Nest\_21 | 12 | 0 | Blend | 0 | 0 | 0 |
| Nest\_21 | 12 | 0 | Blend | 0 | 1 | 0 |
| Nest\_21 | 12 | 0 | Blend | 0 | 0 | 0 |
| Nest\_22 | 10 | 0 | Blend | 1 | 1 | 3 |
| Nest\_22 | 10 | 0 | Blend | 1 | 1 | 3 |
| Nest\_22 | 10 | 0 | Blend | 1 | 1 | 3 |
| Nest\_22 | 10 | 0 | Blend | 0 | 0 | 3 |
| Nest\_22 | 10 | 0 | Blend | 1 | 1 | 3 |
| Nest\_22 | 10 | 0 | Blend | 0 | 0 | 3 |
| Nest\_22 | 10 | 0 | Blend | 0 | 0 | 3 |
| Nest\_22 | 10 | 0 | Blend | 1 | 1 | 3 |
| Nest\_22 | 10 | 0 | Blend | 0 | 0 | 3 |
| Nest\_22 | 10 | 0 | Blend | 0 | 1 | 3 |
| Nest\_27 | 10 | 0 | Blend | 0 | 1 | 0 |
| Nest\_27 | 10 | 0 | Blend | 0 | 1 | 0 |
| Nest\_27 | 10 | 0 | Blend | 1 | 1 | 0 |
| Nest\_27 | 10 | 0 | Blend | 0 | 1 | 0 |
| Nest\_27 | 10 | 0 | Blend | 0 | 1 | 0 |
| Nest\_27 | 10 | 0 | Blend | 0 | 1 | 0 |
| Nest\_27 | 10 | 0 | Blend | 0 | 0 | 0 |
| Nest\_27 | 10 | 0 | Blend | 0 | 1 | 0 |
| Nest\_27 | 10 | 0 | Blend | 0 | 1 | 0 |
| Nest\_27 | 10 | 0 | Blend | 0 | 1 | 0 |
| Nest\_12 | 4 | 0 | Blend | 0 | 1 | 1 |
| Nest\_12 | 4 | 0 | Blend | 0 | 0 | 1 |
| Nest\_12 | 4 | 0 | Blend | 1 | 1 | 1 |
| Nest\_12 | 4 | 0 | Blend | 0 | 0 | 1 |
| Nest\_23 | 1 | 0 | Blend | 1 | 1 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 1 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 1 | 1 | 0 |
| Nest\_4 | 28 | 0 | control | 1 | 1 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 1 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 1 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 0 | 0 |
| Nest\_4 | 28 | 0 | control | 0 | 1 | 0 |
| Nest\_3 | 12 | 0 | control | 0 | 1 | 8 |
| Nest\_3 | 12 | 0 | control | 0 | 1 | 8 |
| Nest\_3 | 12 | 0 | control | 0 | 1 | 8 |
| Nest\_3 | 12 | 0 | control | 0 | 0 | 8 |
| Nest\_3 | 12 | 0 | control | 0 | 0 | 8 |
| Nest\_3 | 12 | 0 | control | 0 | 1 | 8 |
| Nest\_3 | 12 | 0 | control | 0 | 1 | 8 |
| Nest\_3 | 12 | 0 | control | 0 | 1 | 8 |
| Nest\_3 | 12 | 0 | control | 0 | 1 | 8 |
| Nest\_3 | 12 | 0 | control | 0 | 1 | 8 |
| Nest\_3 | 12 | 0 | control | 0 | 0 | 8 |
| Nest\_3 | 12 | 0 | control | 0 | 1 | 8 |
| Nest\_13 | 11 | 0 | control | 0 | 1 | 0 |
| Nest\_13 | 11 | 0 | control | 1 | 0 | 0 |
| Nest\_13 | 11 | 0 | control | 0 | 1 | 0 |
| Nest\_13 | 11 | 0 | control | 0 | 1 | 0 |
| Nest\_13 | 11 | 0 | control | 0 | 0 | 0 |
| Nest\_13 | 11 | 0 | control | 1 | 1 | 0 |
| Nest\_13 | 11 | 0 | control | 1 | 1 | 0 |
| Nest\_13 | 11 | 0 | control | 0 | 0 | 0 |
| Nest\_13 | 11 | 0 | control | 0 | 0 | 0 |
| Nest\_13 | 11 | 0 | control | 1 | 1 | 0 |
| Nest\_13 | 11 | 0 | control | 0 | 0 | 0 |
| Nest\_10 | 10 | 0 | control | 1 | 1 | 2 |
| Nest\_10 | 10 | 0 | control | 1 | 0 | 2 |
| Nest\_10 | 10 | 0 | control | 1 | 1 | 2 |
| Nest\_10 | 10 | 0 | control | 1 | 0 | 2 |
| Nest\_10 | 10 | 0 | control | 1 | 0 | 2 |
| Nest\_10 | 10 | 0 | control | 1 | 0 | 2 |
| Nest\_10 | 10 | 0 | control | 1 | 1 | 2 |
| Nest\_10 | 10 | 0 | control | 1 | 0 | 2 |
| Nest\_10 | 10 | 0 | control | 0 | 1 | 2 |
| Nest\_10 | 10 | 0 | control | 0 | 0 | 2 |
| Nest\_1 | 11 | 0 | control | 0 | 1 | 0 |
| Nest\_1 | 11 | 0 | control | 1 | 1 | 0 |
| Nest\_1 | 11 | 0 | control | 0 | 1 | 0 |
| Nest\_1 | 11 | 0 | control | 0 | 1 | 0 |
| Nest\_1 | 11 | 0 | control | 0 | 1 | 0 |
| Nest\_1 | 11 | 0 | control | 0 | 1 | 0 |
| Nest\_1 | 11 | 0 | control | 0 | 0 | 0 |
| Nest\_1 | 11 | 0 | control | 0 | 0 | 0 |
| Nest\_1 | 11 | 0 | control | 0 | 0 | 0 |
| Nest\_1 | 11 | 0 | control | 0 | 0 | 0 |
| Nest\_1 | 11 | 0 | control | 1 | 0 | 0 |
| Nest\_5 | 9 | 0 | control | 0 | 1 | 0 |
| Nest\_5 | 9 | 0 | control | 1 | 1 | 0 |
| Nest\_5 | 9 | 0 | control | 1 | 0 | 0 |
| Nest\_5 | 9 | 0 | control | 1 | 1 | 0 |
| Nest\_5 | 9 | 0 | control | 1 | 1 | 0 |
| Nest\_5 | 9 | 0 | control | 0 | 0 | 0 |
| Nest\_5 | 9 | 0 | control | 0 | 1 | 0 |
| Nest\_5 | 9 | 0 | control | 0 | 0 | 0 |
| Nest\_5 | 9 | 0 | control | 0 | 1 | 0 |
| Nest\_18 | 6 | 0 | queenright | 0 | 0 | 0 |
| Nest\_18 | 6 | 0 | queenright | 0 | 0 | 0 |
| Nest\_18 | 6 | 0 | queenright | 0 | 0 | 0 |
| Nest\_18 | 6 | 0 | queenright | 0 | 0 | 0 |
| Nest\_18 | 6 | 0 | queenright | 0 | 1 | 0 |
| Nest\_18 | 6 | 0 | queenright | 0 | 0 | 0 |
| Nest\_11 | 19 | 0 | queenright | 1 | 0 | 0 |
| Nest\_11 | 19 | 0 | queenright | 1 | 0 | 0 |
| Nest\_11 | 19 | 0 | queenright | 1 | 0 | 0 |
| Nest\_11 | 19 | 0 | queenright | 1 | 0 | 0 |
| Nest\_11 | 19 | 0 | queenright | 0 | 0 | 0 |
| Nest\_11 | 19 | 0 | queenright | 1 | 1 | 0 |
| Nest\_11 | 19 | 1 | queenright | 1 | 1 | 0 |
| Nest\_11 | 19 | 0 | queenright | 0 | 0 | 0 |
| Nest\_11 | 19 | 0 | queenright | 0 | 0 | 0 |
| Nest\_11 | 19 | 0 | queenright | 0 | 1 | 0 |
| Nest\_11 | 19 | 0 | queenright | 0 | 1 | 0 |
| Nest\_11 | 19 | 0 | queenright | 0 | 0 | 0 |
| Nest\_11 | 19 | 0 | queenright | 0 | 0 | 0 |
| Nest\_11 | 19 | 0 | queenright | 0 | 0 | 0 |
| Nest\_11 | 19 | 0 | queenright | 0 | 0 | 0 |
| Nest\_11 | 19 | 0 | queenright | 0 | 0 | 0 |
| Nest\_11 | 19 | 0 | queenright | 0 | 0 | 0 |
| Nest\_11 | 19 | 0 | queenright | 0 | 0 | 0 |
| Nest\_11 | 19 | 0 | queenright | 0 | 0 | 0 |
| Nest\_25 | 8 | 0 | queenright | 0 | 0 | 2 |
| Nest\_25 | 8 | 0 | queenright | 0 | 0 | 2 |
| Nest\_25 | 8 | 0 | queenright | 0 | 0 | 2 |
| Nest\_25 | 8 | 1 | queenright | 1 | 1 | 2 |
| Nest\_25 | 8 | 0 | queenright | 1 | 0 | 2 |
| Nest\_25 | 8 | 0 | queenright | 0 | 0 | 2 |
| Nest\_25 | 8 | 0 | queenright | 1 | 1 | 2 |
| Nest\_25 | 8 | 0 | queenright | 0 | 0 | 2 |
| Nest\_6 | 9 | 0 | queenright | 1 | 1 | 0 |
| Nest\_6 | 9 | 0 | queenright | 0 | 1 | 0 |
| Nest\_6 | 9 | 0 | queenright | 0 | 1 | 0 |
| Nest\_6 | 9 | 0 | queenright | 0 | 1 | 0 |
| Nest\_6 | 9 | 0 | queenright | 0 | 1 | 0 |
| Nest\_6 | 9 | 0 | queenright | 0 | 1 | 0 |
| Nest\_6 | 9 | 1 | queenright | 1 | 1 | 0 |
| Nest\_6 | 9 | 0 | queenright | 1 | 0 | 0 |
| Nest\_6 | 9 | 0 | queenright | 0 | 1 | 0 |
| Nest\_19 | 4 | 0 | queenright | 1 | 1 | 0 |
| Nest\_19 | 4 | 1 | queenright | 1 | 1 | 0 |
| Nest\_19 | 4 | 0 | queenright | 1 | 1 | 0 |
| Nest\_19 | 4 | 0 | queenright | 0 | 1 | 0 |
| Nest\_15 | 6 | 1 | queenright | 1 | 1 | 0 |
| Nest\_15 | 6 | 0 | queenright | 0 | 0 | 0 |
| Nest\_15 | 6 | 0 | queenright | 0 | 0 | 0 |
| Nest\_15 | 6 | 0 | queenright | 1 | 1 | 0 |
| Nest\_15 | 6 | 0 | queenright | 0 | 0 | 0 |
| Nest\_15 | 6 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 1 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 1 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 1 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 1 | 1 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 1 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 1 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 0 | 0 |
| Nest\_20 | 27 | 0 | queenright | 0 | 1 | 0 |

Table S4. Binomial generalized linear mixed model output testing for differences in the number of mated females coded as an additional covariate. Significance levels are based on Wald z tests (intercept, shown between brackets).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Estimate** | **SE** | **z value** | ***p* value** |  |
| **(intercept)** | 1.54 | 0.51 | 2.99 | 0.002 | \*\* |
| **blend**  | 0.09 | 0.47 | 0.19 | 0.848 |  |
| **queenright** | -0.98 | 0.44 | -2.25 | 0.025 | \* |
| **colony size** | -0.09 | 0.03 | -3.22 | 0.001 | \*\* |
| **inseminated** | -0.09 | 0.07 | -1.42 | 0.155 |  |



Figure S1. Examples of *Polistes satan* females with different levels of ovary activation and insemination status. (A) Dominant female with activated ovaries and a full spermatheca; (B) Subordinate female with inactivated ovaries but full spermatheca; (C) Subordinate female with slightly activated ovaries but empty spermatheca. Left column shows ovary activation, right column insemination status (red arrows indicate the spermatheca). White bars = 5 mm and red bars = 500 µm.