

## Supporting Information for:

An innovative approach combining metabarcoding and ecological interaction networks for selecting candidate biological control agents

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## Supplementary Texts

### *Appendix S1: Curation and transformation of the interaction matrix*

In order to produce an interaction matrix, in which observations are resources and variables are consumers, the original dataset should be checked. First, for each sample, the taxa having the highest number of reads were set as the consumer. This assumption was confirmed in most of the cases (the specimen collected in the tube was the consumer and produced the highest number of reads). However due to the simultaneous detection of possible preys and parasitoids from the specimen sampled and the contrasted amplification rates between taxonomic groups (Alberdi et al. 2018), this was not always the case. Consequently, a second step of data manual validation was required on each sample (Supplementary Figure S2) in order to 1) verify whether the consumer was correctly defined according to the observation from the field, 2) add the source plant for herbivorous arthropods, 3) define the status of the taxa simultaneously amplified with the consumer (prey, parasitoid or contamination). The next step consisted in removing cannibalistic interactions (i. e. delete reads at the intersection of a same source and consumer species). Indeed, DNA-based methods are not suitable to disentangle predator and prey sequences (Taberlet et al. 2018). As metabarcoding neither provides quantitative information about the trophic links (Deagle et al. 2019), the numbers of reads were converted to binary information, then occurrence frequencies of interactions between a pair of consumer/prey species were calculated as the percentage of consumer samples positive for the prey over the total number of consumer sampled in the dataset. All analyses were carried out under R version 3.5.2 (R Core Team 2018).

## References cited in Appendix S1

- Alberdi A, Aizpurua O, Gilbert MTP, Bohmann K (2018) Scrutinizing key steps for reliable metabarcoding of environmental samples. *Methods in Ecology and Evolution* 9:134–147. <https://doi.org/10.1111/2041-210X.12849>
- Deagle BE, Thomas AC, McInnes JC, et al (2019) Counting with DNA in metabarcoding studies: How should we convert sequence reads to dietary data? *Molecular Ecology* 28:391–406. <https://doi.org/10.1111/mec.14734>
- R Core Team (2018). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>.
- Taberlet P, Bonin A, Coissac E, Zinger L (2018) *Environmental DNA: For Biodiversity Research and Monitoring*. Oxford University Press

## Supplementary Tables

Table S1: Locations of the different sites prospected per sampling date in the three bioclimatic regions.

	Site	Latitude	Longitude	Environment
<b>Semi-oceanic</b>				
<i>Date 1</i>	Laurabuc	43.26462	1.99578	Agricultural
	Saint-Martin-Lalande	43.29428	1.99238	Agricultural
	Castelnaudary	43.33395	1.99262	Agricultural
<i>Date 2</i>	Laurabuc	43.26462	1.99578	Agricultural
	Saint-Martin-Lalande	43.29428	1.99238	Agricultural
<i>Date 3</i>	Laurabuc	43.26462	1.99578	Agricultural
	Villasavary	43.23643	2.03641	Ruderal
<b>Mediterranean</b>				
<i>Date 1</i>	La Valsière	43.65123	3.83356	Ruderal
	La Valsière	43.65123	3.83356	Ruderal
<i>Date 2</i>	Mauguio	43.6069	3.98868	Agricultural
	La Valsière	43.65123	3.83356	Ruderal
<i>Date 3</i>	Mauguio	43.6069	3.98868	Agricultural
	La Valsière	43.65123	3.83356	Ruderal
<b>Continental</b>				
<i>Date 1</i>	Mornant	45.60496	4.68696	Agricultural
	Saint-Génis-Laval	45.6909	4.76503	Agricultural
<i>Date 2</i>	Saint Laurent d'Agny	45.6335	4.6831	Agricultural
	Le Clair	45.63451	4.69026	Ruderal
<i>Date 3</i>	Saint Laurent d'Agny	45.6335	4.6831	Agricultural
	Thurigneux	45.59188	4.64755	Ruderal

Table S2: Detailed number of reads obtained from high-throughput sequencing for each of the CO1 markers employed

Marker	Raw reads	Filtered reads	Percentage of reads retained	Variants 2%
<b>HEX</b>	9083407	1205146	0,133	408
<b>HCO</b>	48226250	7190702	0,149	847
<b>LEP</b>	50173753	12320157	0,246	759
<b>Total</b>	<b>107483410</b>	<b>20716005</b>	<b>0,193</b>	<b>2014</b>

Table S3: List of the taxa included in the sub-network (Figure 2)

Node ID	Taxon	Order (Family)	Trophic level
1	<i>Agapanthia cardui</i>	Coleoptera (Cerambycidae)	Herbivore
2	<i>Agapanthia pannonica</i>	Coleoptera (Cerambycidae)	Herbivore
3	<i>Agromyzidae</i>	Diptera (Agromyzidae)	Herbivore
4	<i>Alloxysta consobrina</i>	Hymenoptera (Figitidae)	Natural enemy (parasitoid)
5	<i>Anthemis altissima</i>	Asterales (Asteraceae)	Plant
6	<i>Aphididae</i>	Hemiptera (Aphididae)	Herbivore
7	<i>Aphidius ervi</i>	Hemiptera (Aphididae)	Herbivore
8	<i>Aphidius sonchi</i>	Hemiptera (Aphididae)	Herbivore
9	<i>Aphis craccivora</i>	Hemiptera (Aphididae)	Herbivore
10	<i>Aphis fabae</i>	Hemiptera (Aphididae)	Herbivore
11	<i>Avena sp.</i>	Poales (Poaceae)	Plant
12	<i>Bracon radialis</i>	Hymenoptera (Braconidae)	Natural enemy (parasitoid)
13	<i>Bracon sp.</i>	Hymenoptera (Braconidae)	Natural enemy (parasitoid)
14	<i>Bracon telengai</i>	Hymenoptera (Braconidae)	Natural enemy (parasitoid)
15	<i>Braconidae</i>	Hymenoptera (Braconidae)	Natural enemy (parasitoid)
16	<i>Brassicogethes aeneus</i>	Coleoptera (Nitidulidae)	Herbivore
17	<i>Campiglossa producta</i>	Diptera (Tephritidae)	Herbivore
18	<i>Carduus pycnocephalus</i>	Asterales (Asteraceae)	Plant
19	<i>Cerastium glomeratum</i>	Caryophyllales (Caryophyllaceae)	Plant
20	<i>Cicadella viridis</i>	Hemiptera (Cicadellidae)	Herbivore
21	<i>Cichorium intybus</i>	Asterales (Asteraceae)	Plant
22	<i>Cirsium arvense</i>	Asterales (Asteraceae)	Plant
23	<i>Cirsium vulgare</i>	Asterales (Asteraceae)	Plant
24	<i>Closterotomus norvegicus</i>	Hemiptera (Miridae)	Herbivore
25	<i>Cnephasia stephensiana</i>	Lepidoptera (Tortricidae)	Herbivore
26	<i>Coccinella septempunctata</i>	Coleoptera (Coccinellidae)	Natural enemy (predator)
27	<i>Coreus marginatus</i>	Hemiptera (Coreidae)	Herbivore
28	<i>Crepis foetida</i>	Asterales (Asteraceae)	Plant
29	<i>Crepis vesicaria</i>	Asterales (Asteraceae)	Plant
30	<i>Curculionidae</i>	Coleoptera (Curculionidae)	Herbivore
31	<i>Cynipidae</i>	Hymenoptera (Cynipidae)	Herbivore
32	<i>Dacnusa maculipes</i>	Hymenoptera (Braconidae)	Natural enemy (parasitoid)
33	<i>Dasytes tristiculus</i>	Coleoptera (Melyridae)	Herbivore
34	<i>Diadegma erucator</i>	Hymenoptera (Ichneumonidae)	Natural enemy (parasitoid)
35	<i>Dicot unknown</i>	/	Plant
36	<i>Diplazon tibiatorius</i>	Hymenoptera (Ichneumonidae)	Natural enemy (parasitoid)
37	<i>Dolycoris baccarum</i>	Hemiptera (Pentatomidae)	Herbivore
38	<i>Ensina sonchi</i>	Diptera (Tephritidae)	Herbivore
39	<i>Ephedrus sp.</i>	Hymenoptera (Braconidae)	Natural enemy (parasitoid)
40	<i>Episyrphus balteatus</i>	Diptera (Syrphidae)	Natural enemy (predator)
41	<i>Erigeron sp.</i>	Asterales (Asteraceae)	Plant
42	<i>Euphorbia helioscopia</i>	Malpighiales (Euphorbiaceae)	Plant

43	<i>Geranium rotundifolium</i>	Geraniales (Geraniaceae)	Plant
44	<i>Geranium sp.</i>	Geraniales (Geraniaceae)	Plant
45	<i>Hecatera dysodea</i>	Lepidoptera (Noctuidae)	Herbivore
46	<i>Heliophanus cupreus</i>	Araneae (Saltividae)	Natural enemy (predator)
47	<i>Heliophanus sp.</i>	Araneae (Saltividae)	Natural enemy (predator)
48	<i>Hordeum murinum</i>	Poales (Poaceae)	Plant
49	<i>Hyalopterus pruni</i>	Hemiptera (Aphididae)	Herbivore
50	<i>Hypericum perforatum</i>	Theales (Clusiaceae)	Plant
51	<i>Hyperomyzus lactucae</i>	Hemiptera (Aphididae)	Herbivore
52	<i>Hypochaeris radicata</i>	Asterales (Asteraceae)	Plant
53	<i>Knautia arvensis</i>	Dipsacales (Dipsacaceae)	Plant
54	<i>Kochiura aulica</i>	Araneae (Theridiidae)	Natural enemy (predator)
55	<i>Lactuca serriola</i>	Asterales (Asteraceae)	Plant
56	<i>Lathyrus sp.</i>	Fabales (Fabaceae)	Plant
57	<i>Lepidargyrus ancorifer</i>	Hemiptera (Miridae)	Herbivore
58	<i>Lepidium draba</i>	Capparales (Brassicaceae)	Plant
59	<i>Leptophyes punctatissima</i>	Orthoptera (Tettigoniidae)	Natural enemy (predator)
60	<i>Liorhyssus hyalinus</i>	Hemiptera (Rhopalidae)	Omnivore
61	<i>Lipolexis gracilis</i>	Hymenoptera (Braconidae)	Natural enemy (parasitoid)
62	<i>Liriomyza sonchi</i>	Diptera (Agromyzidae)	Herbivore
63	<i>Lixus punctiventris</i>	Coleoptera (Curculionidae)	Herbivore
64	<i>Lolium sp.</i>	Poales (Poaceae)	Plant
65	<i>Lygaeus equestris</i>	Hemiptera (Lygaeidae)	Omnivore
66	<i>Macrosiphum rosae</i>	Hemiptera (Aphididae)	Herbivore
67	<i>Medicago orbicularis</i>	Fabales (Fabaceae)	Plant
68	<i>Microplitis sp.</i>	Hymenoptera (Braconidae)	Natural enemy (parasitoid)
69	<i>Miridae</i>	Hemiptera (Miridae)	Omnivore
70	<i>Misumena vatia</i>	Araneae (Thomisidae)	Omnivore
71	<i>Neoscona adianta</i>	Araneae (Araneidae)	Omnivore
72	<i>Nezara viridula</i>	Hemiptera (Pentatomidae)	Herbivore
73	<i>Nysius cymoides</i>	Hemiptera (Orsillidae)	Omnivore
74	<i>Oedemera crassipes</i>	Coleoptera (Oedemeridae)	Herbivore
75	<i>Oedemera flavipes</i>	Coleoptera (Oedemeridae)	Herbivore
76	<i>Ophiomyia cunctata (beckeri)</i>	Diptera (Agromyzidae)	Herbivore
77	<i>Opiinae</i>	Hymenoptera (Braconidae)	Natural enemy (parasitoid)
78	<i>Orius sp.</i>	Hemiptera (Anthocoridae)	Herbivore
79	<i>Papaver rhoeas</i>	Ranunculales (Papaveraceae)	Plant
80	<i>Philaenus sp.</i>	Hemiptera (Aphrophoridae)	Herbivore
81	<i>Philaenus spumarius</i>	Hemiptera (Aphrophoridae)	Herbivore
82	<i>Phytomyza horticola</i> ( <i>syngenesiae</i> )	Diptera (Agromyzidae)	Herbivore
83	<i>Phytomyza lateralis (cichorii)</i>	Diptera (Agromyzidae)	Herbivore
84	<i>Picris echioides</i>	Asterales (Asteraceae)	Plant
85	<i>Plantago lanceolata</i>	Lamiales (Plantaginaceae)	Plant
86	<i>Platycheirus scutatus</i>	Diptera (Syrphidae)	Natural enemy (predator)
87	<i>Poa pratensis</i>	Poales (Poaceae)	Plant
88	<i>Poa trivialis</i>	Poales (Poaceae)	Plant

89	<i>Poaceae</i>	Poales (Poaceae)	Plant
90	<i>Praon volucre</i>	Hymenoptera (Braconidae)	Natural enemy (parasitoid)
91	<i>Psilothrix viridicoeruleus</i>	Coleoptera (Dasytidae)	Herbivore
92	<i>Psyllobora vigintiduopunctata</i>	Coleoptera (Coccinellidae)	Herbivore
93	<i>Rhagonycha fulva</i>	Coleoptera (Cantharidae)	Natural enemy (predator)
94	<i>Rubus ulmifolius</i>	Rosales (Rosaceae)	Plant
95	<i>Rumex crispus</i>	Polygonales (Polygonaceae)	Plant
96	<i>Runcinia grammica</i>	Araneae (Thomisidae)	Omnivore
97	<i>Senecio vulgaris</i>	Asterales (Asteraceae)	Plant
98	<i>Sonchus asper</i>	Asterales (Asteraceae)	Plant
99	<i>Sonchus oleraceus</i>	Asterales (Asteraceae)	Plant
100	<i>Sphaerophoria sp.</i>	Diptera (Syrphidae)	Plant
101	<i>Stictopleurus punctatonervosus</i>	Hemiptera (Rhopalidae)	Omnivore
102	<i>Taraxacum officinale</i>	Asterales (Asteraceae)	Plant
103	<i>Cephaledo bifasciata</i>	Hymenoptera (Tenthredinidae)	Herbivore
104	<i>Tephritidae</i>	Diptera (Tephritidae)	Herbivore
105	<i>Tephritis cometa</i>	Diptera (Tephritidae)	Herbivore
106	<i>Tephritis formosa</i>	Diptera (Tephritidae)	Herbivore
107	<i>Tephritis sp.</i>	Diptera (Tephritidae)	Herbivore
108	<i>Tephritis vespertina</i>	Diptera (Tephritidae)	Herbivore
109	<i>Tortricidae</i>	Lepidoptera (Tortricidae)	Herbivore
110	<i>Trombidiidae</i>	Acariformes (Trombidiidae)	Natural enemy (Parasit)
111	<i>Tythaspis sedecimpunctata</i>	Coleoptera (Coccinellidae)	Omnivore
112	<i>Uroleucon sonchi</i>	Hemiptera (Aphididae)	Herbivore
113	<i>Verbascum blattaria</i>	Scrophulariales (Scrophulariaceae)	Plant
114	<i>Veronica persica</i>	Lamiales (Plantaginaceae)	Plant
115	<i>Vicia sativa</i>	Fabales (Fabaceae)	Plant
116	<i>Viola arvensis</i>	Violales (Violaceae)	Plant

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Table S4: List of interactions included in the meta-network (Figure S5)

Interaction	Resource	Consumer	Occurrence frequency
1	<i>Acyrtosiphon pisum</i>	<i>Aphidius eadyi</i>	100
2	<i>Anthemis altissima</i>	Chrysomelidae	50
3	<i>Anthemis altissima</i>	<i>Microplontus rugulosus</i>	100
4	<i>Anthemis altissima</i>	<i>Nysius graminicola</i>	17
5	<i>Anthemis altissima</i>	<i>Oedemera flavipes</i>	33
6	<i>Anthemis altissima</i>	<i>Omphalapion dispar</i>	90
7	<i>Anthemis altissima</i>	<i>Psilothrix viridicoeruleus</i>	9
8	<i>Anthemis altissima</i>	<i>Tephritis sp.</i>	4
9	Aphididae	<i>Alloxysta consobrina</i>	50
10	Aphididae	<i>Platycheirus scutatus</i>	100
11	<i>Aphis fabae</i>	<i>Liorhyssus hyalinus</i>	3
12	<i>Aphis fabae</i>	<i>Lipolexis gracilis</i>	100
13	<i>Aphis fabae</i>	<i>Lygaeus equestris</i>	11
14	<i>Aphis fabae</i>	<i>Praon volucre</i>	9
15	<i>Artemisia vulgaris</i>	<i>Aphrodes sp.</i>	100
16	<i>Artemisia vulgaris</i>	<i>Deraeocoris ruber</i>	50
17	<i>Artemisia vulgaris</i>	<i>Liriomyza artemisicola</i>	100
18	<i>Artemisia vulgaris</i>	<i>Macrosiphoniella artemisiae</i>	100
19	<i>Artemisia vulgaris</i>	<i>Orius niger</i>	25
20	<i>Avena sp.</i>	<i>Calamobius filum</i>	50
21	<i>Avena sp.</i>	Miridae	4
22	<i>Avena sp.</i>	<i>Orthocephalus saltator</i>	20
23	<i>Baetis vernus</i>	<i>Neoscona adianta</i>	33
24	<i>Brassicogethes aeneus</i>	<i>Misumena vatia</i>	17
25	<i>Brassicogethes aeneus</i>	<i>Neoscona adianta</i>	33
26	<i>Brassicogethes aeneus</i>	<i>Runcinia grammica</i>	23
27	<i>Bromus sp.</i>	<i>Hispa atra</i>	67
28	<i>Campiglossa producta</i>	<i>Bracon radialis</i>	33
29	<i>Campiglossa producta</i>	<i>Bracon sp.</i>	6
30	<i>Campiglossa producta</i>	<i>Runcinia grammica</i>	8
31	<i>Capsella bursa pastoris</i>	<i>Aulacobaris coeruleascens</i>	25
32	<i>Capsella bursa pastoris</i>	<i>Ceutorhynchus pallidactylus</i>	3
33	<i>Carduus pycnocephalus</i>	<i>Agapanthia cardui</i>	62
34	<i>Carduus pycnocephalus</i>	<i>Agapanthia dahli</i>	100
35	<i>Carduus pycnocephalus</i>	<i>Agonopterix subpropinquella</i>	38
36	<i>Carduus pycnocephalus</i>	Agromyzidae	1
37	<i>Carduus pycnocephalus</i>	<i>Ceratapion gibbirostre</i>	100
38	<i>Carduus pycnocephalus</i>	Curculionidae	76
39	<i>Carduus pycnocephalus</i>	Cynipidae	50
40	<i>Carduus pycnocephalus</i>	<i>Hadroplontus trimaculatus</i>	100
41	<i>Carduus pycnocephalus</i>	<i>Lepidargyrus ancorifer</i>	44
42	<i>Carduus pycnocephalus</i>	<i>Liorhyssus hyalinus</i>	3
43	<i>Carduus pycnocephalus</i>	Miridae	29
44	<i>Carduus pycnocephalus</i>	<i>Nezara viridula</i>	17
45	<i>Carduus pycnocephalus</i>	<i>Philaenus spumarius</i>	6



46	<i>Carduus sp.</i>	<i>Agonopterix subpropinquella</i>	62
47	<i>Cassida vibex</i>	<i>Neoscona adianta</i>	33
48	<i>Cerastium glomeratum</i>	<i>Philaenus spumarius</i>	1
49	<i>Cerastium glomeratum</i>	<i>Scaptomyza graminum</i>	100
50	<i>Chenopodium album</i>	<i>Chrysoesthia sexguttella</i>	100
51	<i>Chenopodium album</i>	<i>Megoura viciae</i>	100
52	<i>Chenopodium album</i>	<i>Subcoccinella vigintiquatuorpunctata</i>	100
53	<i>Chrysoperla lucasina</i>	<i>Nigma puella</i>	50
54	<i>Cichorium intybus</i>	<i>Pentatomidae</i>	50
55	<i>Cichorium intybus</i>	<i>Philaenus spumarius</i>	1
56	<i>Cichorium intybus</i>	<i>Uroleucon sonchi</i>	1
57	<i>Cirsium arvense</i>	<i>Agonopterix propinquella</i>	100
58	<i>Cirsium arvense</i>	<i>Aphis fabae</i>	14
59	<i>Cirsium arvense</i>	<i>Brassicogethes aeneus</i>	54
60	<i>Cirsium arvense</i>	<i>Cassida rubiginosa</i>	100
61	<i>Cirsium arvense</i>	<i>Cassida vibex</i>	100
62	<i>Cirsium arvense</i>	<i>Hadroplontus litura</i>	100
63	<i>Cirsium arvense</i>	<i>Larinus planus</i>	100
64	<i>Cirsium arvense</i>	<i>Larinus turbinatus</i>	100
65	<i>Cirsium arvense</i>	<i>Nysius graminicola</i>	33
66	<i>Cirsium arvense</i>	<i>Oedemera flavipes</i>	33
67	<i>Cirsium arvense</i>	<i>Orthocephalus saltator</i>	40
68	<i>Cirsium arvense</i>	<i>Oxycarenus pallens</i>	33
69	<i>Cirsium arvense</i>	<i>Phytomyza horticola (syngenesiae)</i>	2
70	<i>Cirsium arvense</i>	<i>Phytomyza spinaciae</i>	100
71	<i>Cirsium vulgare</i>	<i>Nysius cymoides</i>	12
72	<i>Cirsium vulgare</i>	<i>Oxycarenus pallens</i>	33
73	<i>Convolvulus arvensis</i>	<i>Bedellia somnulentella</i>	100
74	<i>Convolvulus arvensis</i>	<i>Hypocassida subferruginea</i>	100
75	<i>Convolvulus arvensis</i>	<i>Stigmella freyella</i>	100
76	<i>Crepis foetida</i>	<i>Lepidargyrus ancorifer</i>	11
77	<i>Crepis foetida</i>	<i>Nysius cymoides</i>	12
78	<i>Crepis vesicaria</i>	<i>Aphis fabae</i>	14
79	<i>Crepis vesicaria</i>	<i>Aphrodes makarovi</i>	50
80	<i>Crepis vesicaria</i>	<i>Campiglossa producta</i>	13
81	<i>Crepis vesicaria</i>	<i>Cheilosia grossa</i>	50
82	<i>Crepis vesicaria</i>	<i>Tephritis formosa</i>	3
83	<i>Crepis vesicaria</i>	<i>Tephritis sp.</i>	26
84	<i>Crepis vesicaria</i>	<i>Uroleucon hypochoeridis</i>	100
85	<i>Cynodon dactylon</i>	<i>Myzus lythri</i>	100
86	<i>Dactylis glomerata</i>	<i>Psammotettix nodosus</i>	100
87	<i>Dactylis glomerata</i>	<i>Sitobion avenae</i>	100
88	<i>Daucus carota</i>	<i>Orius niger</i>	25
89	<i>Dicot unknown</i>	<i>Curculionidae</i>	12
90	<i>Dicot unknown</i>	<i>Philaenus sp.</i>	25
91	<i>Diplotaxis eruroides</i>	<i>Aulacobaris coeruleascens</i>	75
92	<i>Diplotaxis eruroides</i>	<i>Ceutorhynchus pallidactylus</i>	72
93	<i>Diplotaxis eruroides</i>	<i>Daraeocoris sp.</i>	100
94	<i>Diplotaxis eruroides</i>	<i>Oedemera lurida</i>	33

95	<i>Ensina sonchi</i>	<i>Bracon sp.</i>	22
96	<i>Ensina sonchi</i>	<i>Bracon telengai</i>	33
97	<i>Ensina sonchi</i>	<i>Braconidae</i>	75
98	<i>Ensina sonchi</i>	<i>Coreus marginatus</i>	40
99	<i>Ensina sonchi</i>	<i>Kochiura aulica</i>	17
100	<i>Ensina sonchi</i>	<i>Liorhyssus hyalinus</i>	3
101	<i>Ensina sonchi</i>	<i>Lygaeus equestris</i>	56
102	<i>Ensina sonchi</i>	<i>Nysius cymoides</i>	12
103	<i>Epilobium sp.</i>	<i>Mompha divisella</i>	100
104	<i>Episyrphus balteatus</i>	<i>Misumena vatia</i>	17
105	<i>Erigeron sp.</i>	<i>Eurydema ornata</i>	100
106	<i>Erigeron sp.</i>	<i>Hyperomyzus lactucae</i>	2
107	<i>Erigeron sp.</i>	<i>Lygaeidae</i>	100
108	<i>Erigeron sp.</i>	<i>Psilothrix viridicoeruleus</i>	18
109	<i>Erigeron sp.</i>	<i>Stictopleurus punctatonervosus</i>	14
110	<i>Euphorbia helioscopia</i>	<i>Philaenus spumarius</i>	1
111	<i>Euphorbia helioscopia</i>	<i>Thripidae</i>	100
112	<i>Forficula auricularia</i>	<i>Misumena vatia</i>	33
113	<i>Geranium rotundifolium</i>	<i>Corizus hyoscyami</i>	100
114	<i>Geranium rotundifolium</i>	<i>Liorhyssus hyalinus</i>	3
115	<i>Geranium rotundifolium</i>	<i>Uroleucon inulae</i>	100
116	<i>Geranium rotundifolium</i>	<i>Uroleucon sonchi</i>	6
117	<i>Geranium sp.</i>	<i>Philaenus spumarius</i>	3
118	<i>Hecatera dysodea</i>	<i>Microplitis sp.</i>	100
119	<i>Hordeum murinum</i>	<i>Philaenus spumarius</i>	1
120	<i>Hordeum murinum</i>	<i>Sitobion fragariae</i>	50
121	<i>Hyalopterus pruni</i>	<i>Aphidius sonchi</i>	4
122	<i>Hypericum perforatum</i>	<i>Coreus marginatus</i>	20
123	<i>Hypericum perforatum</i>	<i>Cryptocephalus moraei</i>	100
124	<i>Hyperomyzus lactucae</i>	<i>Alloxysta consobrina</i>	50
125	<i>Hyperomyzus lactucae</i>	<i>Aphidius sonchi</i>	83
126	<i>Hyperomyzus lactucae</i>	<i>Leptophyes punctatissima</i>	20
127	<i>Hyperomyzus lactucae</i>	<i>Miridae</i>	8
128	<i>Hyperomyzus lactucae</i>	<i>Praon volucre</i>	86
129	<i>Hyperomyzus lactucae</i>	<i>Sphaerophoria sp.</i>	11
130	<i>Hyperomyzus lactucae</i>	<i>Stictopleurus punctatonervosus</i>	14
131	<i>Hyperomyzus lactucae</i>	<i>Trombidiidae</i>	50
132	<i>Hyperomyzus lactucae</i>	<i>Tytthaspis sedecimpunctata</i>	14
133	<i>Hyperomyzus picridis</i>	<i>Aphidius sonchi</i>	4
134	<i>Hyperomyzus sp.</i>	<i>Aphidius sonchi</i>	9
135	<i>Hypochaeris radicata</i>	<i>Agromyzidae</i>	1
136	<i>Knautia arvensis</i>	<i>Agapanthia sp.</i>	100
137	<i>Knautia arvensis</i>	<i>Philaenus sp.</i>	25
138	<i>Lactuca serriola</i>	<i>Agromyzidae</i>	23
139	<i>Lactuca serriola</i>	<i>Aphis craccivora</i>	50
140	<i>Lactuca serriola</i>	<i>Cnephasia asseclana</i>	100
141	<i>Lactuca serriola</i>	<i>Hyperomyzus lactucae</i>	6
142	<i>Lactuca serriola</i>	<i>Liorhyssus hyalinus</i>	3
143	<i>Lactuca serriola</i>	<i>Liriomyza serriolae</i>	100

144	<i>Lactuca serriola</i>	<i>Lixus punctiventris</i>	2
145	<i>Lactuca serriola</i>	<i>Ophiomyia cunctata (beckeri)</i>	4
146	<i>Lactuca serriola</i>	<i>Pemphigus bursarius</i>	100
147	<i>Lactuca serriola</i>	Pentatomidae	50
148	<i>Lactuca serriola</i>	<i>Philaenus spumarius</i>	1
149	<i>Lactuca serriola</i>	<i>Phytomyza horticola (syngenesiae)</i>	4
150	<i>Lactuca serriola</i>	<i>Phytomyza lateralis (cichorii)</i>	17
151	<i>Lactuca serriola</i>	<i>Sitobion fragariae</i>	50
152	<i>Lactuca serriola</i>	<i>Uroleucon sonchi</i>	5
153	<i>Lamium purpureum</i>	<i>Cnephasia sp.</i>	17
154	<i>Lasius niger</i>	<i>Cheiracanthium mildei</i>	50
155	<i>Lasius niger</i>	<i>Neoscona adianta</i>	33
156	<i>Lasius niger</i>	<i>Runcinia grammica</i>	8
157	<i>Lathyrus sp.</i>	<i>Philaenus spumarius</i>	4
158	<i>Lepidargyrus ancorifer</i>	<i>Runcinia grammica</i>	8
159	<i>Lepidium draba</i>	<i>Ceutorhynchus pallidactylus</i>	25
160	<i>Lepidium draba</i>	<i>Nysius cymoides</i>	38
161	<i>Linaria vulgaris</i>	<i>Aphis sp.</i>	100
162	<i>Liorhysus hyalinus</i>	<i>Kochiura aulica</i>	17
163	<i>Liriomyza cicerina</i>	<i>Neoscona adianta</i>	33
164	<i>Lolium perenne</i>	Acrididae	100
165	<i>Lolium perenne</i>	<i>Megaloceroea recticornis</i>	50
166	<i>Lolium perenne</i>	<i>Tytthaspis sedecimpunctata</i>	14
167	<i>Lolium rigidum</i>	<i>Calamobius filum</i>	50
168	<i>Lolium sp.</i>	<i>Coreus marginatus</i>	20
169	<i>Lolium sp.</i>	<i>Oulema melanopus OUduftschmidi</i>	100
170	<i>Lycoriella sativae</i>	<i>Neoscona adianta</i>	33
171	<i>Macrosiphoniella artemisiae</i>	Miridae	4
172	<i>Macrosiphoniella artemisiae</i>	Rhopalidae	100
173	<i>Medicago orbicularis</i>	<i>Dolycoris baccarum</i>	17
174	<i>Medicago orbicularis</i>	<i>Nezara viridula</i>	17
175	<i>Medicago orbicularis</i>	<i>Sitona discoideus</i>	33
176	<i>Medicago polymorpha</i>	<i>Hypera postica</i>	50
177	<i>Megaloceroea recticornis</i>	<i>Neoscona adianta</i>	33
178	<i>Megaloceroea recticornis</i>	<i>Runcinia grammica</i>	8
179	<i>Melanostoma mellinum</i>	<i>Misumena vatia</i>	17
180	Miridae	<i>Ephedrus sp.</i>	10
181	Miridae	<i>Runcinia grammica</i>	8
182	<i>Nehemitropia lividipennis</i>	<i>Neoscona adianta</i>	33
183	<i>Oedemera flavipes</i>	<i>Runcinia grammica</i>	8
184	<i>Ophiomyia cunctata (beckeri)</i>	Braconidae	12
185	<i>Papaver rhoeas</i>	<i>Brassicogethes aeneus</i>	4
186	<i>Papaver rhoeas</i>	Miridae	4
187	<i>Papaver rhoeas</i>	<i>Oedemera lurida</i>	33
188	<i>Philaenus spumarius</i>	<i>Heliophanus cupreus</i>	33
189	<i>Phytomyza horticola (syngenesiae)</i>	<i>Bracon telengai</i>	33
190	<i>Phytomyza horticola (syngenesiae)</i>	<i>Dacnusa maculipes</i>	100
191	<i>Phytomyza horticola (syngenesiae)</i>	Opiinae	100
192	<i>Picris echioides</i>	Agromyzidae	1

193	<i>Picris echioides</i>	<i>Brassicogethes aeneus</i>	7
194	<i>Picris echioides</i>	<i>Cheilosia latifrons</i>	50
195	<i>Picris echioides</i>	<i>Hyperomyzus lactucae</i>	4
196	<i>Picris echioides</i>	<i>Hyperomyzus picridis</i>	100
197	<i>Picris echioides</i>	<i>Hyperomyzus sp.</i>	100
198	<i>Picris echioides</i>	<i>Lepidargyrus ancorifer</i>	11
199	<i>Picris echioides</i>	<i>Liorhyssus hyalinus</i>	3
200	<i>Picris echioides</i>	<i>Nezara viridula</i>	17
201	<i>Picris echioides</i>	<i>Nysius graminicola</i>	17
202	<i>Picris echioides</i>	<i>Orthocephalus saltator</i>	20
203	<i>Picris echioides</i>	<i>Philaenus spumarius</i>	9
204	<i>Picris echioides</i>	<i>Phytomyza horticola (syngenesiae)</i>	15
205	<i>Picris echioides</i>	<i>Phytomyza lateralis (cichorii)</i>	33
206	<i>Picris echioides</i>	<i>Tephritis sp.</i>	7
207	<i>Picris echioides</i>	<i>Uroleucon picridis</i>	100
208	<i>Picris echioides</i>	<i>Uroleucon sonchi</i>	1
209	<i>Picris echioides</i>	<i>Uroleucon sp.</i>	100
210	<i>Plantago lanceolata</i>	<i>Aspilapteryx tringipennella</i>	100
211	<i>Plantago lanceolata</i>	<i>Phytomyza plantaginis</i>	100
212	<i>Plantago lanceolata</i>	<i>Uroleucon sonchi</i>	2
213	<i>Platycheirus scutatus</i>	<i>Diplazon tibiatorius</i>	100
214	<i>Poa pratensis</i>	<i>Philaenus spumarius</i>	7
215	<i>Poa trivialis</i>	<i>Orius sp.</i>	50
216	<i>Poa trivialis</i>	<i>Philaenus spumarius</i>	1
217	<i>Poaceae</i>	<i>Anotylus inustus</i>	50
218	<i>Poaceae</i>	<i>Cantharis rustica</i>	100
219	<i>Poaceae</i>	<i>Cnephasia sp.</i>	33
220	<i>Poaceae</i>	<i>Ischodemus sabuleti</i>	91
221	<i>Poaceae</i>	<i>Lasius niger</i>	3
222	<i>Poaceae</i>	<i>Luperina dumerilii</i>	100
223	<i>Poaceae</i>	<i>Neophilaenus campestris</i>	80
224	<i>Poaceae</i>	<i>Oscinella maura</i>	100
225	<i>Poaceae</i>	<i>Philaenus spumarius</i>	1
226	<i>Poaceae</i>	<i>Tytthaspis sedecimpunctata</i>	71
227	<i>Poaceae</i>	<i>Uroleucon sonchi</i>	1
228	<i>Polygonum aviculare</i>	<i>Rhinoncus perpendicularis</i>	100
229	<i>Psilothrix viridicoeruleus</i>	<i>Neoscona adianta</i>	33
230	<i>Psyllobora vigintiduopunctata</i>	<i>Misumena vatia</i>	17
231	<i>Rubus ulmifolius</i>	<i>Philaenus spumarius</i>	1
232	<i>Rumex acetosa</i>	<i>Perapion neofallax</i>	27
233	<i>Rumex crispus</i>	<i>Philaenus spumarius</i>	3
234	<i>Rumex sp.</i>	<i>Perapion neofallax</i>	73
235	<i>Scaeva pyrastris</i>	<i>Miridae</i>	4
236	<i>Senecio vulgaris</i>	<i>Nezara viridula</i>	17
237	<i>Senecio vulgaris</i>	<i>Nysius senecionis</i>	100
238	<i>Senecio vulgaris</i>	<i>Sphenella marginata</i>	100
239	<i>Setaria pumila</i>	<i>Neophilaenus campestris</i>	20
240	<i>Setisquamalonchaea fumosa</i>	<i>Runcinia grammica</i>	8
241	<i>Sitobion avenae</i>	<i>Aphidius uzbekistanicus</i>	100

242	<i>Sitobion fragariae</i>	<i>Trombidiidae</i>	50
243	<i>Sitona discoideus</i>	<i>Microctonus aethiopoidea</i>	100
244	<i>Sonchus asper</i>	<i>Acyrtosiphon malvae</i>	100
245	<i>Sonchus asper</i>	<i>Acyrtosiphon pisum</i>	50
246	<i>Sonchus asper</i>	<i>Agromyzidae</i>	20
247	<i>Sonchus asper</i>	<i>Anoecia corni</i>	100
248	<i>Sonchus asper</i>	<i>Campiglossa producta</i>	13
249	<i>Sonchus asper</i>	<i>Cheilosia latifrons</i>	50
250	<i>Sonchus asper</i>	<i>Ensina sonchi</i>	9
251	<i>Sonchus asper</i>	<i>Erebidae</i>	100
252	<i>Sonchus asper</i>	<i>Heterotoma planicornis</i>	100
253	<i>Sonchus asper</i>	<i>Hyperomyzus lactucae</i>	17
254	<i>Sonchus asper</i>	<i>Liorhyssus hyalinus</i>	34
255	<i>Sonchus asper</i>	<i>Liriomyza sonchi</i>	14
256	<i>Sonchus asper</i>	<i>Lixus punctiventris</i>	2
257	<i>Sonchus asper</i>	<i>Macrosiphum euphorbiae</i>	67
258	<i>Sonchus asper</i>	<i>Nysius graminicola</i>	17
259	<i>Sonchus asper</i>	<i>Ophiomyia cunctata (beckeri)</i>	8
260	<i>Sonchus asper</i>	<i>Philaenus spumarius</i>	9
261	<i>Sonchus asper</i>	<i>Phytomyza horticola (syngenesiae)</i>	15
262	<i>Sonchus asper</i>	<i>Psilothrix viridicoeruleus</i>	9
263	<i>Sonchus asper</i>	<i>Tephritis formosa</i>	7
264	<i>Sonchus asper</i>	<i>Tephritis sp.</i>	11
265	<i>Sonchus asper</i>	<i>Triodia sylvina</i>	100
266	<i>Sonchus asper</i>	<i>Uroleucon jaceae</i>	100
267	<i>Sonchus oleraceus</i>	<i>Agapanthia cardui</i>	15
268	<i>Sonchus oleraceus</i>	<i>Agapanthia pannonica</i>	50
269	<i>Sonchus oleraceus</i>	<i>Agromyzidae</i>	52
270	<i>Sonchus oleraceus</i>	<i>Aphididae</i>	100
271	<i>Sonchus oleraceus</i>	<i>Aphis craccivora</i>	50
272	<i>Sonchus oleraceus</i>	<i>Aphis fabae</i>	71
273	<i>Sonchus oleraceus</i>	<i>Brassicogethes aeneus</i>	21
274	<i>Sonchus oleraceus</i>	<i>Campiglossa producta</i>	60
275	<i>Sonchus oleraceus</i>	<i>Cicadella viridis</i>	100
276	<i>Sonchus oleraceus</i>	<i>Closterotomus norvegicus</i>	100
277	<i>Sonchus oleraceus</i>	<i>Cnephasia stephensiana</i>	33
278	<i>Sonchus oleraceus</i>	<i>Curculionidae</i>	12
279	<i>Sonchus oleraceus</i>	<i>Cynipidae</i>	50
280	<i>Sonchus oleraceus</i>	<i>Dasytes tristiculus</i>	8
281	<i>Sonchus oleraceus</i>	<i>Dolycoris baccarum</i>	50
282	<i>Sonchus oleraceus</i>	<i>Ensina sonchi</i>	90
283	<i>Sonchus oleraceus</i>	<i>Hecatera dysodea</i>	100
284	<i>Sonchus oleraceus</i>	<i>Hyalopterus pruni</i>	100
285	<i>Sonchus oleraceus</i>	<i>Hyperomyzus lactucae</i>	69
286	<i>Sonchus oleraceus</i>	<i>Lepidargyrus ancorifer</i>	22
287	<i>Sonchus oleraceus</i>	<i>Liorhyssus hyalinus</i>	50
288	<i>Sonchus oleraceus</i>	<i>Liriomyza sonchi</i>	79
289	<i>Sonchus oleraceus</i>	<i>Lixus punctiventris</i>	96
290	<i>Sonchus oleraceus</i>	<i>Lygaeus equestris</i>	11

291	<i>Sonchus oleraceus</i>	<i>Macrosiphum rosae</i>	100
292	<i>Sonchus oleraceus</i>	<i>Miridae</i>	38
293	<i>Sonchus oleraceus</i>	<i>Nezara viridula</i>	33
294	<i>Sonchus oleraceus</i>	<i>Nysius cymoides</i>	12
295	<i>Sonchus oleraceus</i>	<i>Oedemera crassipes</i>	100
296	<i>Sonchus oleraceus</i>	<i>Oedemera flavipes</i>	33
297	<i>Sonchus oleraceus</i>	<i>Ophiomyia cunctata (beckeri)</i>	88
298	<i>Sonchus oleraceus</i>	<i>Orius sp.</i>	50
299	<i>Sonchus oleraceus</i>	<i>Philaenus sp.</i>	25
300	<i>Sonchus oleraceus</i>	<i>Philaenus spumarius</i>	40
301	<i>Sonchus oleraceus</i>	<i>Phytomyza horticola (syngenesiae)</i>	63
302	<i>Sonchus oleraceus</i>	<i>Phytomyza lateralis (cichorii)</i>	50
303	<i>Sonchus oleraceus</i>	<i>Psilothrix viridicoeruleus</i>	18
304	<i>Sonchus oleraceus</i>	<i>Stictopleurus punctatonervosus</i>	57
305	<i>Sonchus oleraceus</i>	<i>Tenthredo bifasciata</i>	100
306	<i>Sonchus oleraceus</i>	<i>Tephritidae</i>	100
307	<i>Sonchus oleraceus</i>	<i>Tephritis cometa</i>	100
308	<i>Sonchus oleraceus</i>	<i>Tephritis formosa</i>	89
309	<i>Sonchus oleraceus</i>	<i>Tephritis sp.</i>	48
310	<i>Sonchus oleraceus</i>	<i>Tephritis vespertina</i>	100
311	<i>Sonchus oleraceus</i>	<i>Tortricidae</i>	100
312	<i>Sonchus oleraceus</i>	<i>Uroleucon sonchi</i>	84
313	<i>Sonchus oleraceus</i>	<i>Coreus marginatus</i>	60
314	<i>Sphaerophoria sp.</i>	<i>Lygaeus equestris</i>	11
315	<i>Sphaerophoria sp.</i>	<i>Misumena vatia</i>	50
316	<i>Sphaerophoria sp.</i>	<i>Neoscona adianta</i>	67
317	<i>Sphaerophoria sp.</i>	<i>Runcinia grammica</i>	15
318	<i>Taraxacum officinale</i>	<i>Campiglossa producta</i>	13
319	<i>Taraxacum officinale</i>	<i>Orthochaetes setiger</i>	100
320	<i>Taraxacum officinale</i>	<i>Phytomyza horticola (syngenesiae)</i>	2
321	<i>Taraxacum officinale</i>	<i>Stictopleurus punctatonervosus</i>	14
322	<i>Tephritidae</i>	<i>Bracon radialis</i>	67
323	<i>Tephritidae</i>	<i>Bracon sp.</i>	28
324	<i>Tephritidae</i>	<i>Braconidae</i>	12
325	<i>Tephritis formosa</i>	<i>Bracon sp.</i>	44
326	<i>Tephritis formosa</i>	<i>Bracon telengai</i>	33
327	<i>Tephritis formosa</i>	<i>Kochiura aulica</i>	17
328	<i>Tephritis formosa</i>	<i>Lygaeus equestris</i>	11
329	<i>Tephritis formosa</i>	<i>Miridae</i>	4
330	<i>Tephritis sp.</i>	<i>Tephritis formosa</i>	1
331	<i>Tortricidae</i>	<i>Diadegma erucator</i>	75
332	<i>Uroleucon sonchi</i>	<i>Aphidius ervi</i>	100
333	<i>Uroleucon sonchi</i>	<i>Coccinella septempunctata</i>	14
334	<i>Uroleucon sonchi</i>	<i>Ephedrus sp.</i>	80
335	<i>Uroleucon sonchi</i>	<i>Episyrphus balteatus</i>	6
336	<i>Uroleucon sonchi</i>	<i>Heliophanus sp.</i>	50
337	<i>Uroleucon sonchi</i>	<i>Praon volucre</i>	5
338	<i>Uroleucon sonchi</i>	<i>Psyllobora vigintiduopunctata</i>	9
339	<i>Uroleucon sonchi</i>	<i>Rhagonycha fulva</i>	22

340	<i>Uroleucon sp.</i>	<i>Ephedrus sp.</i>	10
341	<i>Verbascum blattaria</i>	<i>Lepidargyrus ancorifer</i>	11
342	<i>Verbascum blattaria</i>	<i>Nysius cymoides</i>	25
343	<i>Veronica persica</i>	<i>Philaenus sp.</i>	25
344	<i>Vicia cracca</i>	<i>Deraeocoris ruber</i>	50
345	<i>Vicia sativa</i>	<i>Acyrtosiphon pisum</i>	50
346	<i>Vicia sativa</i>	<i>Lygaeus equestris</i>	11
347	<i>Vicia sativa</i>	<i>Miridae</i>	8
348	<i>Vicia sativa</i>	<i>Philaenus spumarius</i>	4
349	<i>Viola arvensis</i>	<i>Philaenus spumarius</i>	1
350	<i>Zyginidia scutellaris</i>	<i>Neoscona adianta</i>	33

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Supplementary Figures

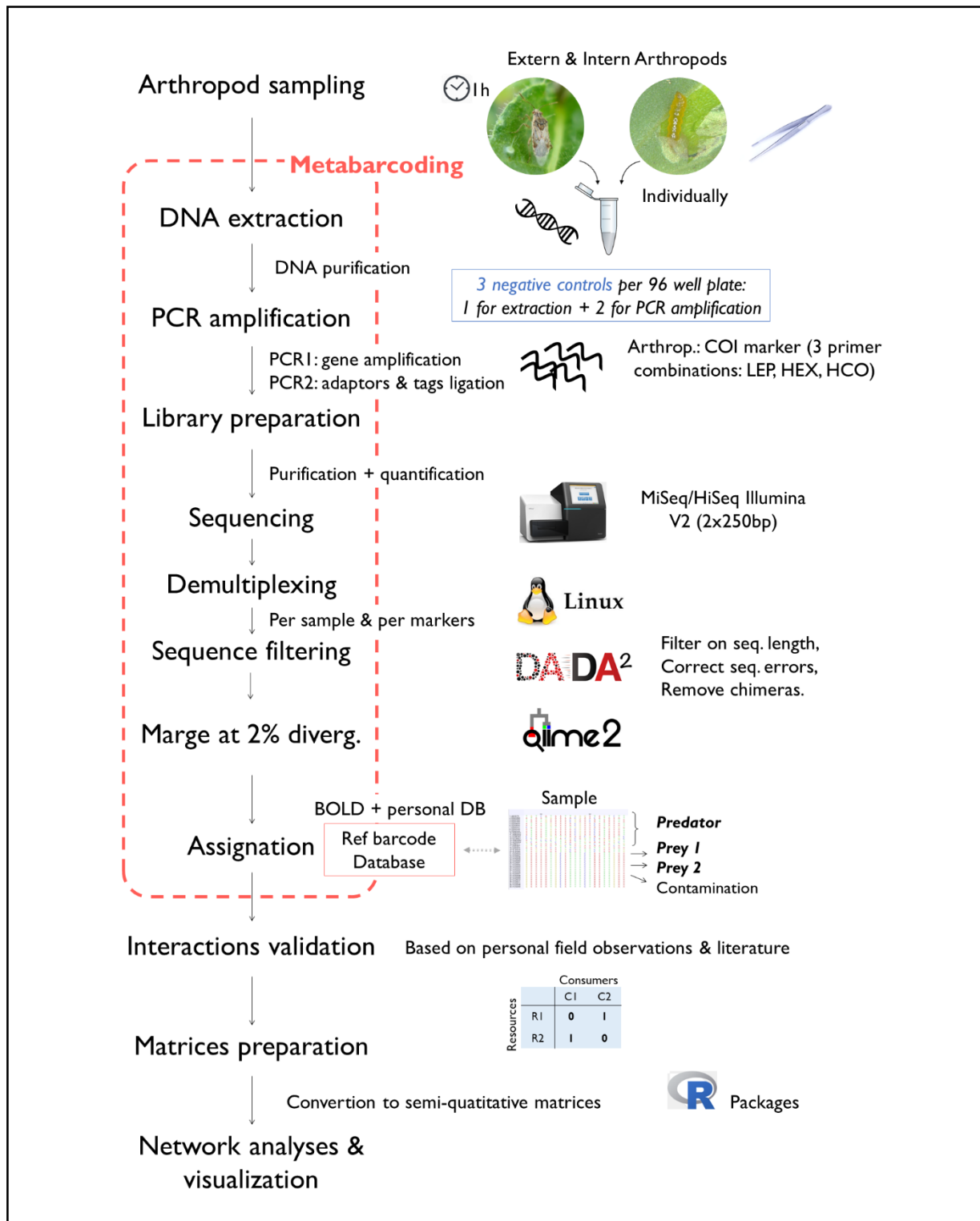


Figure S1: Overview of the entire process for the reconstruction of interactions between plants, herbivores and natural enemies.



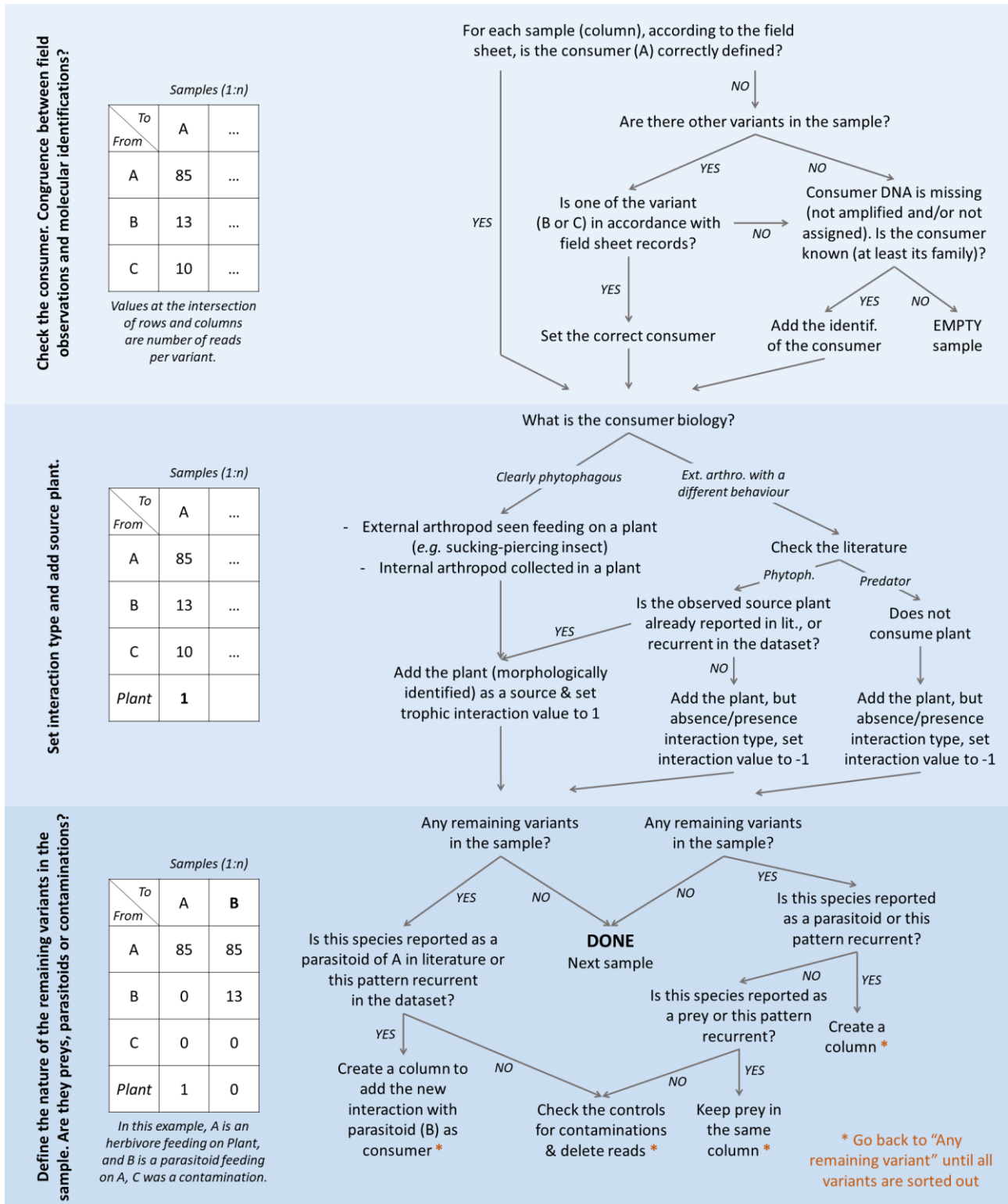
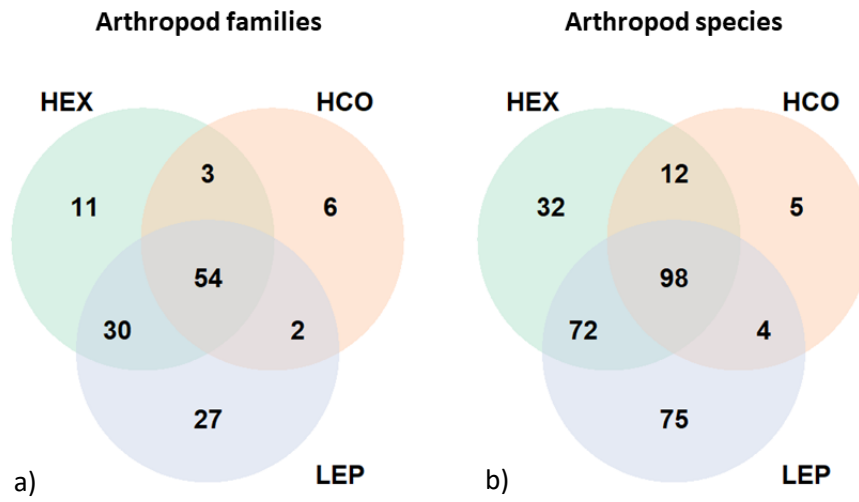


Figure S2: Flow diagram presenting the process followed for the transformation of raw data from sequencing into an adjacency matrix.



*Figure S3: Venn diagram of taxonomic coverage obtained with the three COI markers used in this study, represented through a) arthropod family diversity and b) arthropod species diversity.*

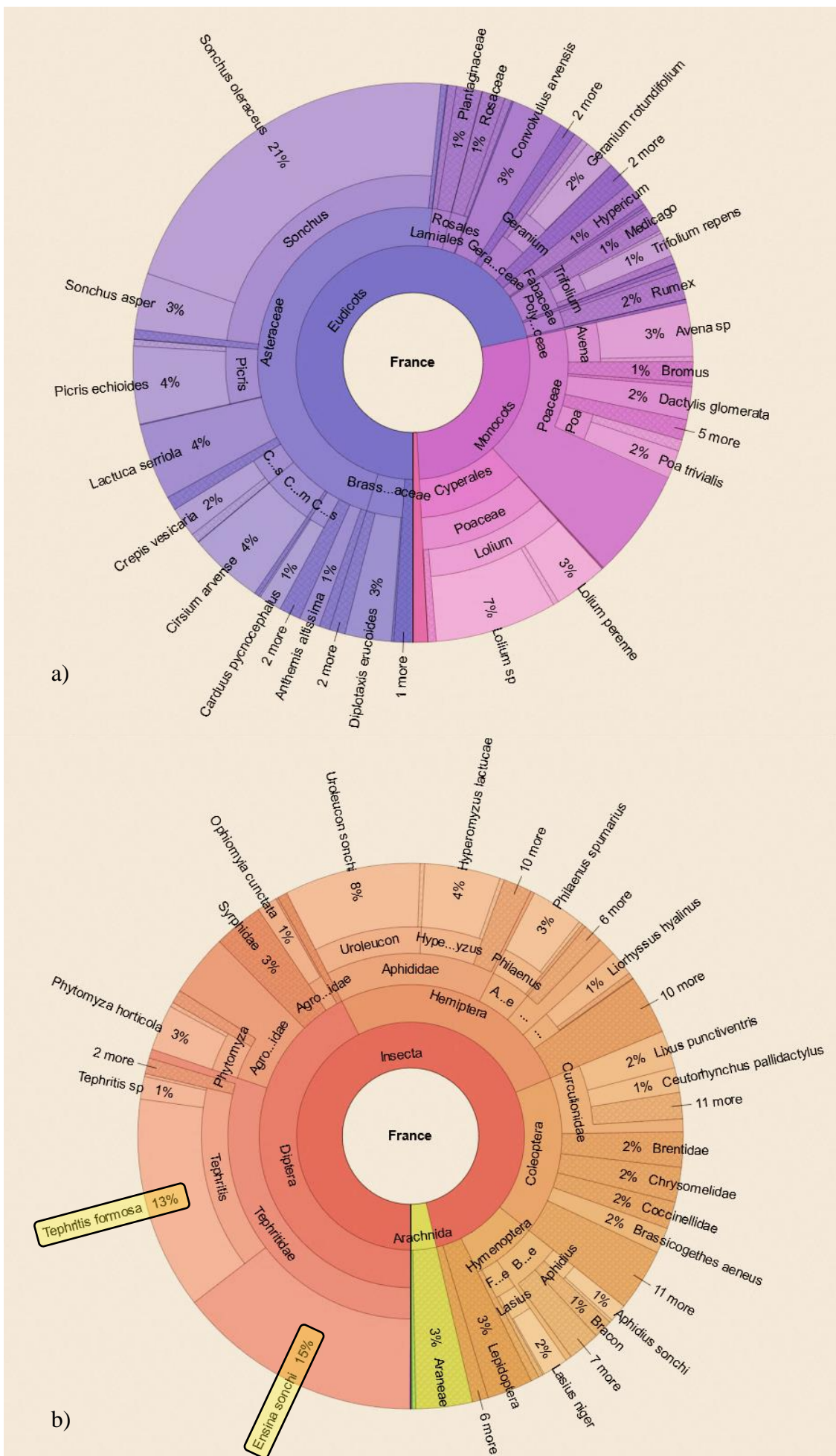
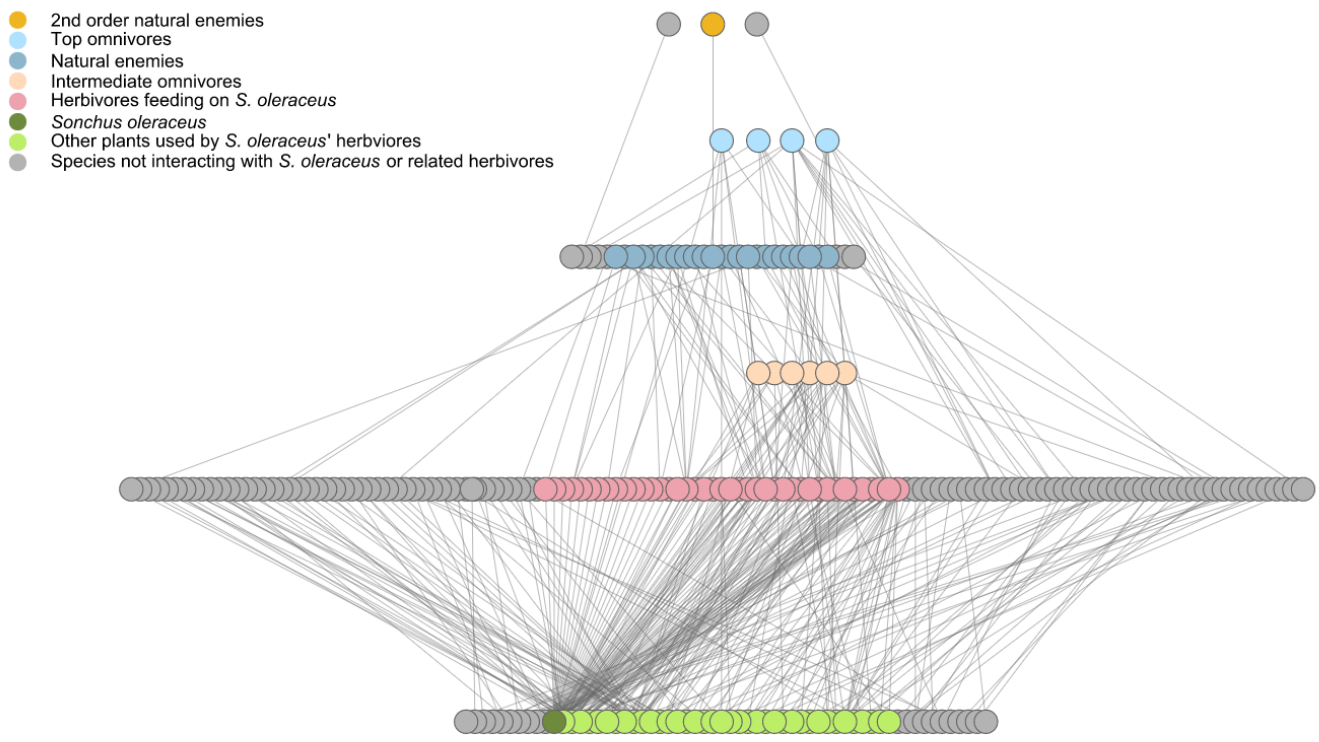


Figure S4: Taxonomic abundance of a) plants and b) arthropods in the dataset after data validation. This diagram allows visualizing the hierarchical organisation of taxonomic affiliation for each species, considering species abundance. E.g. Tephritis Formosa and Ensina sonchi (Tephritidae: Diptera) were two arthropod species very frequently sampled during this campaign (Spring 2018) representing 13% and 15% of samples collected, respectively.



*Figure S5: Meta-network reconstructed through intense sampling in France during spring 2018. Colored nodes refer to subnetwork centred on *S. oleraceus* related interactions. The meta-network is composed of 241 nodes and 350 links, the subnetwork is composed of 116 nodes and 213 links.*