

Landscape complexity effects on *Brassicogethes aeneus* abundance and larval parasitism rate: a two-year field study

Silva Vilumets, Riina Kaasik, Marjolein Lof, Gabriella Kovacs, John Holland, and Eve Veromann

Supplementary Table 1. The characteristics of the study region in 2014 hectares (ha): field size (ha), adjacent element type (herbaceous linear (HL)); woody linear (WL); another crop (CT), seminatural habitat (SNH) (%), arable land (%), arable land excluding permanent grassland (%), winter oilseed rape (OSR) (%), wheat (%), woody area (%), woody linear (%), herbaceous area (%), herbaceous linear (%), fallow area (%), permanent grassland (%).

ID	Year	Field size	Adjacent element type	SNH (%)	Arable land (%)	Arable land excluding permanent grassland (%)	OSR (%)	Wheat (%)	Woody area (%)	Woody linear (%)	Herbaceous area (%)	Herbaceous linear (%)	Fallow area (%)	Permanent grassland (%)
LS1.HL	2014	9.7	HL	22.9	59.1	28.8	6.8	1.3	13.3	0.7	7.6	1.4	0.0	30.3
LS2.CT	2014	37.8	CT	43.0	52.6	46.9	12.0	24.4	34.8	0.1	2.1	0.8	5.1	5.7
LS3.CT	2014	4.5	CT	68.7	26.4	25.8	9.5	5.0	59.4	0.0	8.1	0.6	0.5	0.6
LS4.CT	2014	9.5	CT	26.1	62.2	60.2	27.7	6.8	18.2	0.3	6.0	0.3	1.3	2.0
LS5.HL	2014	26.8	HL	33.7	36.2	33.5	8.9	14.4	20.1	0.3	12.0	1.3	0.0	2.7
LS6.WL	2014	12.4	WL	24.0	66.1	53.9	3.9	7.0	16.8	0.2	3.3	1.0	2.7	12.2
LS7.HL	2014	41.3	HL	28.0	69.2	66.9	23.6	20.1	25.6	0.0	1.5	0.9	0.0	2.3
LS8.CT	2014	52.3	CT	23.4	73.7	70.6	28.2	0.9	17.2	0.0	4.6	1.6	0.0	3.1
LS9.WL	2014	12	WL	30.7	51.7	24.0	3.8	0.0	13.8	1.7	13.3	1.9	0.0	27.7
LS10.WL	2014	11.5	WL	35.5	61.0	59.9	16.2	28.7	31.1	0.4	2.4	0.7	0.9	1.2
LS11.HL	2014	6.4	HL	34.2	59.3	56.6	10.5	24.1	27.6	0.8	3.1	0.8	1.9	2.7
LS12.HL	2014	6	HL	46.6	42.9	41.9	2.9	8.9	24.1	0.2	21.3	1.0	0.0	1.1
LS13.HL	2014	20.6	HL	37.0	57.3	56.3	6.6	33.3	29.4	0.1	6.7	0.8	0.0	1.0
LS14.WL	2014	73.8	WL	39.3	56.9	53.1	30.5	14.7	22.8	0.9	8.6	0.5	6.5	3.8
LS15.CT	2014	52.7	CT	47.7	46.8	43.8	26.1	8.8	31.2	0.3	8.4	0.5	7.2	3.0
LS16.WL	2014	43.7	WL	40.0	53.7	48.8	30.7	4.3	26.8	0.4	7.8	0.8	4.3	4.9
LS17.WL	2014	16.6	WL	75.9	20.2	18.5	5.3	0.7	61.3	0.9	11.7	0.7	1.4	1.7
LS18.CT	2014	10.5	CT	20.9	73.4	56.7	10.9	3.9	16.5	0.1	3.1	0.7	0.4	16.7
max				75.9	73.7	70.6	30.7	33.3	61.3	1.7	21.3	1.9	7.2	30.3
min				20.9	20.2	18.5	2.9	0.0	13.3	0.0	1.5	0.3	0.0	0.6
average				37.7	53.8	47.0	14.7	11.5	27.2	0.4	7.3	0.9	1.8	6.8
HL average				33.8	54.0	47.3	9.9	17.0	23.4	0.4	8.7	1.0	0.3	6.7
CT average				38.3	55.9	50.7	19.1	8.3	29.6	0.1	5.4	0.7	2.4	5.2
WL average				40.9	51.6	43.0	15.1	9.2	28.8	0.7	7.8	0.9	2.6	8.6

Supplementary Table 2. The characteristics of the study region in 2015 hectares (ha): field size(ha), adjacent element type (herbaceous linear (HL)); woody linear (WL); another crop (CT), seminatural habitat (SNH) (%), arable land (%), arable land excluding permanent grassland (%), winter oilseed rape OSR (%), wheat (%), woody area (%), woody linear (%), herbaceous area (%), herbaceous linear (%), fallow area (%), permanent grassland (%).

ID	Year	Field size	Adjacent element	SNH (%)	Arable land (%)	Arable land excluding permanent grassland (%)	OSR (%)	Wheat (%)	Woody area (%)	Woody linear (%)	Herbaceous area (%)	Herbaceous linear (%)	Fallow area (%)	Permanent grassland (%)
LS1.HL	2015	9.7	CT	11.3	82.7	82.7	14.0	16.7	7.6	0.5	2.0	1.3	0.0	0.1
LS2.CT	2015	37.8	CT	24.5	70.3	69.9	18.7	26.7	20.6	0.4	1.7	1.8	0.0	0.4
LS3.CT	2015	4.5	CT	43.0	53.1	53.1	19.9	5.7	30.0	0.7	3.1	0.3	9.0	0.0
LS4.CT	2015	9.5	CT	43.1	52.8	52.5	10.7	10.9	29.4	0.8	4.4	1.1	7.4	0.2
LS5.HL	2015	26.8	CT	39.5	54.5	54.5	11.7	0.2	33.4	0.2	4.7	1.1	0.0	0.0
LS6.WL	2015	12.4	CT	43.6	47.0	47.0	5.4	12.9	30.3	0.8	7.2	1.9	3.5	0.0
LS7.HL	2015	41.3	HL	22.2	68.1	58.8	12.8	38.9	16.1	0.4	3.4	2.3	0.0	9.3
LS8.CT	2015	52.3	HL	14.5	68.1	68.1	15.1	0.1	1.4	1.0	9.0	2.3	0.7	0.0
LS9.WL	2015	12	HL	29.2	67.2	67.2	19.1	8.8	25.1	0.0	0.6	3.4	0.0	0.0
LS10.WL	2015	11.5	HL	34.9	58.7	56.7	16.8	24.5	14.8	0.3	6.8	1.9	11.0	2.0
LS11.HL	2015	6.4	HL	47.7	48.8	48.8	11.9	14.9	40.7	0.1	3.4	2.0	1.4	0.0
LS12.HL	2015	6	HL	52.0	44.7	40.4	4.8	13.2	47.6	0.3	1.6	2.3	0.3	4.3
LS13.HL	2015	20.6	WL	24.1	70.0	70.0	29.6	23.3	18.1	0.4	3.4	2.2	0.0	0.0
LS14.WL	2015	73.8	WL	22.9	73.0	71.2	21.6	33.4	16.4	0.1	4.8	1.3	0.3	1.8
LS15.CT	2015	52.7	WL	36.8	53.7	37.7	9.6	1.6	21.4	0.5	4.4	1.2	9.2	16.0
LS16.WL	2015	43.7	WL	39.2	40.3	40.3	15.7	0.0	17.4	0.2	11.0	1.7	8.9	0.0
LS17.WL	2015	16.6	WL	44.1	45.2	43.1	15.7	15.1	29.2	0.7	10.2	1.4	2.6	2.1
LS18.CT	2015	10.5	WL	51.1	45.6	45.6	30.3	9.3	39.8	0.2	9.7	1.5	0.0	0.0
max				52.0	82.7	82.7	30.3	38.9	47.6	1.0	11.0	3.4	11.0	16.0
min				11.3	40.3	37.7	4.8	0.0	1.4	0.0	0.6	0.3	0.0	0.0
average				34.7	58.0	56.0	15.7	14.2	24.4	0.4	5.1	1.7	3.0	2.0
HL average				33.4	59.3	56.7	13.4	16.7	24.3	0.4	4.2	2.4	2.2	2.6
CT average				34.2	60.1	60.0	13.4	12.2	25.2	0.5	3.8	1.2	3.3	0.1
WL average				36.4	54.6	51.3	20.4	13.8	23.7	0.4	7.2	1.6	3.5	3.3

Supplementary Table 3. Mean ($\pm$ SE) number of *Brassicoglyphus aeneus* per WOSR plant (collected using plant taping method) during bud stage of plants (BBCH 50–59), the parasitism rates (%) of *B. aeneus* larvae per field, and the total proportions (%) of semi-natural habitats (SNH) around the focal field within 1km radius, in 2014 and 2015.

Year	Adjacent habitat	Mean number of <i>B. aeneus</i> per plant ($\pm$ SE)	Parasitism (%) ($\pm$ SE)	Total SNH (%)
2014	Another crop	0.18 $\pm$ 0.08	53.98 $\pm$ 11.65	43.00
2014	Another crop	0.18 $\pm$ 0.05	91.67 $\pm$ 8.33	68.67
2014	Another crop	0.08 $\pm$ 0.03	93.75 $\pm$ 6.25	26.09
2014	Another crop	0.78 $\pm$ 0.12	83.89 $\pm$ 4.92	23.40
2014	Another crop	0.08 $\pm$ 0.03	85.00 $\pm$ 8.06	47.70
2014	Another crop	0.27 $\pm$ 0.07	51.60 $\pm$ 11.39	20.89
2014	Herbaceous linear SNH	0.03 $\pm$ 0.01	54.03 $\pm$ 15.66	22.91
2014	Herbaceous linear SNH	0.23 $\pm$ 0.07	55.00 $\pm$ 15.12	33.72
2014	Herbaceous linear SNH	0.35 $\pm$ 0.09	85.32 $\pm$ 6.09	28.04
2014	Herbaceous linear SNH	0.24 $\pm$ 0.06	74.39 $\pm$ 6.05	34.18
2014	Herbaceous linear SNH	0.12 $\pm$ 0.03	74.75 $\pm$ 8.04	46.63
2014	Herbaceous linear SNH	0.18 $\pm$ 0.07	70.00 $\pm$ 10.18	37.04
2014	Woody linear SNH	0.32 $\pm$ 0.07	55.00 $\pm$ 15.12	24.02
2014	Woody linear SNH	0.80 $\pm$ 0.15	57.70 $\pm$ 11.06	30.68
2014	Woody linear SNH	0.11 $\pm$ 0.03	46.06 $\pm$ 13.62	35.51
2014	Woody linear SNH	0.07 $\pm$ 0.03	60.04 $\pm$ 9.00	39.31
2014	Woody linear SNH	0.12 $\pm$ 0.05	59.84 $\pm$ 10.94	40.04
2014	Woody linear SNH	0.49 $\pm$ 0.12	75.45 $\pm$ 13.39	75.91
2015	Another crop	0.19 $\pm$ 0.06	41.67 $\pm$ 14.43	11.30
2015	Another crop	0.54 $\pm$ 0.08	85.81 $\pm$ 7.10	24.46
2015	Another crop	1.86 $\pm$ 0.37	44.83 $\pm$ 9.19	43.00
2015	Another crop	0.19 $\pm$ 0.04	94.29 $\pm$ 5.71	43.14
2015	Another crop	0.17 $\pm$ 0.04	92.86 $\pm$ 7.14	39.46
2015	Another crop	0.39 $\pm$ 0.08	90.19 $\pm$ 4.96	43.64
2015	Herbaceous linear SNH	0.53 $\pm$ 0.08	100 $\pm$ 0	22.21
2015	Herbaceous linear SNH	0.59 $\pm$ 0.14	0 $\pm$ 0	14.46
2015	Herbaceous linear SNH	0.49 $\pm$ 0.07	0 $\pm$ 0	29.20
2015	Herbaceous linear SNH	0.24 $\pm$ 0.05	93.75 $\pm$ 6.25	34.92
2015	Herbaceous linear SNH	0.82 $\pm$ 0.15	45.09 $\pm$ 10.49	47.65
2015	Herbaceous linear SNH	0.87 $\pm$ 0.11	80.96 $\pm$ 8.36	52.04

2015	Woody linear SNH	0.32 ± 0.06	75.00 ± 25.00	24.07
2015	Woody linear SNH	0.34 ± 0.07	76.00 ± 19.39	22.88
2015	Woody linear SNH	0.4 ± 0.07	92.86 ± 7.14	36.81
2015	Woody linear SNH	0.32 ± 0.06	25.00 ± 25.00	39.23
2015	Woody linear SNH	0.58 ± 0.08	100 ± 0	44.13
2015	Woody linear SNH	0.11 ± 0.03	100 ± 0	51.12

Supplementary Table 4. Correlations between the total abundance of *Brassicogethes aeneus* in 2014 and landscape characteristics within the 1 km radius of the focal field. The first value in the table represents the correlation coefficient (r) and the second value represents the p-value.

	<i>B. aeneus</i>	Seminatural habitat	Arable land	Arable land without grassland	Oilseed rape	Wheat	Grassland	Woody area	Woody linear	Herbaceous area	Herbaceous linear	Fallow area
<i>B. aeneus</i>		-0.08 0.7558	0.08 0.7610	-0.06 0.8110	-0.15 0.5639	-0.36 0.1424	0.23 0.3632	-0.07 0.7874	0.31 0.2138	0.04 0.8711	0.68 0.0020	-0.37 0.1337
Seminatural habitat	-0.08 0.7558		-0.89 0.0000	-0.60 0.0090	-0.17 0.4936	-0.06 0.7992	-0.44 0.0659	0.93 0.0000	0.09 0.7173	0.39 0.1068	-0.37 0.1312	0.20 0.4311
Arable land	0.08 0.7610	-0.89 0.0000		0.82 0.0000	0.35 0.1493	0.17 0.4988	0.25 0.3196	-0.75 0.0004	-0.22 0.3816	-0.60 0.0080	0.13 0.6057	-0.05 0.8577
Arable land without grassland	-0.06 0.8110	-0.60 0.0090	0.82 0.0000		0.55 0.0179	0.43 0.0720	-0.35 0.1528	-0.43 0.0781	-0.50 0.0341	-0.60 0.0078	-0.23 0.3542	0.07 0.7796
Oilseed rape	-0.15 0.5639	-0.17 0.4936	0.35 0.1493	0.55 0.0179		-0.02 0.9497	-0.35 0.1510	-0.14 0.5751	-0.20 0.4258	-0.33 0.1880	-0.35 0.1576	0.50 0.0362
Wheat	-0.36 0.1424	-0.06 0.7992	0.17 0.4988	0.43 0.0720	-0.02 0.9497		-0.45 0.0582	0.07 0.7880	-0.23 0.3657	-0.37 0.1264	-0.33 0.1825	0.09 0.7366
Grassland	0.23 0.3632	-0.44 0.0659	0.25 0.3196	-0.35 0.1528	-0.35 0.1510	-0.45 0.0582		-0.50 0.0338	0.49 0.0400	0.04 0.8847	0.61 0.0077	-0.20 0.4375
Woody area	-0.07 0.7874	0.93 0.0000	-0.75 0.0004	-0.43 0.0781	-0.14 0.5751	0.07 0.7880	-0.50 0.0338		-0.08 0.7457	0.07 0.7678	-0.45 0.0578	0.11 0.6749
Woody linear	0.31 0.2138	0.09 0.7173	-0.22 0.3816	-0.50 0.0341	-0.20 0.4258	-0.23 0.3657	0.49 0.0400	-0.08 0.7457		0.35 0.1596	0.34 0.1698	0.08 0.7484
Herbaceous area	0.04 0.8711	0.39 0.1068	-0.60 0.0080	-0.60 0.0078	-0.33 0.1880	-0.37 0.1264	0.04 0.8847	0.07 0.7678	0.35 0.1596		0.24 0.3385	-0.14 0.5742
Herbaceous linear	0.68 0.0020	-0.37 0.1312	0.13 0.6057	-0.23 0.3542	-0.35 0.1576	-0.33 0.1825	0.61 0.0077	-0.45 0.0578	0.34 0.1698	0.24 0.3385		-0.47 0.0514
Fallow area	-0.37 0.1337	0.20 0.4311	-0.05 0.8577	0.07 0.7796	0.50 0.0362	0.09 0.7366	-0.20 0.4375	0.11 0.6749	0.08 0.7484	-0.14 0.5742	-0.47 0.0514	

Supplementary Table 5. Correlations between the total abundance of *Brassicogethes aeneus* in 2015 and landscape characteristics within the 1 km radius of the focal field. The first value in the table represents the correlation coefficient (r) and the second value represents the p-value.

	<i>B. aeneus</i>	Seminatural habitat	Arable land	Arable land without grassland	Oilseed rape	Wheat	Grassland	Woody area	Woody linear	Herbaceous area	Herbaceous linear	Fallow area
<i>B. aeneus</i>		0.3825 0.22	0.5024 -0.17	0.5418 -0.15	0.7337 -0.09	0.6673 -0.11	0.9569 -0.01	0.3260 0.25	0.4875 0.17	0.2901 -0.26	0.3639 -0.23	0.4665 0.18
Seminatural habitat	0.3825 0.22		0.0000 -0.92	0.0000 -0.86	0.3942 -0.21	0.1497 -0.35	0.9602 -0.01	0.0000 0.89	0.5951 -0.13	0.3511 0.23	0.3727 -0.22	0.2103 0.31
Arable land	0.5024 -0.17	0.0000 -0.92		0.0000 0.95	0.2517 0.29	0.0387 0.49	0.9118 -0.03	0.0014 -0.69	0.9767 -0.01	0.0335 -0.50	0.4639 0.18	0.0854 -0.42
Arable land without grassland	0.5418 -0.15	0.0000 -0.86	0.0000 0.95		0.1280 0.37	0.0782 0.43	0.1541 -0.35	0.0051 -0.63	0.9162 -0.03	0.0760 -0.43	0.4711 0.18	0.0499 -0.47
Oilseed rape	0.7337 -0.09	0.3942 -0.21	0.2517 0.29	0.1280 0.37		0.4292 0.20	0.1878 -0.33	0.4579 -0.19	0.2529 -0.28	0.6045 0.13	0.9951 0.00	0.4533 -0.19
Wheat	0.6673 -0.11	0.1497 -0.35	0.0387 0.49	0.0782 0.43	0.4292 0.20		0.6791 0.10	0.4581 -0.19	0.4496 -0.19	0.2020 -0.32	0.4966 0.17	0.2256 -0.30
Grassland	0.9569 -0.01	0.9602 -0.01	0.9118 -0.03	0.1541 -0.35	0.1878 -0.33	0.6791 0.10		0.8119 -0.06	0.8100 0.06	0.6051 -0.13	0.9159 -0.03	0.3358 0.24
Woody area	0.3260 0.25	0.0000 0.89	0.0014 -0.69	0.0051 -0.63	0.4579 -0.19	0.4581 -0.19	0.8119 -0.06		0.2247 -0.30	0.6378 -0.12	0.6955 -0.10	0.7637 -0.08
Woody linear	0.4875 0.17	0.5951 -0.13	0.9767 -0.01	0.9162 -0.03	0.2529 -0.28	0.4496 -0.19	0.8100 0.06	0.2247 -0.30		0.3013 0.26	0.3093 -0.25	0.3378 0.24
Herbaceous area	0.2901 -0.26	0.3511 0.23	0.0335 -0.50	0.0760 -0.43	0.6045 0.13	0.2020 -0.32	0.6051 -0.13	0.6378 -0.12	0.3013 0.26		0.5353 -0.16	0.2552 0.28
Herbaceous linear	0.3639 -0.23	0.3727 -0.22	0.4639 0.18	0.4711 0.18	0.9951 0.00	0.4966 0.17	0.9159 -0.03	0.6955 -0.10	0.3093 -0.25	0.5353 -0.16		0.0840 -0.42
Fallow area	0.4665 0.18	0.2103 0.31	0.0854 -0.42	0.0499 -0.47	0.4533 -0.19	0.2256 -0.30	0.3358 0.24	0.7637 -0.08	0.3378 0.24	0.2552 0.28	0.0840 -0.42	