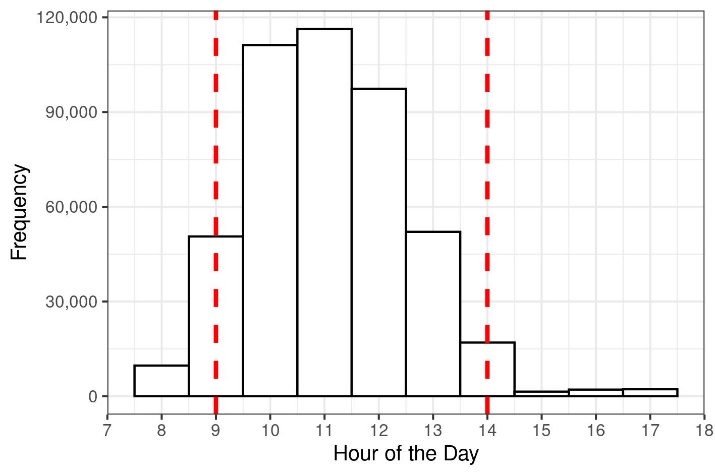
# 

**Appendices to J Poll Ecol 38(1), Ștefan et al.**

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# Appendix Figure I. Frequency of images by hour of the day

Distribution of the number of images by hour of the day for the 213 annotated "plant folders" (each representing approximately 1 hour of time-lapse images). The red dashed lines represent 95% quantile-based confidence intervals, indicating the range within which 95% of the images fall in the distribution.



# Appendix Table I. List of sampling sites in and around Leipzig and Halle, Germany.

Site metadata provided by Amibeth Thompson.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Site name** | **Type** | **Latitude**  **(WGS84)** | **Longitude (WGS84)** | **Notes** |
| HAL-721-1 | Meadow | 51.489865 | 11.933866 | in park, gravel area, 125 m b/w transects |
| HAL-722-2 | Meadow | 51.490957 | 11.934477 | along road |
| HAL-723-3 | Meadow | 51.490471 | 11.939207 | in park |
| HAL-724-4 | Meadow | 51.489829 | 11.938118 | in park |
| HAL-725-5 | Meadow | 51.494844 | 11.949442 | in Peisnitz |
| HAL-726-6 | Meadow | 51.494526 | 11.948066 | in Peisnitz |
| HAL-727-7 | Meadow | 51.496376 | 11.939412 | in gravel area, 30 m b/w transects |
| HAL-728-8 | Meadow | 51.496914 | 11.938965 | in gravel area |
| HAL-729-9 | Meadow | 51.500061 | 11.942803 | between buildings, 75 m b/w transects |
| HAL-730-10 | Meadow | 51.500394 | 11.941824 | between buildings, 75 m b/w transects |
| LEI\_A-701-1 | Roadside | 51.381921 | 12.272399 | along gravel spot |
| LEI\_A-702-2 | Roadside | 51.381344 | 12.271475 | along road |
| LEI\_A-703-3 | Meadow | 51.375605 | 12.279626 | meadow |
| LEI\_A-704-4 | Meadow | 51.376405 | 12.278860 | meadow |
| LEI\_A-705-5 | Meadow | 51.373104 | 12.285967 | meadow, 80 m b/w transects |
| LEI\_A-706-6 | Meadow | 51.374005 | 12.285946 | along river/creek |
| LEI\_A-707-7 | Forest | 51.367095 | 12.279839 | forest edge, 95 m b/w transects |
| LEI\_A-708-8 | Forest | 51.367667 | 12.278746 | forest edge, 95 m b/w transects |
| LEI\_A-709-9 | Meadow | 51.382265 | 12.266712 | along river |
| LEI\_A-710-10 | Roadside | 51.381686 | 12.267349 | edge of meadow |
| LEI\_C-837-1 | Roadside | 51.321546 | 12.385721 | NA |
| LEI\_C-838-2 | Roadside | 51.321746 | 12.386616 | NA |
| LEI\_C-839-3 | Meadow | 51.322031 | 12.389959 | NA |
| LEI\_C-840-4 | Roadside | 51.326800 | 12.387749 | NA |
| LEI\_C-841-5 | Roadside | 51.329163 | 12.382719 | NA |
| LEI\_C-842-6 | Meadow | 51.320892 | 12.386599 | NA |
| LEI\_C-843-7 | Meadow | 51.320296 | 12.397112 | NA |
| LEI\_C-844-8 | Roadside | 51.321984 | 12.399551 | NA |
| LEI\_C-845-9 | Roadside | 51.323747 | 12.405742 | NA |
| LEI\_C-846-10 | Roadside | 51.323747 | 12.405742 | NA |

# Appendix Table II. List of sampled plant species and number of annotated images.

“No. folders”: Number of one-hour folders containing time-lapse images (proxy for the number of hours spent observing each plant species);

“No. img.”: Total number of images visually inspected for the presence of arthropods;

“No. img. w. arthropod”: Number of images containing an arthropod;

“% img. w. arthropod”: Percentage of images containing an arthropod, relative to the total number of images.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Id.** | **Plant** | **No. folders** | **No. img.** | **No. img. w. arthropod** | **% img. w. arthropod** |
| 1 | *Achillea millefolium* | 4 | 9,154 | 1,204 | 13.15 |
| 2 | *Asteraceae* “white” | 1 | 1,832 | 325 | 17.74 |
| 3 | *Berteroa incana* | 5 | 13,100 | 335 | 2.56 |
| 4 | *Bunias orientalis* | 3 | 8,328 | 376 | 4.51 |
| 5 | *Carduus acanthoides* | 10 | 22,040 | 1,776 | 8.06 |
| 6 | *Centaurea jacea* | 54 | 118,476 | 11,413 | 9.63 |
| 7 | *Centaurea scabiosa* | 3 | 3,814 | 681 | 17.86 |
| 8 | *Centaurea stoebe* | 3 | 8,308 | 233 | 2.8 |
| 9 | *Cichorium intybus* | 29 | 63,574 | 1,929 | 3.03 |
| 10 | *Cirsium vulgare* | 2 | 3,748 | 514 | 13.71 |
| 11 | *Clematis vitalba* | 7 | 13,798 | 2,072 | 15.02 |
| 12 | *Crepis biennis* | 11 | 21,224 | 832 | 3.92 |
| 13 | *Daucus carota* | 15 | 31,054 | 4,713 | 15.18 |
| 14 | *Echium vulgare* | 3 | 6,078 | 53 | 0.87 |
| 15 | *Erigeron annuus* | 2 | 3,243 | 191 | 5.89 |
| 16 | *Hypericum perforatum* | 6 | 10,049 | 255 | 2.54 |
| 17 | *Hypochaeris radicata* | 2 | 3,986 | 91 | 2.28 |
| 18 | *Lamium purpureum* | 1 | 2,505 | 13 | 0.52 |
| 19 | *Leucanthemum vulgare* | 1 | 2,577 | 838 | 32.52 |
| 20 | *Lotus corniculatus* | 1 | 1,988 | 57 | 2.87 |
| 21 | *Melilotus albus* | 1 | 2,086 | 43 | 2.06 |
| 22 | *Origanum vulgare* | 3 | 7,099 | 437 | 6.16 |
| 23 | *Picris hieracioides* | 17 | 36,037 | 1,172 | 3.25 |
| 24 | *Scorzoneroides autumnalis* | 1 | 3,802 | 69 | 1.81 |
| 25 | *Sedum sp* | 1 | 1,828 | 14 | 0.77 |
| 26 | *Senecio inaequidens* | 2 | 4,394 | 65 | 1.48 |
| 27 | *Silene latifolia* | 1 | 3,037 | 5 | 0.16 |
| 28 | *Tanacetum vulgare* | 6 | 12,729 | 2,054 | 16.14 |
| 29 | *Trifolium medium* | 1 | 3,903 | 23 | 0.59 |
| 30 | *Trifolium pratense* | 12 | 26,083 | 1,416 | 5.43 |
| 31 | *Trifolium repens* | 1 | 1,907 | 6 | 0.31 |
| 32 | *Verbascum densiflorum* | 1 | 2,116 | 144 | 6.81 |
| 33 | *Vicia villosa* | 3 | 6,159 | 153 | 2.48 |
|  | **TOTAL** | **213** | **460,056** | **33,502** | **7.28** |

# Appendix Table III. Visible features and identification assessments for Hymenoptera in the smartphone images dataset.

The column "Taxa ID" corresponds to the identifiers used in Appendix Tab. V. The column "Ref." contains reference IDs, with further details provided at the bottom of the table. The column "R/S." indicates whether the identification is robust (R) or subjective (S). Identifications evaluated as "robust" (R) are based on clear distinguishing characteristics that could be consistently identified across the images, supported by detailed descriptions in dichotomous keys (e.g. Scheuchl 1995; Amiet 1996; Westrich 2023) and other sources (referenced in the column "Ref."). Subjective (S) identifications refer to cases where expert judgment was necessary due to less distinct features. These identifications relied on the entomological expertise of co-authors, drawing from their previous microscope-based work and familiarity with the descriptions in the dichotomous keys mentioned above and other cited sources.

Note that the example images were cropped and scaled from the full-view captures to enhance clarity. Insects can appear photographed from multiple angles due to their natural movement on the target flower, over which the smartphone was mounted. A taxonomist made the final identification decision based on all available views of the same individual appearing in a sequence of consecutive images. The table below illustrates example images that may not capture all visible features, given the multiple images associated with each individual. The complete image dataset will be made available upon reasonable request.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Taxa ID** | **Image examples (cropped)** | **Visible distinguishing features and identification assessments** | **Ref.** | **R/S** |
| 1. No family id. possible. |  | All hymenopterans have four wings, which are sometimes visible even in low-quality images. Hymenopterans also generally have long antennae, which are often geniculate ("elbowed") and easily spotted in most images. In contrast, dipterans have two wings and generally short antennae. Apocrita, which represent all hymenopterans observed in our dataset, are additionally defined by the presence of a petiole ("wasp-waist") separating the mesosoma and metasoma, which is often visible even in the lowest-quality images. | [1] | R |
| 2. Andrenidae |  | Bees in this family in Germany are generally black and may have pale banding on the abdomen. Most species are the size of a honeybee (*Apis mellifera*) or smaller, and all carry pollen in scopae on the hind tibiae and basal leg segments. Andrenids are distinguished from halictids by the basal vein, which lacks a strong curve, and by the absence of an abdominal furrow in females. | [2] | S |
|  |
| 3. Andrenidae, *Andrena* |  | Facial foveae (patches of hairs between the compound eyes and the antennal socket, see 1st image), and the presence of three submarginal cells in the wings (see 2nd image). Species-level identification would depend on microscopic traits. | [2] p. 239 | R |
|  |
| 4. Apidae, *Apis mellifera* |  | Characteristic golden-brown colouration, corbiculae (“pollen baskets”), striped abdomen, and banana-shaped marginal cell.  Identifying features like the corbiculae and the banana-shaped marginal cell are not always visible in our image dataset, but they further confirm the identification when present. | - | S |
| 5. Apidae, *Bombus* |  | These are large, predominantly black corbiculate bees with quite variable hair colours. We classify them as *Bombus* based on unique characteristics in their wing venation: notably, the first of the three submarginal cells has an incomplete vein, and the marginal cell is noticeably longer than the distance from the apex to the wing tip. Bees have been assigned to this genus because some of the key features of the *Bombus* morphospecies are visible, though parts of the specimen are unfortunately obscured, preventing more specific identification. For instance, in the 1st image shown, the terminal abdominal segments are not visible, which limits the identification. However, the strong thoracic banding and the large size of this bee suggest that a more specific classification might have been possible if the abdomen were visible. | [2] p. 785 | S |
|  |
| 6. Apidae, *Bombus* - black |  | Large corbiculate bees, solid black with no other colouration. Includes *Bombus ruderatus*. | - | R |
| 7. Apidae, *Bombus* - red tailed |  | Red hairs on the terminal few abdominal segments. Examples of species and morphotypes included in this group are: *B. confusus*, *B. lapidarius*, *B. lapponicus*, *B. monticola*, *B. pomorum*, *B. pratorum*, *B. pyrenaeus*, *B. ruderarius*, *B. rupestris*, *B. soroeensis*, *B. sylvarum*, and *B. wurflenii*. | - | R |
| 8. Apidae, *Bombus lapidarius* |  | Male bees with yellow hairs on the thorax but only black and red hairs on the abdomen. This species is part of the red-tailed group, but when these traits were visible, identification to the species level was possible. | [3] | S |
| 9. Apidae, *Bombus -* red yellow |  | Red hairs on the thorax and red and/or yellow hairs on the abdomen. Examples of species and morphotypes included in this group are: *B. humilis*, *B. muscorum*, and *B. pascuorum* | - | S |
| 10. Apidae, *Bombus* - striped |  | One or two (generally quite bold) thoracic bands in yellow or white and variably-coloured abdominal banding. They lack the strong “tail” marking of the other Bombus morphospecies groups and any red colouration on the thorax. Examples of species and morphotypes included in this group are: *B. campestris, B. distinguendus, B. flavidus, B. haematurus, B. mesomelas, B. mucidus, B. sichelii, B. subterraneus,* and *B. veteranus.* | - | R |
| 11. Apidae, *Bombus* - white tailed |  | White hairs on the terminal few abdominal segments. Examples of species and morphotypes included in this group are: *B. argillaceus, B. barbutellus, B. bohemicus, B. cryptarum, B. gerstaeckeri, B. hortorum, B. jonellus, B. lucorum, B. magnus, B. norvegicus, B. quadricolor, B. ruderatus, B. semenoviellus, B. soroeensis, B. subterraneus, B. sylvestris, B. terrestris,* and *B. vestalis.* | - | R |
| 12. Colletidae, *Colletes* |  | The identification here relies on a combination of factors: the overall shape of the bee, its light-coloured face, the gently curved antennae, and even the angle at which its body aligns during flight. Taken together, these traits suggest a likely match, though it is important to acknowledge that this conclusion is drawn from just two available instances, which inevitably introduces some degree of uncertainty. Species-level identification relies on traits that may only be visible in higher-quality images or under a microscope. | - | S |
|  |
| 13. Colletidae, *Hylaeus* |  | Fairly small, hairless, and black with white to yellow maculations, especially on the face and thorax. They also have two submarginal cells and the second is half the size of the first, which is unique to this genus when compared to other small, dark, hairless bees in Germany. Species differentiation relies on minute differences in maculation not visible in field images. | [2] p.188; [4] | S |
| 14. Cynipidae |  | Compact mesosoma, tall metasoma when viewed from the side, visible ovipositor, and small size. These individuals are quite small, and in the image dataset, they often appear obscured by surrounding flower parts, making clear identification challenging. No further identification was attempted as the species were unlikely to pollinate. | [5] | S |
| 15. Formicidae |  | No wings, geniculate antennae, and the presence of a petiole between the mesosoma and metasoma. No further identification was attempted as the species were unlikely to pollinate. | [6] | R |
| 16. Halictidae |  | Strongly curved basal vein in the wing. The abdominal furrow suggests females in the genera *Halictus* or *Lasioglossum*. | [2] | S |
| 17. Halictidae, *Halictus* |  | Apical banding of the tergites, strongly curved basal vein, three submarginal cells, abdominal furrow in females. Further identification is complicated by numerous similar species present in Germany and the need for microscopic traits, but two were distinctive - see below. | [2] p. 356 | S |
| 18. Halictidae, *Halictus* *scabiosae* |  | Large size and doubly-banded abdomen in females. | [7] | S |
| 19. Halictidae, *Halictus* *subauratus* |  | Iridescent green compound eyes, metallic greenish-gold body. | [8] | S |
| 20. Halictidae, *Lasioglossum* |  | Basal banding of the tergites, strongly curved basal vein, three submarginal cells, abdominal furrow in females. Additionally, the distal wing venation is often weakened. Generally black with pale stripes, some species have red visible on the abdomen. Further identification is complicated by numerous similar species present in Germany and the need for microscopic traits, but one was distinctive - see below. | [2] p. 356 | S |
|  |
| 21. Halictidae, *Lasioglossum* *calceatum* |  | Males can be distinguished by the red colouration of the abdomen. | [9] | S |
| 22. Megachilidae |  | Ventral abdominal scopa in most genera. Only two submarginal cells. | [2] p. 434 | R |
| 23. Megachilidae, *Anthidium manicatum* |  | Large size and broken yellow abdominal bands. | [10] | R |
| 24. Megachilidae, *Megachile* |  | The end of the abdomen is typically angled upwards. Generally conspicuous ventral abdominal scopa. Species-level identification would depend on traits that are only visible under a microscope. | [11] | S |
| 25. Megachilidae, *Osmia* |  | The abdomen is generally horizontal or even curled under. Generally conspicuous ventral abdominal scopa. Species-level identification would depend on traits that are only visible under a microscope. | [12] | S |
| 26. Melittidae, *Dasypoda* |  | Conspicuously long hairs on the hind legs.  Species-level identification requires examining leg and abdomen hairs, which our images do not allow. | [13] | R |
| 27. Melittidae, *Macropis* |  | Dense, light-coloured patch of long hairs on the hind tibiae.  Species-level identification requires examining leg and abdomen hairs, which our images do not allow. | [14] | S |
| 28. Pompilidae, *Episyron* |  | Spines and reddish colouration on legs. Species-level identification would depend on traits that are only visible under a microscope. | - | S |
| 29. Vespidae |  | Position in which its wings are held at rest (up and out, rather than against the body) and its characteristic black and yellow colouration. No further identification was attempted as the species were unlikely to pollinate. | - | S |

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[4] Martin HJ, Wildbienen - Maskenbienen: *Hylaeus*. [online] URL: <https://www.wildbienen.de/eb-hylae.htm> (accessed 25 October 2024)

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[6] NCSU Department of Entomology - Formicidae. [online] URL: <https://genent.cals.ncsu.edu/insect-identification/order-hymenoptera/family-formicidae/> (accessed 25 October 2024)

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[10] Martin HJ, Wildbienen - Wollbienen: *Anthidium manicatum*. [online] URL: <https://www.wildbienen.de/eb-amani.htm> (accessed 25 October 2024)

[11] Martin HJ, Wildbienen - Blattschneider- & Mörtelbienen: *Megachile*. [online] URL: <https://www.wildbienen.de/eb-megac.htm> (accessed 25 October 2024)

[12] Martin HJ, Wildbienen - Mauerbienen: *Osmia*. [online] URL: <https://www.wildbienen.de/eb-osmia.htm> (accessed 25 October 2024)

[13] Martin HJ, Wildbienen - Hosenbienen: *Dasypoda*. [online] URL: <https://www.wildbienen.de/eb-dasyp.htm> (accessed 25 October 2024)

[14] Martin HJ, Wildbienen - Schenkelbienen: *Macropis*. [online] URL: <https://www.wildbienen.de/eb-macro.htm> (accessed 25 October 2024)

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Westrich P (2023) Faszination Wildbienen. [online] URL: <https://www.wildbienen.info/> (accessed 4 December 2023).

# Appendix Table IV. Visible features and identification assessments for Diptera in the smartphone images dataset.

The column "Taxa ID" corresponds to the identifiers used in Appendix Tab. VI. The column "Ref." contains reference IDs, with further details provided at the bottom of the table. The column "R/S." indicates whether the identification is robust (R) or subjective (S). Identification evaluated as "robust" (R) were carried out using the Hoverfly field guide (Ball 2015 - [2]), following a step-by-step process using all visible characteristics across the photo series for each fly. These identifications were cross-checked against multiple sources, which are provided in the "Ref." column. Subjective (S) identifications were made based on the co-author’s previous experience with microscope-based identification and compiled information from family descriptions in dichotomous keys (including Marshall 2012 - [3]), Stephen Falk’s online image collections [4], and other sources. All non-Syrphid Diptera identifications were classified as subjective due to reliance on expert judgement and less distinct features.

Note that the example images were cropped and scaled from the full-view captures to enhance clarity. Insects appear photographed from multiple angles due to their natural movement on the target flower, over which the smartphone was mounted. A taxonomist made the final identification decision based on all available views of the same individual appearing in a sequence of consecutive images. The table below illustrates example images that may not capture all visible features, given the multiple images associated with each individual. The complete image dataset will be made available upon reasonable request.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Taxa ID** | **Image examples (cropped)** | **Visible distinguishing features and identification assessments** | **Ref.** | **R/S.** |
| 1. No family id. possible. |  | Robust body shape, single pair of wings, compound eyes, three pairs of legs. Reduced antennal size. Stout body shape seemed characteristic of Brachycera. | [1] p. 23-51;  [2] p. 12-13 | S |
| 2. Anthomyiidae, Anthomyia |  | Very small fly. Bold grey and black pattern on thorax and abdomen. Further species-level identification was not feasible, as it would require clear views of genitalia to determine sex, and the additional distinguishing features appeared to be sex-dependent. | [3] p. 533 | S |
| 3. Calliphoridae/ Muscidae |  | Robust, metallic green fly. Silver pilosity on face. Fewer, thinner bristles on thorax and abdomen, suggesting it's not a green metallic Tachinidae. Possibly Muscidae (*Neomyia*) or Calliphoridae (*Lucilia*). Distinguishing between these two families would require high resolution photos of the face, thorax bristles and the wing veins. Similarly, identification to lower taxonomic levels within these families was not possible because the required identifying features (including body and facial bristles and hairs, wing veins, and antennae hairs) cannot be seen in the images. | [3] p. 507-508;  [4]; [5]-[11] | S |
| 4. Chyromyidae |  | Distinctive bright, iridescent eyes and pale-yellow body colour. Minute fly, clear wings. Further identification within this family would depend on features not seen in our images, such as thorax bristles, leg colour, body colour variations, leg bristles, and bristle colour. | [3] p. 325, 449;  [12] p. 124-125 | S |
| 5. Sarcophagidae/  Tachinidae |  | Wing vein M1 curving forward. Lower calypter broadly rounded-triangular. A stout, thick-bristled fly with black/silver checkered pattern on abdomen. | [12] p. 157, 165 | S |
| 6. Syrphidae |  | Compact build, large compound eyes dominating most of the head, striking black and yellow markings. No strong bristles on the thorax or abdomen. | [2] p. 12-13, 49-54;  [13] p. 7-11 | R |
|  |
| 7. Syrphidae, *Episyrphus balteatus* |  | Yellow face. The two orange bands on each abdomen segment are separated by two dark bands, distinctive for this species. | [2] p. 55-62, 68, 95, 138-139 | R |
| 8. Syrphidae, *Eristalis* |  | Honey-bee mimic. One pair of wings, large eyes, particular yellow abdomen markings. Distinctive and well-defined loop in wing vein R4+5, vein R2+3 meets vein R1 rather than ending on the costa. Black stripe on yellow face. Further identification to the species level was not possible as microscopy is needed to show details such as hairs on wing calypter, body and face hair colour, leg colour, facial stripe view, antennal hairs, wing veins, and male genitalia. | [2] p. 55-62, 198-207;  [14] | R |
| 9. Syrphidae, *Helophilus trivittatus* |  | Large hoverfly. Well-defined loop in wing vein R4+5. Thorax with longitudinal pale stripes. One dark ring on hind tibia. Black antennae. Completely yellow face without black stripe. Scutellum pale haired. Tergites with lemon yellow markings and black hind margins. | [2] p. 55-62, 198-199, 214–216;  [13]; [15] | R |
| 10. Syrphidae, *Myathropa florea* |  | Loop in vein R4+5. Thorax with a pale bar creating the distinctive "Batman" black shape at the back. Only one mainland European species. | [2] p. 55-62 198-199, 210-211; [3] p. 418; [16] | R |
| 11. Syrphidae, *Paragus* |  | Small black fly. Concave head. Abdomen slightly constricted. Somewhat elongated antennae. Dark abdomen without yellow or silvery markings. Long wings in relation to abdomen.  Species-level identification would depend on traits that are only visible under a microscope. | [2] p. 55-62, 92;  [17] | R |
| 12. Syrphidae, *Scaeva* |  | Concave head, yellow face with swollen frons. Very pale lunulate (crescent-shaped) abdominal markings on tergites 3 + 4. Ideally, a clearer view of the wing veins would be needed for further identification. | [2] p. 55-62, 94-95, 122 | R |
| 13. Syrphidae, *Sphaerophoria* |  | Concave head. Small, narrowly built body. Sides of the thorax with sharp, distinct yellow markings. Elongate abdomen with black and yellow bands.  Subjective note: this genus is also part of the genera cluster “black yellow elongated”. It could be more easily identified from other genera in the cluster if the yellow stripe on thorax sides is visible. Males of *S. scripta* might be identifiable to species level if the abdomen is shown to be longer than the wings, but the photo angle plays a crucial role. | [2] p. 55-62, 94, 108–111;  [18] | R |
| 14. Syrphidae, *Syritta / Tropidia* |  | One pair of wings, large compound eyes dominating most of head. No strong bristles. Distinctive hoverfly stance in flight. Narrow body with grey dust on the side of the thorax, yellow spotted abdomen, dark colouring and swollen hind femurs. Microscope study of hind femora would be required to determine between these two genera. They could not be visually separated with this lower level of image resolution in our smartphone image dataset. | [2] p. 55-62, 250 | S |
|  |
| 15. Syrphidae, black yellow elongated |  | One pair of wings, large compound eyes dominating most of head. No strong bristles. Black and yellow patterned elongated abdomen. Image resolution not high enough to distinguish features necessary for further identification. Includes species from the genera *Epistrophella, Melangyna, Meligramma, Meliscaeva,* and *Sphaerophoria*, listed in [21]. | [2]; [3]; [4] | S |
| 16. Syrphidae, black yellow rounded |  | One pair of wings, large compound eyes dominating most of head. No strong bristles. Concave head. Broad abdomen with black and yellow markings. Sides of thorax hairy. Image resolution not high enough to distinguish features necessary for further identification. Includes species from the genera *Dasysyrphus, Didea, Epistrophe, Eupeodes, Megasyrphus, Parasyrphus,* and *Syrphus*, listed in [21]. | [2]; [3]; [4] | S |
| 17. Syrphidae, dark yellow patterned |  | One pair of wings, large compound eyes dominating most of head. No strong bristles. Small dark fly, with minimal yellow abdominal patterning. Image resolution not high enough to distinguish features necessary for further identification. Includes species from the genera *Chalcosyrphus, Chamaesyrphus, Melanostoma, Pelecocera, Platycheirus, Pyrophaena, Xanthandrus,* and *Xylota*, listed in [21]. | [2]; [3]; [4] | S |
| 18. Syrphidae, *Helophilus / Parhelophilus* |  | Loop in wing vein R4+5. Thorax with longitudinal pale stripes. One dark ring on hind tibia. Antennae colour not visible to diagnose between these genera. | [2] p. 55-62, 198-199;  [19]; [20] | R |
| 19. Syrphidae, small black |  | One pair of wings, large compound eyes dominating most of head, indicating Syrphidae. No strong bristles. Small, black fly. Image resolution not high enough to distinguish features necessary for further identification. Includes species from the genera *Cheilosia, Chrysogaster, Eumerus, Heringia, Lejogaster, Melanogaster, Orthonevra, Paragus, Pipizella, Portevinia, Psilota, Riponnensia, Syrphocheilosia, Trichopsomyia,* and *Triglyphus*, listed in [21]. | [2]; [3]; [4] | S |
| 20. Tachinidae, *Eliozeta / Clytiomya* |  | Wing veins, thick bristles on thorax and abdomen indicate Tachinidae. Yellow body colour and yellow marking on abdomen indicate these genera. Further identification was not possible without higher image resolution or microscope identification (for example to see features including genitalia, and details in abdominal and thorax bristle arrangement). | [3] p. 386 | S |

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# Appendix Table V. Counts of instances (bounding boxes) containing a flower visitor in the order Hymenoptera

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Id.** | **Family** | **Genus** | **Morphospecies** | **Species** | **No. boxes** | **% boxes** |
| 1 | NA |  |  |  | 2,138 | 10.187 |
| 2 | Andrenidae |  |  |  | 355 | 1.692 |
| 3 | Andrenidae | *Andrena* |  |  | 253 | 1.206 |
| 4 | Apidae | *Apis* |  | *mellifera* | 3,307 | 15.757 |
| 5 | Apidae | *Bombus* |  |  | 115 | 0.548 |
| 6 | Apidae | *Bombus* | black |  | 7 | 0.033 |
| 7 | Apidae | *Bombus* | red\_tailed |  | 3,669 | 17.482 |
| 8 | Apidae | *Bombus* | red\_tailed | *lapidarius* | 7 | 0.033 |
| 9 | Apidae | *Bombus* | red\_yellow |  | 698 | 3.326 |
| 10 | Apidae | *Bombus* | striped |  | 10 | 0.048 |
| 11 | Apidae | *Bombus* | white\_tailed |  | 672 | 3.202 |
| 12 | Colletidae | *Colletes* |  |  | 2 | 0.01 |
| 13 | Colletidae | *Hylaeus* |  |  | 402 | 1.915 |
| 14 | Cynipidae |  |  |  | 390 | 1.858 |
| 15 | Formicidae |  |  |  | 2,426 | 11.560 |
| 16 | Halictidae |  |  |  | 2,092 | 9.968 |
| 17 | Halictidae | *Halictus* |  |  | 2,250 | 10.721 |
| 18 | Halictidae | *Halictus* |  | *scabiosae* | 287 | 1.368 |
| 19 | Halictidae | *Halictus* |  | *subauratus* | 422 | 2.011 |
| 20 | Halictidae | *Lasioglossum* |  |  | 1,074 | 5.117 |
| 21 | Halictidae | *Lasioglossum* |  | *calceatum* | 28 | 0.133 |
| 22 | Megachilidae |  |  |  | 28 | 0.133 |
| 23 | Megachilidae | *Anthidium* |  | *manicatum* | 13 | 0.062 |
| 24 | Megachilidae | *Megachile* |  |  | 150 | 0.715 |
| 25 | Megachilidae | *Osmia* |  |  | 4 | 0.019 |
| 26 | Melittidae | *Dasypoda* |  |  | 3 | 0.014 |
| 27 | Melittidae | *Macropis* |  |  | 178 | 0.848 |
| 28 | Pompilidae | *Episyron* |  |  | 5 | 0.024 |
| 29 | Vespidae |  |  |  | 2 | 0.010 |
|  | **TOTAL** |  |  |  | **20,987** | **100** |

# Appendix Table VI. Counts of instances (bounding boxes) containing a flower visitor in the order Diptera

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Id.** | **Family / Family cluster** | **Morphological cluster / Genera group** | **Genus** | **Species** | **No. box** | **% box** |
| 1 | NA |  |  |  | 2,897 | 48.583 |
| 2 | Anthomyiidae |  | *Anthomyia* |  | 17 | 0.285 |
| 3 | Calliphoridae/Muscidae |  |  |  | 184 | 3.086 |
| 4 | Chyromyidae |  |  |  | 57 | 0.956 |
| 5 | Sarcophagidae/Tachinidae |  |  |  | 15 | 0.252 |
| 6 | Syrphidae |  |  |  | 7 | 0.117 |
| 7 | Syrphidae |  | *Episyrphus* | *balteatus* | 224 | 3.756 |
| 8 | Syrphidae |  | *Eristalis* |  | 341 | 5.719 |
| 9 | Syrphidae |  | *Helophilus* | *trivittatus* | 11 | 0.184 |
| 10 | Syrphidae |  | *Myathropa* | *florea* | 671 | 11.253 |
| 11 | Syrphidae |  | *Paragus* |  | 4 | 0.067 |
| 12 | Syrphidae |  | *Scaeva* |  | 4 | 0.067 |
| 13 | Syrphidae |  | *Sphaerophoria* |  | 289 | 4.847 |
| 14 | Syrphidae | black yellow elongated |  |  | 621 | 10.414 |
| 15 | Syrphidae | black yellow rounded |  |  | 488 | 8.184 |
| 16 | Syrphidae | dark yellow patterned |  |  | 38 | 0.637 |
| 17 | Syrphidae | *Helophilus/ Parahelophilus* |  |  | 12 | 0.201 |
| 18 | Syrphidae | small black |  |  | 19 | 0.319 |
| 19 | Syrphidae | *Syritta/Tropidia* |  |  | 32 | 0.537 |
| 20 | Tachinidae | *Eliozeta/Clytiomya* |  |  | 32 | 0.537 |
|  | **TOTAL** |  |  |  | **5,963** | **100** |

# Appendix VII. Fieldwork protocol

This field protocol describes the optimal process of setting the smartphone on top of a target flower. Specifically, this involves setting the optimal distance from the flower and minimising background noise to capture clear images of pollinators.

## **A. Pre-fieldwork Checklist**

Field gear (see also Figure 1):

1. Tripods suitable for phones - both small and large;
2. Sticks to stabilise the plants (<https://www.amazon.com/dp/B07VQJVM4M/?th=1>);
3. Yarn to attach the plant to the stick;
4. Scissors for cutting the yarn as necessary;
5. Power banks for charging;
6. USB cables for phone-to-power bank connection;
7. Mobile phones and any associated accessories;
8. Adequate quantities of printed field note forms (refer to [section D.3](#_4b8e25nkvvi7)) along with pencils;
9. Chairs for rest and work;
10. Adequate food and water supplies;
11. Recommended: sunscreen, sunhat and rain gear;
12. Check weather forecast: umbrellas and waterproof clothing may be needed;
13. Install the [Flora Incognita](https://play.google.com/store/apps/details?id=com.floraincognita.app.floraincognita&hl=en) app on your phone for plant identification. Note that this app requires an internet connection to function.

Ensure that the following devices are fully charged before fieldwork begins:

1. Mobile phones
2. Power banks. Keep an eye out for any signs of failure, such as bulging due to overheating in the sun. If this occurs, cease usage immediately and arrange for proper disposal and replacement.

Verify that there is sufficient storage space on the phones to store images. At the end of each day, download the day's images for storage and clear the phone's memory.

If you are driving, remember to bring your valid driver's licence and identification card/passport.

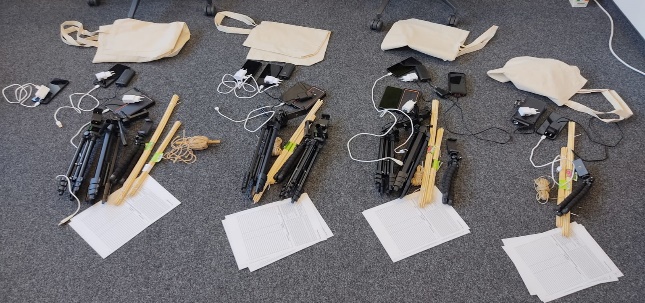


Figure 1. Example of gear for fieldwork

## **B. During Fieldwork**

### **B.1. Fieldwork procedure**

1. Select a target flower, preferably choosing an open flower whenever possible (refer to section [B.2. Selection of Open Flowers](#_by4n6qs3c66f)).
2. Turn on the phone if it is not already on. Confirm that the app settings are configured correctly (refer to section [C.1. Settings](#_29yvwk25yzgi)). These should have been set at the start of the field season and should remain unchanged unless otherwise instructed. However, it is good practice to double-check that everything is correctly set.
3. For each individual flower or plant, create a separate folder on your phone (see section [C.2. How to create a “plant-folder”](#_fmoddyfenhev), e.g., centaurea-scabiosa-vs-01).
4. Assess the position of the sun and anticipate its path. It is crucial to avoid having the sun directly in front or behind the camera as it could lead to underexposed or overexposed images. Thus, the phone should not directly face the sun; the sun should be to your left or right. Select a flower that allows for these conditions.
5. Secure the stick firmly near the flower to prevent wind displacement. Refer to section [B.3. The support stick](#_lhlffh1eo5ji), for more details on stick placement and usage.
6. Secure the flower to the stick without damaging the plant (refer to section [B.5. Using yarn to secure the flower to the stick](#_4qbhasgsmzs2)). Make sure the yarn is not visible in the image and is never situated between the flower and the camera, as it obstructs visibility.
7. Mount the phone onto the tripod.
8. Connect the phone to the power bank. Ensure neither the power bank nor the cable obscures the camera's view.
9. After determining the optimal position relative to the sun and the flower, ascertain the best distance from the flower (see sections [B.4. Image background and distance from the flower](#_hd2mfnfkpa8) & [B.2. Selection of open flowers](#_by4n6qs3c66f)).
10. Confirm the stability of the tripod and the phone.
11. Ensure the camera focus is on the flower, not on the stick or background. This is vital for image quality and deserves ample time to perfect. Reconfirm that the focus is locked and not set to auto (refer to section [C.1. Settings](#_29yvwk25yzgi)). Make sure there is no flash as well.
12. Address any other issues that could affect image quality, such as obstructions in front of the camera, smudges on the camera lens, or lens condensation.
13. You may now begin the one-hour session. Activate the Open Camera app's shutter button to start capturing time-lapse images. Set an alarm on your personal phone to remind you to stop recording after one hour. Note that the Open Camera app does not have a built-in timer (not at the moment).



1. Complete the field notes for the flower and the session, noting down the exact folder name used for the plant (e.g., centaurea-scabiosa-vs-01).
2. Start setting up another phone on a different plant.
3. Maintain distance from the target plant to avoid scaring away potential flower visitors.
4. Periodically check if the wind has displaced the flower or tripod, verify the app is still capturing images, and troubleshoot any unexpected issues (e.g., the phone shutting down due to overheating or low battery).
5. After one hour, stop the Open Camera app by pressing the shutter button . The screen might be off to conserve battery, so you might need to activate it first.



### **B.2. Selection of open flowers**

Select plants with open flowers that are easily accessible for camera positioning. The phone's surface should align parallel with the flower's surface, ensuring an optimal view of the pollinator when it settles on the flower (refer to the examples below).

Preferably avoid tall plants, especially those exceeding 1 metre in height, as the wind may easily displace them even when secured to a support stick. If the target plant species tends to be tall, ensure that the support stick is firmly anchored in the soil.

Examples of desirable open flowers and high-quality images:

|  |  |  |
| --- | --- | --- |
| Image quality is good, but the shot could be closer to the flower. Note also that the support stick should be situated under the flower. A thinner stick would be preferable. |  | Both the flower and insect are in focus, occupying a significant portion of the image, allowing detailed observation of the insect's wing venation. Larger insects, like bumblebees, generally lend themselves to near-ideal images. |
| Good image. In an ideal scenario, there would be no artificial objects, such as the clothespin, visible in the background. | When dealing with inflorescences, aim to select those that aren't too wide, ensuring they can fit entirely within the photo. This allows you to capture the complete inflorescence while maintaining an optimal distance. |  |

### **B.3. The support stick**

Ensure that the support stick is secured firmly into the ground, ideally with its top positioned below the flower. If the top of the support stick is situated near or slightly above the flower, insects may land on it rather than on the flower. Additionally, ants may readily climb the stick, entering the camera's field of view, which we aim to minimise as much as possible.

It's important to steer clear of situations similar to those illustrated in the images below:

|  |  |  |
| --- | --- | --- |
| Insects using the stick for rest: the stick should not serve as a perch for insects to rest upon. | Stick obscuring the primary flowers: the stick must not obstruct the view of the main flowers, as it limits our visibility of the insects. | Insect concealed behind the stick: circumstances where the insect ends up behind the stick should be avoided. The stick should be placed directly below the flower for optimal visibility. |

### **B.4. Image background and distance from the flower**

Invest sufficient time in determining the optimal distance from the flower to minimise the amount of background noise. Try to exclude other flowers from the background to prevent out-of-focus insects from being visible.

The flower should occupy a significant portion of the camera’s display. The objective is to make the insects appear as large as possible in the image (see examples below and refer to section "[B.2. Selection of open flowers](#_by4n6qs3c66f)" for further examples).

Below are cases where the capture could be improved by placing the phone closer to the flower and taking photos from an overhead, rather than lateral, perspective.

|  |  |
| --- | --- |
| **Current situation** | **Possible improvements** |
|  |  |
| Left: good enough capture; Right: this image is superior as it minimises background noise and provides an excellent top-down view of the insect. It might require being very close to the target flower though. | |
|  |  |
| If we are too distant from the target flower, there will be too much background "noise". Many insects will end up out of focus, and they are on the background flowers. This can make insect identification challenging or impossible (left). Therefore, position the phone closer to the target flower (right). | |
|  |  |
| The focus here is on the stick, not the main target flower (left). The stick should be beneath the flower and out of the camera's view (right). If you can't position the stick beneath the flower, avoid including the stick in the photo. Only the main flower should be visible with no other flowers in the background (right). | |
|  |  |
| Here, the focus is on the yarn, not the main flower. Be sure to dedicate enough time to lock the focus on the main flower. Avoid including the stick in the photo and avoid capturing background flowers that are out of focus. | |
|  |  |
| Inflorescences are always a challenge. In this case, try to frame just one flower of the inflorescence, or a bunch, but not the entire inflorescence. As far as possible, avoid having artificial elements, like other phones, in the background. If you frame just one flower of the inflorescence, the insects will also occupy a larger area of the image. | |

### **B.5. Using yarn to secure the flower to the stick**

Secure the flower to the stick with yarn without tying it too tightly. If the flower is bound too tightly with the yarn, it may stop the flow of fluids and tend to close, especially on sunny days.

The yarn should not be visible to the camera (see the image below for reasoning). If needed, use scissors to cut the yarn, or simply move the trailing yarn behind the flower(s), out of the camera's field of view.



The bumblebee is obscured by the yarn - avoid such situations. The yarn should not be visible to the camera.

## **C. Open Camera app guide**

Link to the Android app - [Open camera](https://play.google.com/store/apps/details?id=net.sourceforge.opencamera&hl=en&gl=US) (<https://play.google.com/store/apps/details?id=net.sourceforge.opencamera&hl=en&gl=US> )

You may also refer to the app's help page:

<https://opencamera.sourceforge.io/help.html>

<https://opencamera.sourceforge.io/help.html#quickstart>

### **C.1. Settings**

Upon opening the app, locate a button resembling three vertically aligned dots at the top of the main display . Clicking on this button will bring up a pop-up menu presenting the current settings (as shown in the screenshots below). "No Flash" and "Locked Focus" options should already be activated (their icons are underlined in the images below). The Photo Mode should be set to STD (Standard). Depending on your phone model, you may see different image resolutions.

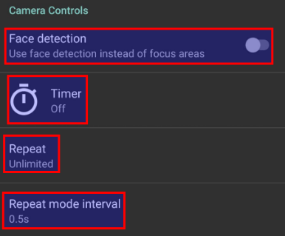


|  |  |
| --- | --- |
|  | Clicking on the three vertical dots allows you to see if the lock icon is visible, indicating that the focus will remain locked during the time-lapse session.  On some phones, you can check if the flash is off as shown in the above image. |

To access all settings, use the Settings wheel/button . Here, the following settings should be enabled (as shown in the screenshot below):



* Face detection = off;
* Timer = off (no need for timer - this is for selfies);
* Repeat = unlimited (it takes photos until you click the shutter button again to stop);
* Repeat mode interval = 1s (attempts to take a photo every second).



Under Settings wheel/button and, set the following:



|  |  |
| --- | --- |
|  |  |

Under Settings wheel/button and, set the following:



|  |  |
| --- | --- |
|  |  |

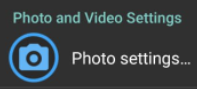
Under Settings wheel/button and, set the following:



|  |  |
| --- | --- |
|  |  |

One crucial option to enable is "Keep display on". Despite its drain on battery life, we need to keep this on because Android otherwise forces the OpenCamera app into sleep mode. It's unclear if the developers will ever address this issue (see user forum [discussion](https://sourceforge.net/p/opencamera/discussion/general/thread/791fb1bc/)).

Under Settings wheel/buttonand, set the following:



* Camera resolution - varies per phone model. Select option 1600 x 1200 (4:3, 1.92 MP).   
  Note that even with the highest resolution, if the focus is blurred, resolution is not the limiting factor and we end up with many high-volume images that are slow for data transfer and provide no useful info. Thus, a good focus leading to sharp images of insects is far more important than image resolution.
* Image quality: 90% (default);
* Image format: JPEG (because it saves Exif metadata about ISO, aperture, phone, etc.; PNG format doesn’t save such metadata);
* Save all images for HDR mode - OFF;
* HDR contrast enhancement - OFF;
* Exposure Bracketing Stops = 2 (default)
* Front camera mirror - OFF/No mirror (default);
* Copyright - leave empty
* Stamp photos - No stamp;
* Datestamp format = ISO 8601 yyyy-mm-dd;
* Time stamp format 24 h;
* GPS stamp format: Degrees/minutes/seconds
* Use addresses: Don’t display address
* Distance unit: Meters
* Custom text: leave empty
* Font size: do not change (default 12)
* Font colour: do not change (default white)
* Test style: do not change (“Shadowed text” default)

### **C.2. How to create a “plant-folder”**

For each flower, we take photos for 1 hour (you'll need to time this with a timer on your personal phone). For each session, you must create a different folder as follows: Settings wheel/button > More camera controls… > Save location > type the name of the plant, your initials (2 letters), and an ID number (for example: centaurea-scabiosa-vs-01), then press OK.



|  |  |
| --- | --- |
|  |  |

Each plant should have its own directory. Even if you have photographed a plant for one hour and then continue with the same plant species for the next hour, you must create a separate folder.

The name of the plant folder should include:

* The name of the plant species (you can use the [Flora Incognita](https://play.google.com/store/apps/details?id=com.floraincognita.app.floraincognita&hl=en) app to identify the plant). If you can only identify the genus, then you can use something like "centaurea-sp", or "fabaceae-sp" (using the plant family). If you can't identify it scientifically, then try to use two descriptive words, like "spiky-bushy". In any case, try to use two words separated by a hyphen.
* Your initials.
* An index: 01, 02, 03…, 09, 10, 11 and so on. For consistency, please use a zero before the digits smaller than 10.

The final plant-directory name should look something like this: "centaurea-scabiosa-vs-01", "centaurea-scabiosa-vs-02", and so on.

Please use hyphens (like this - ) instead of space as a separator. This is crucial for path management and data processing later on.

If it happens that you have the same initials as someone else, then communicate among yourselves so that each of you has a unique set of initials and uses them consistently.

Try to stick with just two letters in your unique initials setting (this ensures consistency in the file naming).

## **D. Checklist after fieldwork day**

### **D.1. Image download and upload**

The overall workflow involves downloading the plant-folders from the phones to your laptop, and then uploading them to a backed-up storage space.

This data transfer process consists of two main steps. First, you download the plant-folders to your laptop. After that, you can upload them from your laptop to a secure storage. It's essential to do this in two steps because we've experienced data loss and interruptions when we tried to transfer data directly from the phones (phones can discharge or an accidental movement of the USB cable can cause the entire data transfer to fail and then you have to repeat it). You might generate 20-40Gb of images each day per smartphone.

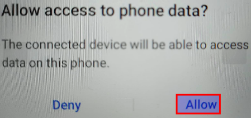
#### **D.1.1. Download plant-folders from the phones to your laptop**

First, download images from the phones directly to your laptop (you can use copy & paste to a location of your choice on your laptop). Keep in mind that this can take a considerable amount of time.

Downloading images from your phone to your laptop can vary depending on each phone type.

#### **D.1.1.1. Connecting BlackView A60 smartphone models**

When you connect their USB cables, a pop-up window will appear on the phone's main screen asking you to allow access for data transfer.



1. Connect the USB cable compatible with the phone to your laptop.
2. Locate the Settings wheel on the phone . For the BlackView A60 smartphones, the settings wheel is also on the main screen. Go to "Connected devices", then "USB File Transfer" and then choose "File Transfer". This action will signal your laptop that the phone is ready for file transfer. Keep in mind that each smartphone model differs in its settings options.



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#### **D.1.2.2. On Windows Operating System (OS)**

Once your phone and laptop are connected (steps explained above), Windows will notify you that the phone is visible and ready for file transfer. You will see the phone name in the File Explorer in Windows (the File Explorer icon looks like a yellow folder and is usually located on the taskbar - lower-left corner of your screen). Navigate to the phone location, then to the DCIM directory where you should see the plant-folders that you created. Steps are illustrated below:

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| 1) File Explorer (for Windows). Click on it to visualise the content of your laptop. | 2) Then, you should be able to see the name of your phone (names differ depending on the phone model). Double click on the icon corresponding to your phone to visualise the content. |
|  |  |
| 3) Double click on the new icon. | 4) Double click on the DCIM directory. Here Android stores images by default. |
|  |  |
| 5) Then you can see your plant folders. Each should contain thousands of images. |  |

Now, create a directory on your laptop, in a location of your choice (e.g., in the "Documents" directory - navigate with File Explorer) with the exact date of the fieldwork day (we can call this the “date-directory” or “date-folder” in this tutorial). Please use the date format "year-month-day", like yyyy-mm-dd (e.g., 2022-04-28). See illustrated steps below:

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| --- | --- |
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| 1) You find “Documents” on the left content list of the File Explorer. Right-click on “Documents” and a pop-up menu will appear, then select “Open in new window”. | |
|  |  |
| 2) Create a date directory for that particular day. Respect the format yyyy-mm-dd. | To create a directory/folder: right-click on the empty content of the File explorer canvas, then choose New > Folder. |

You can now copy the plant-folders from the phone to your laptop in the date-directory you created above.

Avoid having scattered images that do not belong to a plant-folder. Also, make sure to adhere to the details about the naming protocol in section [C.2. "How to create a plant-folder"](#_fmoddyfenhev). You should have done that directly in the field on the phones. This time, you can correct any typos while adhering to the naming convention.

Once the file transfer is completed (for each phone), connect the phones to charge along with the power banks connected to the electric grid (see section "[D.4. Charge phones & power banks](#_cf3jtjxj96cb)"). While they charge, you can now delete the plant-folders from the phone (see section "[D.2. Delete the plant-folders from the phone](#_a813m086gy9k)").

Now is a good time to review your downloaded photos on your laptop and check if they align with the guidelines and examples given in sections "[B.2. Selection of open flowers](#_by4n6qs3c66f)" & "[B.4. Image background and distance from the flower](#_hd2mfnfkpa8)". This provides feedback and you can learn what to improve for the next fieldwork day.

### **D.2. Delete the plant-folders from the phone**

Each phone model varies, but the general procedure typically includes the following steps:

* Navigate to the Gallery / DCIM folder using the File Manager app.
* In the DCIM folder, you should see the plant-folders that you created during the day.
* Long press on a folder to activate the selection mode.
* Select the folder icons that you want to delete by clicking on each one.
* The delete option should appear.

Below is a step-by-step example:

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| 1) Locate the File Manager app on the phone (this varies from model to model). | 2) In this case, the OpenCamera app saves the plant-folders in the “Internal shared storage”. However, on some models, you might need to choose the SD card option. If you press on the arrow-up symbol, you should see two options (as shown in the image above). |
|  |  |
| 3) Navigate to the DCIM folder (this is where the Android OS usually stores photos). | 4) Inside the DCIM folder, you should see the plant-folders that you created with the OpenCamera app. If they are not there, check the OpenCamera folder (if it exists on your phone). Otherwise, the files might be stored on the SD card, so return to step 2 and choose the SD card path option. |
|  |  |
| 5) If you long-press on a plant-folder, Android will activate the multiple-selection mode (you'll see a transparent circle at the right corner of each folder). You can now lift your finger and touch each plant-folder that you want to select and then delete. Selected folders will have a blue circle with a “checked” symbol in the right corner. | 6) When you have selected all the plant-folders that you need to delete, the “delete” button should appear at the bottom of the screen. Press it, and the folders will be deleted. Be patient as this operation may take time and is likely irreversible due to its large size. |

### **D.3. Field notes**

Here's an example of a site-info table that should be printed and used as field notes for each plant-folder, which means each time you set a phone to take photos for one hour:

| Date (yyyy-mm-dd): |  |
| --- | --- |
| Site location (name/description): |  |
| GPS coordinates from Google maps/phone, e.g. 51.318204,12.396281 (latitude N, longitude E): |  |
| Observer name (your name): |  |
| Plant-folder name (as given in your phone) |  |
| Device (see label on the back): |  |
| Weather (sunny/cloudy/rainy): |  |
| Time start recording (hh-mm): |  |
| Time end of recording (hh-mm): |  |
| I observed insects on the flower (yes/unsure) |  |
| Observations/Notes/Comments: |  |

At the end of the day or later, you need to digitise these field notes by filling in a corresponding Excel spreadsheet.

Each plant-folder (1 hour of observations) should have its own Excel file named "site-info" and contains the table from above. Name the spreadsheet to match its corresponding plant-folder name (e.g., centaurea-scabiosa-vs-01.xlsx). To rename a file, right-click on its icon and choose the rename option. Save the Excel file with its corresponding plant-folder under the corresponding date-folder.

### **D.4. Charge phones & power banks**

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| --- | --- |
| It's recommended to turn off the phones whilst they charge to preserve battery life.  There may not always be enough chargers available to charge both the phones and power banks simultaneously. If this situation arises, first plug the power banks into the power source. Then, connect the phones to the charging power banks. The phones will slowly charge from the power banks, which in turn will be charging directly from the mains electricity (see image to the right) |  |