PoshBee

Database of field records

Deliverable D1.6

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PoshBee

Pan-european assessment, monitoring, and mitigation of stressors on the health of bees

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1.0	Final	27 May 2020	Various WP1 members c/o Jane Stout TCD

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Contents

1. Background

This deliverable summarises the field records database. The WP1 field records database consists of 13 tables (detailed below), available on the PoshBee website (www.poshbee.eu, public access embargo until May 2023). All data were collected according to PoshBee field protocols (Deliverable 1.1), with each dataset linked to the relevant Protocol. For landscape context of field sites (Task 1.2), see Deliverable 1.2.

Item	Task No.	Details	File name
1	1.3.2	Sites and surrounding fields	WP1_HABITAT_CROP_DATA_ 20200521
2	1.3.3	Crop pollen and *Apis* pollen sacs for chemical analysis	WP1_SAMPLE_NEBIH_pollen from flowers and *Apis* traps_20200521
3	1.3.4	Individual *Apis* and *Bombus* for proteomic analysis	WP1_SAMPLE_BIOPARK_haemolymph_20200521
4	1.3.4	Individual *Apis* and *Bombus* for chemical	WP1_SAMPLE_CREA_bee specimens chemicals_20200521
5	1.3.4	*Apis* and *Bombus* wax, *Apis* royal jelly for chemical analysis	WP1_SAMPLE_CREA_royal jelly and wax_20200521
6	1.3.4	*Apis*, *Bombus* and *Osmia* bee bread, *Bombus* pollen sacs for chemical analysis	WP1_SAMPLE_PIWET_pollen stores_20200521
7	1.3.5	Hive set up and pests (*Vespa velutina*, Small Hive Beetle (SHB), Brood diseases & Deformed Wing, Varroa)	WP1_*APIS*_PESTS_DISEASES_ 20200521
8	1.3.5	Colony set up and weights, performance and pests (DWV, wax moths, Cuckoo bees, other invertebrates, mould)	WP1_*BOMBUS*_PERFORMANCE_20200521
9	1.3.3 & 1.3.5	Individual *Apis*, *Bombus* and solitary for disease analysis, nectar for chemical analysis	WP1_SAMPLE_ANSES_bee pathology_plus_nectar_20200521
10	1.2	Insect abundance (*Apis*, *Bombus*, Solitary, Syrphids, Lepidoptera), floral richness and abundance	WP1_POLLINATOR_AND_FLORAL_SURVEYS_20200522
11	*	Individual *Apis* for metal analysis	WP1_SAMPLE_ANSES_*Apis* workers for metal analysis_20200521
12	*	*Apis* and *Bombus* individuals for gut microbiome analysis	WP1_SAMPLE_UFZ_bee gut microbiota_20200521
13	*	*Apis* and *Bombus* individuals for wing asymmetry and fat body analysis	WP1_SAMPLE_UMONS_bees for wing and fat analysis_20200521

* Additional dataset

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2. Sites and surrounding fields (Task 1.3.2)

Background data for each site were collected. Each site in the site network has a unique identification code, denoting country, crop and site. For each site, data include field size (area, ha), crop variety, total number of varieties (apple only), crop density (OSR: stem density, m-2; apples: tree density per ha, mean tree height, m), management system (organic/conventional – apples only), date crop sown (OSR only), start and end date of flowering, and dates of *Apis*, *Bombus* and *Osmia* installation.

Data sheet: WP1_HABITAT_CROP_DATA_20200521
Protocol: 1.3.1
Metadata:

Country	country code: CHE-Switzerland; ESP-Spain; EST-Estonia; GBR-United Kingdom; GER-Germany; IRL-Ireland; ITA-Italy; SWE-Sweden	
Crop	crop code: APP-apples; OSR-oilseed rape	
Site	code 1-16 for each country. 1-8 OSR; 9-16 APP	
Site_code	combination of country, crop, and site codes	
EUNIS codes	Boundary Feature	Code
	No boundary - fields run/ merge into each other	NB
	Bare boundary (wire fence; wooden fence; stone wall)	BB
	Hedgerow (mixed) / buffer zones / flower strips	FA
	Windbreak or monoculture hedge	G5
	Woodland edge	E5
	Ditch / grassy verge	E2
	Habitat	Code
	Apples	APP
	Oil seed rape	OSR
	Pasture/Improved Grassland/	E2
	Coniferous woodland	G3
	Deciduous woodland	G1
	Mixed woodland	G4
	Horticulture other than apples	I1.2
	Cereals/ arable crops other than OSR	I1.1
	Bare tilled arable land	I1.5
	Semi-natural habitat/Meadows	SN
	Parkland	I2
	High density housing / urban	J1
	Low density housing / suburban	J2

3. Crop pollen and *Apis* pollen sacs for chemical analysis (Task 1.3.3)

To determine exposure to agrochemicals from different aspects of the bee environment, pollen was collected from crop plants for analysis of chemical contamination. In addition, we collected pollen from foraging honey bees (*Apis mellifera*) via pollen traps attached to PoshBee hives.

Crop pollen: For each site, data include date crop flowers were collected, dates of oven drying, oven temperature, date pollen was processed, identity of the processor, the smallest sieve pore (μm), pollen weight (mg), dates posted and received.

Apis pollen sacs: For each site, data include date pollen sacs were collected, identity of the collector, fresh weight, dates posted and received.

Datasheet: WP1_SAMPLE_NEBIH_pollen from flowers and *Apis* traps_20200521
Protocol: 1.4.2

4. Individual *Apis* and *Bombus* for proteomic analysis (Task 1.3.4)

Haemolymph samples were taken from live bees (~15 *Apis*, ≥5 *Bombus* and 1-6 *Osmia*) at each site (except *Osmia* – due to low abundance these were only collected in Germany and Italy), with a total of 2,833 samples collected and delivered to WP9 (BIOPARK) for analysis (see summary data table below). For each site, data include a unique sample identifier (bar code), date of collection, identity of collector and identity of hive/nest/colony bees were taken from.

Datasheet: WP1_SAMPLE_BIOPARK_haemolymph_20200521
Protocol: 1.6.1
Summary data:

Country	Crop	*Apis*	*Bombus*	*Osmia*
CHE	APP	121	41	
	OSR	121	40	
ESP	APP	122	41	
	OSR	120	40	
EST	APP	126	46	
	OSR	127	48	
GBR	APP	120	25	
	OSR	120	35	
GER	APP	127	42	36
	OSR	122	46	27
IRL	APP	155	97	
	OSR	146	48	
ITA	APP	123	42	11
	OSR	126	43	23
SWE	APP	122	35	
	OSR	125	44	

5. Individual *Apis* and *Bombus* for chemical analysis (Task 1.3.4)

To determine the contamination level of bees by multiple agrochemicals, adult bees (*Apis* and *Bombus*) were collected. For each site, data include date of collection, identity of collector, hive/nest bees were taken from, dates posted and received by WP2 (CREA) for analysis.

Datasheet: WP1_SAMPLE_CREA_bee specimens chemicals_20200521
Protocol: 1.4.4
Summary data:

Country	Crop	*Apis*	*Bombus*
CHE	APP	615	239
	OSR	645	240
ESP	APP	537	250
	OSR	522	259
EST	APP	480	549
	OSR	420	563
GBR	APP	581	238
	OSR	542	225
GER	APP	507	246
	OSR	480	240
IRL	APP	601	248
	OSR	594	263

ITA	APP	480	240
	OSR	480	240
SWE	APP	475	180
	OSR	466	240

6. *Apis* and *Bombus* wax, *Apis* royal jelly for chemical analysis (Task 1.3.4)

To determine the contamination level of bee products by multiple agrochemicals, wax was collected from *Apis* and *Bombus*, and royal jelly from *Apis*, from three countries (Germany, Italy and Sweden only). For each site, data include date of collection, identity of collector, total fresh weight (g), number of cells (royal jelly only), processing date and identity of processor.

Datasheet: WP1_SAMPLE_CREA_royal jelly and wax_20200521
Protocol: 1.4.6 and 1.4.7
Summary data: (total weight, g)

Country	Crop	*Apis* wax	*Bombus* wax	Royal Jelly
GER	APP	305	211	-
	OSR	66.77	68.81	2.69
ITA	APP	58.44	100.43	28.81
	OSR	103.99	199.33	19.67
SWE*	APP			11.89
	OSR			11

* Swedish wax data collation in progress

7. *Apis*, *Bombus* and *Osmia* bee bread, *Bombus* pollen sacs for chemical analysis (Task 1.3.4)

To determine the contamination level of stored pollen by multiple agrochemicals, bee bread was collected from *Apis*, stored pollen from *Bombus* and *Osmia*, and pollen sacs from foraging *Bombus*. For each site, data include date of collection, identity of collector, total fresh weight (g), dates posted and received by WP2 (PIWET) for analysis.

Datasheet: WP1_SAMPLE_PIWET_pollen stores_20200521
Protocol: 1.4.5, 1.5.9, 1.5.10
Summary data: (total weight, g)

Country	Crop	*Apis* bee bread	*Bombus* pollen sacs*	*Bombus* pollen stores	*Osmia* pollen Stores***
CHE	APP	140.9	1859	135.556	188.5
	OSR	155.3	3005	89.94	228.6
ESP	APP	158.79	389.6	106.6917	106.55
	OSR	165.89	546.6	109.0846	139.34
EST	APP	96.7	8172	42.95	135.03
	OSR	90.22	6536	57.47	140.56
GBR	APP	142	-	13	-
	OSR	146	-	24	-
GER	APP	142.93	297	130	134.66
	OSR	163.66	345	69.44	161.48
IRL	APP	187.3	-	22.9	-
	OSR	159.3	-	39.7	-
ITA	APP	117.81	6410	109.09	82.41
	OSR	152.83	7240	141.71	125.86

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SWE	APP	114.79	5990	0	27
	OSR	121.14	10639	0	0

* No *Bombus* pollen sacs were collected in UK/Ireland

** No *Osmia* were available in UK/Ireland

8. Hive set up and pests (*Vespa velutina*, Small Hive Beetle (SHB), Brood diseases & Deformed Wing, Varroa) (Task 1.3.5)

Details of *Apis* hive set up were collated, including unique hive identification code, hive supplier, beekeeper and date deployed to site. Field pest and disease data were collected (summary below).

Datasheet: WP1_APIS_PESTS_DISEASES_20200521

Protocol: 1.5.2, 1.5.3, 1.5.4, 1.5.5, 1.5.6, 1.5.7, 1.5.8

Summary data:

Vespa velutina	see protocol WP1.5.4
	teams counted *V. velutina* at each site on three different occasions (SWE and GER OSR teams only performed two counts)
	All counts were zero
Small Hive Beetle (SHB)	see protocol WP1.5.3
	oil-filled beetle traps placed in each colony for at least 3 days
	All counts were zero
Brood diseases & Deformed Wing	see protocols WP1.5.5, WP1.5.6, WP1.5.7, WP1.5.8
	AFB - presence/absence data for each hive for presence of brood with symptoms of AFB
	EFB - presence/absence data for each hive for precence of brood with symptoms of EFB
	DW - presence/absence data for each hive for presence of bees with deformed wing symptoms
	chalkbrood - count data for each hive; number of frames in brood chamber were chalkbrood was present from total number of FRAMES
Varroa	see protocol WP1.5.2
	count data of adult female Varroa using a yellow sticky trap in the bottom board; data per hive
Area of board (cm2)	area of the sticky trap in cm-sq
Board clean date	date sampling started
Mite assess date	date sampling ended
Days board in place	days the sticky trap was in place (=end date - start date)
Mite count	counts of adult female mites
Mites_d_m2	standardized counts = mites per day per meter-sq
Varroa observed on adult bees	presence/absence data for each hive

9. Colony set up and weights, performance and pests (DWV, wax moths, Cuckoo bees, other invertebrates, mould) (Task 1.3.5)

Details of *Bombus* colony nest set up and field monitoring were collated, including unique nest identification code, original date *Bombus* colony was weighed (start of sesaon), 2nd date *Bombus* colony was weighed (mid-season), 3rd date *Bombus* colony was weighed (end of season), date the plastic container of the *Bombus* was weighed so that actual colony weight could be calculated, initial weight of colony on receipt (g), weight of colony mid season (g), final weight of *Bombus* colony (g), Initial numbers of workers present in the colony (approximate), presence of Queen in the colony prior to being placed in the field, number of workers collected for pathogen analysis prior to the colony being placed in the field, date colony retrieved from field site.

Nests were dissected in the lab, and data were collated on presence/absence of natal queen, number of workers, males, new queens, intact worker/male and queen cocoons, eclosed worker/male and queen cocoons, pollen cells and nectar cups, date colony was sorted to assess for

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pests, number of individuals with deformed wings, presence/absence of wax moth webs, wax moth larvae, wax moth cocoons, wax moth adults, Cuckoo bees, Flies, wasps, parasitoid, ants, spiders, mites, woodlice, beetles, Collembola, slug/snail, mould, Dermaptera, honey bees.

Datasheet: WP1_BOMBUS_PERFORMANCE_20200521
Protocols: 1.5.9
Summary data: *Bombus* weights (mean, g)

Country	Crop	WGT 1 (g)	WGT 2 (g)	WGT 3 (g)	BOX wt (g)
CHE	APP	707	1123	1216	440
	OSR	697	1303	1390	440
ESP	APP	703	646	659	350
	OSR	733	636	644	350
EST	APP	732	815	1078	424
	OSR	710	853	990	416
GBR	APP	561	643	540	387
	OSR	572	872	662	393
GER	APP	673	744	732	446
	OSR	602	964	1176	492
IRL	APP	544	745	757	373
	OSR	596	768	829	382
ITA	APP	631	714	1085	451
	OSR	648	873	1478	461
SWE	APP	617	979	1389	384
	OSR	637	1150	1770	378

Summary data: *Bombus* colony performance

Country	Crop	Sum of Workers	Sum of Males	Sum of New Queens
CHE	APP	5095	1276	805
	OSR	3440	2105	677
ESP	APP	1491	254	49
	OSR	2402	188	66
EST	APP	1398	1133	486
	OSR	873	570	320
GBR	APP	1181	570	13
	OSR	889	641	18
GER	APP	2994	276	37
	OSR	1499	669	360
IRE	APP	261	328	26
	OSR	838	548	132
ITA	APP	6579	589	664
	OSR	5434	2230	701
SWE	APP	2763	2442	327
	OSR	3632	3017	398

Summary data: *Bombus* pests and disease, total individuals*/presence (DWV = Deformed Wings, WM=Wax Moth)

Country	Crop	DWV	WM webs	WM larvae*	WM cocoons	WM adults	Cuckoo bees	Flies	Wasps	Parasitoid	Ants*	Spiders	Mites	Woodlice	Beetles	Collembola	slug/snail	mould	dermaptera	Honey bee
CHE	APP	6		6				2		0	2		21							
	OSR	3		20				6		0	9		24							
ESP	APP																			
	OSR																			
EST	APP	3	4	4	2		3	9		4	0	2	4							
	OSR		8	7	2	6	1	6			9									
GBR	APP																		6	
	OSR			365															19	
GER	APP	5	1	4			5				29	1						1	6	
	OSR	2	9	10	6	2			1	2	4									
IRE	APP										4		6	4	20		3	3	14	
	OSR												7	6	11	1	8	12		
ITA	APP	2			1	3			3											
	OSR	1			5	4			7											
SWE	APP	5				4		11			1		9				1	2		2
	OSR	2				2		14			2		2		1			7		

10. Individual *Apis*, *Bombus* and *Osmia* for disease analysis, nectar for chemical analysis (Task 1.3.3 and 1.3.5)

To determine the pathogen loads, *Apis*, *Bombus* and *Osmia* individuals were collected and sent to WP2 (ANSES) for analysis. For each site, *Apis* and *Bombus* data include pre-screening (date internal workers collected, identity of collector, number of worker bees collected from each hive/nest, total number of bees collected from that site) and final assessment (date internal workers collected, identity of collector, number of worker bees collected from each hive, total number of bees collected from that site), date samples posted, received and checked by ANSES Sophia Antipolis. For each site, *Osmia* data include pre-screening and final assessment (number of specimens, date specimens collected, personnel) date samples posted, received and checked by ANSES Sophia Antipolis.

To determine exposure to agrochemicals from different aspects of the bee environment, nectar was collected from *Apis* and *Bombus* honey stomachs. For each site, data include date nectar was collected, personnel, volume of nectar obtained, date samples posted, received and checked by ANSES Sophia Antipolis.

Datasheet: WP1_SAMPLE_ANSES_bee pathology_plus_nectar_20200521
Protocols: 1.4.4
Summary data: Total number of bees (PS = Prescreening, F = Final)

Country	Crop	*Apis* PS	*Apis* F	*Bombus* PS	*Bombus* F	*Osmia**
CHE	APP	480	480	96	240	81
	OSR	480	480	96	240	109
ESP	APP	480	480	96	240	38
	OSR	480	480	96	240	67

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EST	APP	480	480	96	207	124
	OSR	480	480	96	157	114
GBR	APP	1698	2633	96	943	-
	OSR	2881	2706	96	665	-
GER	APP	480	480	98	240	74
	OSR	445	480	96	230	60
IRL	APP	480	750	105	181	-
	OSR	480	710	102	336	-
ITA	APP	480	480	96	240	
	OSR	480	480	96	210	
SWE	APP	480	480	96	240	103
	OSR	480	480	96	240	117

* *Osmia* were not available in UK/Ireland

11. Insect abundance (*Apis*, *Bombus*, Solitary, Syrphids, Lepidoptera), floral richness and abundance (Task 1.2)

Data on floral and wild bee abundance were gathered by direct observational surveys conducted during the flowering period of each crop, in the focal fields and their margins/hedgerows. Floral data recorded in 12 x 1m2 quadrats on the ground around the four major field boundaries includes total number of plant species; maximum, mean and median abundance score of floral units. Floral data recorded in 12 x 1m2 quadrats held vertically on the linear feature of the four major field boundaries includes number of plant species recorded, maximum abundance score of floral units.

Insect data collated includes number of *Apis*, *Bombus*, Solitary bees, Syrphids, and Lepidoptera per 5 minute survey, and the number of pollinator groups (out of the 5 groups). Mean values were obtained for each country.

Datasheet: WP1_POLLINATOR_AND_FLORAL_SURVEYS_20200522
Protocols 1.3.3, 1.3.4
Summary data: Insects - Mean abundance per 5 mins per site

Country	Crop	*Apis*	*Bombus*	Solitary	Syrphids	Lepidoptera	No. of groups (/5)
CHE	APP	12.3	1.3	2.7	0.9	0.1	2.8
	OSR	14.2	0.9	1.7	1.1	0.4	3.0
ESP	APP	4.1	0.4	0.5	0.3	0.5	1.6
	OSR	4.7	0.1	2.3	4.5	2.2	2.5
EST	APP	4.6	1.3	0.4	1.2	0.8	2.4
	OSR	4.6	1.3	0.0	1.1	1.4	1.7
GBR	APP	1.4	1.1	0.4	0.9	0.1	2.2
	OSR	1.5	1.0	0.7	0.9	1.1	2.8
GER	APP	9.6	0.8	0.9	0.6	0.2	2.4
	OSR	2.9	0.7	4.2	1.3	0.7	2.5
IRL	APP	5.7	1.7	2.0	0.6	0.3	2.3
	OSR	6.0	2.0	1.0	1.5	0.4	2.2
ITA	APP	15.2	0.6	0.9	0.4	0.2	1.8
	OSR	77.5	0.3	2.2	3.6	0.8	3.0
SWE	APP	2.5	1.1	0.6	0.5	0.1	2.0

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	OSR	3.9	1.6	0.4	0.5	0.2	1.7

Summary data: Flowers – Mean flowering species richness (SR) and floral abundance (A) in ground and hedge quadrats

Country	Crop	Ground				Hedge	
		SR	max A	mean A	median A	SR	A
CHE	APP	11.3	3.0	2.7	2.8	0.1	0.1
	OSR	9.5	3.0	2.7	2.8	0.0	0.0
ESP	APP	6.8	2.8	2.4	2.4	0.0	0.0
	OSR	5.8	3.0	2.7	2.8	0.0	0.0
EST	APP	8.1	3.0	2.1	2.1	0.1	0.4
	OSR	11.5	3.0	2.5	2.6	0.0	0.0
GBR	APP	3.0	2.4	1.8	1.8	0.5	1.3
	OSR	6.0	3.0	1.9	2.0	0.9	2.0
GER	APP	4.4	3.0	1.8	1.6	0.0	0.0
	OSR	9.8	2.9	2.1	2.2	0.9	2.3
IRL	APP	5.9	2.4	1.8	1.8	1.8	2.4
	OSR	7.3	2.9	2.6	2.6	1.0	2.5
ITA	APP	5.4	3.0	2.3	2.3	0.1	0.0
	OSR	3.9	2.1	0.9	0.9	0.0	0.0
SWE	APP	7.5	2.5	2.0	1.9	0.0	0.0
	OSR	9.1	2.9	2.2	2.2	0.4	0.8

12. Individual *Apis* for metal analysis

To determine the contamination level of bees by heavy metals, adult bees (*Apis*) were collected. For each site, data include date of collection, identity of collector, number of bees collected from each hive, total bees per site, dates posted and received by WP2 (ANSES Maisons-Alfort) for analysis.

Datasheet: WP1_SAMPLE_ANSES_Apis workers for metal analysis_20200521
Protocol: 1.4.1
Summary data: Number of individuals

Country	Crop	Total
CHE	APP	720
	OSR	720
ESP	APP	739
	OSR	779
EST	APP	651
	OSR	570
GBR	APP	1467
	OSR	1381
GER	APP	720
	OSR	720
IRL	APP	760
	OSR	750
ITA	APP	480
	OSR	480
SWE	APP	720

| | OSR | 720 | |

13. *Apis* and *Bombus* individuals for gut microbiome analysis

To determine the gut microbiome as a measure of bee health, adult bees (*Apis* and *Bombus*) were collected. For each site, data include date of collection, identity of collector, number of bees collected from each site, dates posted and received by WP2 (UFZ) for analysis.

Datasheet: WP1_SAMPLE_UFZ_bee gut microbiota_20200521
Protocol: 1.6.2
Summary data: Total number of bees

Row Labels	Crop	*Apis*	*Bombus*
CHE	APP	80	40
	OSR	80	40
ESP	APP	148	40
	OSR	122	40
EST	APP		
	OSR		
GBR	APP	163	35
	OSR	137	40
GER	APP	80	40
	OSR	80	
IRL	APP	90	40
	OSR	85	40
ITA	APP	0	40
	OSR	0	40
SWE	APP		
	OSR		

14. *Apis* and *Bombus* individuals for wing asymmetry and fat body analysis

To determine the wing asymmetry and analyse fat bodies as measures of bee health, adult bees (*Apis* and *Bombus*) were collected. For each site, data include date of collection, identity of collector, number of bees collected from each hive/colony, total bees per site, dates posted and received by WP2 (UMONS) for analysis.

Datasheet: WP1_SAMPLE_UMONS_bees for wing and fat analysis_20200521
Protocol: 1.6.2
Summary data: Total number of bees

Row Labels	Crop	*Apis*	*Bombus*
CHE	APP	480	240
	OSR	480	240
ESP	APP	480	240
	OSR	480	230
EST	APP		
	OSR		
GBR	APP	3107	237
	OSR	2446	225
GER	APP		
	OSR	480	240
IRL	APP	720	49
	OSR	480	177

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ITA	APP	480	240
	OSR	480	240
SWE	APP	440	240
	OSR	480	240