

## Supplementary material

**Table S1.** Dominant vegetation in the five sampling locations (Region of Murcia, Spain): crops and vegetation patches.

| Pair of orchards | Location                    | Crops                                                                         | Vegetation patches                                                                 |
|------------------|-----------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Pair 1           | Jumilla                     | Orchards of different peach varieties<br>Pear and plum orchards               | _ <sup>[1]</sup>                                                                   |
| Pair 2           | Las Contiendas,<br>Abanilla | Orchards of different peach varieties<br>A fig orchard and olive groves       | _ <sup>[1]</sup>                                                                   |
| Pair 3           | Los Carrillos,<br>Abanilla  | Orchards of different peach varieties<br>Citrus orchards and vegetable fields | Uncultivated lands where esparto grass ( <i>Stipa tenacissima</i> L.) predominates |
| Pair 4           | Sucina,<br>Murcia           | Orchards of different peach varieties<br>Some citrus orchards                 | Uncultivated lands where esparto grass ( <i>Stipa tenacissima</i> L.) predominates |
| Pair 5           | Calasparra<br>and Cieza     | Almost exclusively, orchards of different peach varieties                     | _ <sup>[1]</sup>                                                                   |

<sup>[1]</sup> Area with continuous crops, without natural vegetation patches.

**Table S2.** Pesticides and plant protection practices applied in each orchard and their location within protection zones for the sustainable use of plant protection products.

| No. orchard | Crop management | Pesticides and other plant protection practices applied                                                                                                                                                                    | Protection Zones <sup>[1]</sup>                         |
|-------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| 1           | organic         | azadirachtin, <i>Beauveria bassiana</i> , copper + oil, mating disruption, spinosad                                                                                                                                        | Buffer zone <sup>[2]</sup>                              |
| 2           | conventional    | copper + oil, deltamethrin, imidacloprid, lambda-cyhalothrin, penconazole, thiacloprid, thiamethoxam, thiram                                                                                                               | Protection zone                                         |
| 3           | organic         | sulphur                                                                                                                                                                                                                    | Buffer zone <sup>[2]</sup>                              |
| 4           | conventional    | copper + oil, imidacloprid, penconazole, pyriproxyfen, thiacloprid                                                                                                                                                         | Buffer zone <sup>[2]</sup>                              |
| 5           | organic         | sulphur                                                                                                                                                                                                                    | Protection zone                                         |
| 6           | conventional    | acetamiprid, bupirimate, copper, cyproconazole, difenoconazole, etofenprox, fenhexamid, flonicamid, imidacloprid, penconazole, pyriproxyfen, spinosad, sulphur, tau-fluvalinate, tetraconazole, thiophanate-methyl, thiram | Protection zone<br>bordering Buffer zone <sup>[2]</sup> |
| 7           | organic         | azadirachtin, cinnamon extract, copper, pyrethrum extract, sulphur                                                                                                                                                         | Buffer zone <sup>[2]</sup>                              |

|     |              |                                                                                                                                                                                                                                      |                                                         |
|-----|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| 8   | conventional | abamectin, acrinathrin, copper + oil, cypermethrin, cyproconazole, difenoconazole, hexythiazox, imidacloprid, pyriproxyfen, spinosad, tebuconazole, tetraconazole, thiram                                                            | Buffer zone <sup>[2]</sup>                              |
| 9   | organic      | pyrethrum extract, sulphur                                                                                                                                                                                                           | Protection zone<br>bordering Buffer zone <sup>[2]</sup> |
| 10a | conventional | acrinathrin, copper + oil, deltamethrin, flonicamid, penconazole                                                                                                                                                                     | Protection zone                                         |
| 10b | conventional | acetamiprid, acrinathrin, chlorpyrifos, deltamethrin, difenoconazole, esfenvalerate, flonicamid, fluopyram, imidacloprid, oil, oxyfluorfen, pyriproxifen, spirotetramat, sulphur, tau-fluvalinate, tebuconazole, thiacloprid, thiram | Protection zone                                         |

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<sup>[1]</sup> Protection Zones for the Sustainable Use of Plant Protection Products.

MAPA (Ministry of Agriculture, Fisheries and Food, Spain), 2022. National Action Plan for the Sustainable Use of Plant Protection Products, PAN 2023-2024. [https://food.ec.europa.eu/system/files/2023-03/pesticides\\_sup\\_nap\\_esp-rev-2023-24.pdf](https://food.ec.europa.eu/system/files/2023-03/pesticides_sup_nap_esp-rev-2023-24.pdf)

MAPA (Ministry of Agriculture, Fisheries and Food, Spain), 2025. Sistema de Información Geográfica de Parcelas Agrícolas (SIGPAC) (v3.5). <https://sigpac.carm.es/VisorSigPacV35/index.html#> [21 January 2025]

<sup>[2]</sup> For Buffer zones, no recommendations are issued beyond the legal obligations established in Royal Decree 1311/2012, of September 14<sup>th</sup>.

**Table S3.** Tentative identification of pesticide residues (PR) by liquid chromatography – time-of-flight – mass spectrometry (LC-QTOF-MS) in *Apis mellifera* L.: number of bees analysed relative to the number of bees captured, number of samples with PR relative to the number of samples analysed, number of PR and PR detected, and number of orchards with PR relative to the number of orchards analysed, per year, crop management and orchard.

| Year | Crop management | No. orchard      | No. bees analysed / captured | No. samples with PR <sup>[1]</sup> / analysed | No. PR <sup>[1]</sup> detected | PR <sup>[1]</sup> detected | No. orchards with PR <sup>[1]</sup> / analysed |
|------|-----------------|------------------|------------------------------|-----------------------------------------------|--------------------------------|----------------------------|------------------------------------------------|
| 2015 | organic         | 1                | 7 / 9                        | 0 / 1                                         | 0                              | –                          | 3 / 5                                          |
|      |                 | 3                | 9 / 15                       | 0 / 1                                         | 0                              | –                          |                                                |
|      |                 | 3 <sup>[2]</sup> | 8 / 14                       | 0 / 1                                         | 0                              | –                          |                                                |
|      |                 | 5                | 34 / 55                      | 1 / 4                                         | 1                              | flufenacet                 |                                                |
|      |                 | 7                | 40 / 41                      | 3 / 4                                         | 1                              | spiromesifen               |                                                |
|      |                 | 9                | 40 / 114                     | 1 / 4                                         | 1                              | iprovalicarb               |                                                |
|      | conventional    | 2                | 8 / 12                       | 0 / 1                                         | 0                              | –                          | 0 / 4                                          |
|      |                 | 4                | 6 / 6                        | 0 / 1                                         | 0                              | –                          |                                                |
|      |                 | 6                | 40 / 68                      | 0 / 4                                         | 0                              | –                          |                                                |

Supplementary tables to the article “A field monitoring study to explore the European honey bee exposure to pesticide residues in orchards”, by Míriam Gurpegui, Manuel González-Núñez, Ana I. García-Valcárcel, Ismael Sánchez-Ramos, Concepción Ornos and M. Dolores Hernando. Spanish Journal of Agricultural Research, Vol. 23, No. 3, 2025 (<https://doi.org/10.5424/sjar/2025233-21272>)

|      |              |                    |           |                             |                         |                                              |       |
|------|--------------|--------------------|-----------|-----------------------------|-------------------------|----------------------------------------------|-------|
|      |              | 8                  | 4 / 4     | 0 / 1                       | 0                       | –                                            |       |
|      |              | 10a <sup>[3]</sup> | 0 / 1     | 0 / 0                       | 0                       | –                                            |       |
|      | total        |                    | 196 / 339 | 5 / 22                      | 3                       |                                              | 3 / 9 |
| 2016 | organic      | 1                  | 7 / 7     | 0 / 1                       | 0                       | –                                            | 3 / 5 |
|      |              | 3                  | 20 / 23   | 0 / 2                       | 0                       | –                                            |       |
|      |              | 5                  | 38 / 43   | 1 / 4                       | 1                       | isoprocarb                                   |       |
|      |              | 7                  | 16 / 16   | 1 / 2                       | 1                       | isoprocarb                                   |       |
|      |              | 9                  | 24 / 26   | 1 (+ 1 <sup>[4]</sup> ) / 3 | 1 (+ 1 <sup>[4]</sup> ) | carbetamide +<br>iprovalicarb <sup>[4]</sup> |       |
|      | conventional | 2                  | 5 / 5     | 0 / 1                       | 0                       | –                                            | 1 / 5 |
|      |              | 4                  | 40 / 63   | 1 / 4                       | 1                       | spiromesifen                                 |       |
|      |              | 6                  | 18 / 18   | 0 / 2                       | 0                       | –                                            |       |
|      |              | 8                  | 5 / 5     | 0 / 1                       | 0                       | –                                            |       |
|      |              | 10b <sup>[3]</sup> | 17 / 19   | 0 / 2                       | 0                       | –                                            |       |

|       |              |                    |           |                              |                         |                           |                             |
|-------|--------------|--------------------|-----------|------------------------------|-------------------------|---------------------------|-----------------------------|
|       | total        |                    | 190 / 225 | 4 (+ 1 <sup>[4]</sup> ) / 22 | 3 (+ 1 <sup>[4]</sup> ) |                           | 4 / 10                      |
| 2017  | organic      | 1                  | 0 / 2     | 0 / 0                        | 0                       | –                         | 0 / 3                       |
|       |              | 3                  | 0 / 1     | 0 / 0                        | 0                       | –                         |                             |
|       |              | 5                  | 35 / 35   | 0 / 4                        | 0                       | –                         |                             |
|       |              | 7                  | 9 / 10    | 0 / 1                        | 0                       | –                         |                             |
|       |              | 9                  | 36 / 86   | 0 / 4                        | 0                       | –                         |                             |
|       | conventional | 2                  | 0 / 0     | 0 / 0                        | 0                       | –                         | 0 (+ 2 <sup>[4]</sup> ) / 3 |
|       |              | 4                  | 0 / 1     | 0 / 0                        | 0                       | –                         |                             |
|       |              | 6                  | 13 / 13   | 0 / 2                        | 0                       | –                         |                             |
|       |              | 8                  | 6 / 6     | 0 (+ 1 <sup>[4]</sup> ) / 1  | 0 (+ 1 <sup>[4]</sup> ) | buturon <sup>[4]</sup>    |                             |
|       |              | 10b <sup>[3]</sup> | 9 / 9     | 0 (+ 1 <sup>[4]</sup> ) / 1  | 0 (+ 1 <sup>[4]</sup> ) | acetochlor <sup>[4]</sup> |                             |
|       | total        |                    | 108 / 163 | 0 (+ 2 <sup>[4]</sup> ) / 13 | 0 (+ 2 <sup>[4]</sup> ) |                           | 0 (+ 2 <sup>[4]</sup> ) / 6 |
| Total | organic      |                    | 323 / 497 | 8 (+ 1 <sup>[4]</sup> ) / 36 | 5                       |                           | 3 / 5                       |
|       | conventional |                    | 171 / 230 | 1 (+ 2 <sup>[4]</sup> ) / 21 | 1 (+ 2 <sup>[4]</sup> ) |                           | 1 (+ 2 <sup>[4]</sup> ) / 5 |

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<sup>[1]</sup> Pesticide residues (PR). <sup>[2]</sup> Bee abundance data in this sampling were considered not representative, due to weather conditions. However, the captured bee specimens were suitable for chemical analysis. <sup>[3]</sup> In the first year of study, sampling was carried out in orchard 10a and in the second and third years, sampling was carried out in orchard 10b. <sup>[4]</sup> Tentative identification of buturon, acetochlor and iprovalicarb, exceed mass error < 5 ppm for at least two ions, preferably the molecular ion, the (de)protonated molecule  $[M+H]^+$  or adduct ion  $[M+Na]^+$  and at least one fragment ion.