Supporting Information

Overview:

Appendix S1. Summary of data

Table S1.1. Summary of data from all plant specific tests.

Plant		1. Flower size (mm)					2. Adult survival						3. Selection in 4-choice test				4. Pollinator composition on flowers						5. Accessibility class	
				Effective			Longevity (days)		-Cox coeff.**								Bees	Hoverflies		Sum	Prop.	pat-		
family /subfam.	species	opening	depth	depth*		N	female	male	est.	s.e.	N	events	no	yes	N	%yes		non-z.	zooph.		zooph.	ches	nectar	pollen
Apiaceae	*Pastinaca sativa*		0	0			17.1	12.9	4.76	0.56	19	17	4	6	10	60%							A	1
	Daucus carota		0	0			15.4	12.3	4.23	0.57	17	17	10	4	14	29%	0	1	12	13	92%	*6*	A	1
	Heracleum spondylium		0	0			14.6	9.0	4.08	0.66	11	8	8	2	10	20%	3	19	26	48	54%	*11*	A	1
	Ammi majus		0	0			12.5	10.8	4.57	0.55	23	19	10	10	20	50%	2	5	30	37	81%	*11*	A	1
	Coriandrum sativum		0	0			9.0	7.7	3.66	0.44	52	50	9	11	20	55%							A	1
	Foeniculum vulgare		0	0			8.4	8.2	3.43	0.49	28	28	12	13	25	52%	0	16	43	59	73%	*11*	A	1
Polygonaceae	*Fagopyrum esculentum*	1.02	0.53	0.53		5	13.5	12.4	4.49	0.43	69	68	20	19	39	49%	1	8	30	39	77%	*7*	A	1
Caryophyllaceae	*Gypsophila elegans*	0.99	1.46	1.46	1)	5	14.0	8.9	3.89	0.61	13	13	12	13	25	52%	2	2	43	47	91%	*8*	A	1
Boraginaceae	*Borago officinalis*	1.19	1.41	1.41	2)	3	14.8	12.5	4.56	0.45	56	54											A	1
	Phacelia tanacetifolia	2.88	4.44	2.13	3)	8	4.0	3.6	1.55	0.52	25	25	19	6	25	24%	42	0	17	59	29%	*8*	C	1
Ranunculaceae	*Ranunculus acris*	open	3.00	1.70	4)	3	7.1	6.3	1.91	0.61	16	15											A	1
Asteraceae																								
/ Carduoideae	*Centaurea cyanus*	1.07	2.60	0	0)	14	9.7	8.9	3.76	0.46	51	48	20	8	28	29%	32	2	43	77	56%	*10*	A	1
	Centaurea jacea	1.03	3.95	3.95		16											20	5	5	30	17%	*7*	C	1
	Circium arvense	0.75	0.96	0.96	5)	26	6.5	5.2	2.60	0.58	15	13											A	1
/ Astereroideae	*Achillea millefolium*	0.96	0.87	0.87		17	10.6	10.3	4.09	0.59	19	15	14	10	24	42%	0	14	41	55	75%	*12*	A	1
	Matricaria recutita	0.63	0.87	0.87		27	8.1	7.1	2.79	0.48	47	42	9	3	12	25%	0	4	56	60	93%	*12*	A	1
	Jacobaea vulgaris	1.08	2.90	2.90		20	7.8	6.2	2.64	0.55	24	19	9	2	11	18%							C	1
	Helianthus annuus (low)	1.40	3.29	0	0)	22											21	2	1	24	4%	*9*	B	1
	Glebionis segetum	1.22	1.83	1.83		27	7.7	4.6	2.95	0.46	37	36	15	9	24	38%	1	19	13	33	39%	*8*	B	1
	Coreopsis tinctoria	0.83	1.92	1.92		23	6.7	4.6	2.19	0.58	21	20	16	3	19	16%	2	21	4	27	15%	*9*	B	1
	Anthemis tinctoria	0.94	1.56	1.56		23	4.6	4.2	1.85	0.51	29	27	7	3	10	30%	3	10	25	38	66%	*8*	B	1
	Tanacetum vulgare	0.71	1.04	1.04		26	4.6	3.6	1.37	0.60	14	14	21	6	27	22%							B	1
	Tripleurosp. maritimum	0.85	1.10	1.10		25	3.4	4.5	2.09	0.59	14	12											B	1
	Leucanthemum vulgare	0.87	1.65	1.68		46	4.3	3.3	1.34	0.50	25	25											B	1
	Cosmos bipinnatus	1.30	4.53	4.48		8	2.7	2.7	1.04	0.63	10	10					19	4	2	25	8%	*6*	C	1
	Calendula officinalis	1.23	2.99	2.90		7	2.3	2.9	0.57	0.54	22	22											C	1
/ Cichorioideae	*Crepis capillaris*	?	?	?			5.0	4.5	1.16	0.66	12	10											C	1
	Cichorium intybus	?	?	?			2.9	2.7	0.35	0.63	10	10	11	2	13	15%							C	1
Fabaceae	*Vicia sativa sativa*		5.75	0	0)	3	13.3	9.5	4.03	0.48	36	35											A	0
	Lotus corniculatus		3.06	3.06	6)	5	3.4	2.6	0.64	0.61	14	14					19	1	9	29	31%	*10*	C	0
	Medicago sativa		3.95	3.95		4	3.1	2.7	1.27	0.53	22	21	11	0	11	0%							C	0
	Vicia cracca		3.77	3.77		3	3.4	2.3	1.35	0.56	16	16											C	0
	other species												81	20	101	20%								
control condition	sucrose						11.3	11.3	4.30	0.45	48	42												
	water						2.0	2.0	1.00	--	27	25												
sum	all species										842	790	318	150	468	32.1%	167	133	400	700	57.1%	*153*		

*) Effective flower depth differs from basic flower depth based on the following notes:
0) EFN (extrafloral nectaries) present: effective depth is assumed to be 0 when considering survival study,
1) height of superior gynoecium,
2) height of throat scales that surround stamens and nectaries,
3) fringes of hairs cover nectaries: effective depth is distance from hairs to nectaries,
4) a lower ring of stamen is blocking the access to the nectaries; effective depth is distance from stamen to nectaries,
5) including 0.3 mm required to bend over the long slips of the corolla,
6) zoophagous hoverflies are not able to trip legume flowers; effective depth is measured from the nearest potential entrance point when flower still 'closed'.
**) Coefficient (absolute estimate and standard error) of Cox Porportional Hazard analysis of survival time relative to water, including sex, year and season as factors (see Tables S4.1 and S4.2).

Table S1.2. Additional flower measures of plants present in field margin strips (test 5) but not in other tests.

Plant		1. Flower size (mm)					5. Accessibility class	
				Effective				
family	species	opening	depth	depth*		N	nectar	pollen
Caryophyllaceae	*Agrostemma githago*		6.10	6.10		2	C	1
Fabaceae	*Trifolium repens*		2.50	2.50		3	C	0
	Trifolium pratense		6.00	6.00		3	C	0
Linaceae	*Linum usitatissimum*	1.25	2.56	2.56		4	C	1
Malvaceae	*Malva sylvestris*	3.50	3.00	1.66	3)	9	C	0
Papaveraceae	*Papaver rhoeas*	open		no nectar			C	1
Plantaginaceae	*Plantago lanceolata*	open		no nectar			C	1
Polemoniaceae	*Gilia capitata*	3.68	4.75	3.28	7)	4	C	1
Polygonaceae	*Persicaria maculosa*	2.25	0.75	0.75		4	A	1

*) Effective flower depth differs from basic flower depth based on the following notes:
3) fringes of hairs cover nectaries: effective depth is distance from hairs to nectaries,
7) opening allows hoverfly head to enter flower: Appendix S3, equation 1 (with r =1.3 mm;sin α=0.64, d =2.55 mm).

Appendix S2. Flower dissections showing effective flower depth. Each scan frame is originally 10 mm in width.

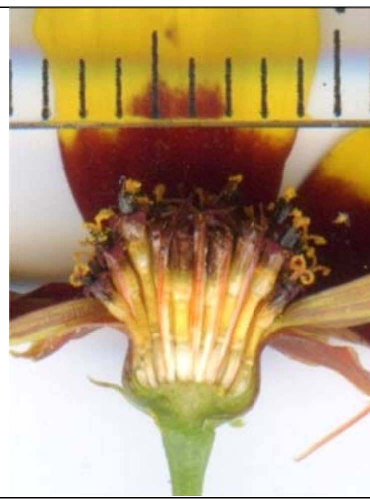
A. **Asteraceae**: Asteroideae (Ast), Carduoideae (Car), Cichorioideae (Cic).

Ast: *Achillea millefolium*

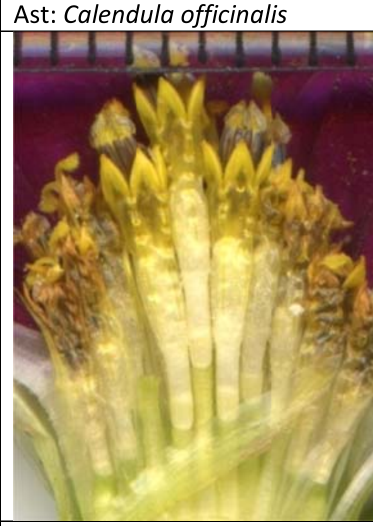
Ast: *Anthemis tinctoria*

Ast: *Calendula officinalis*

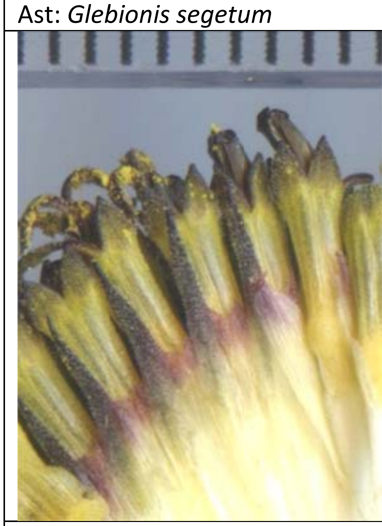
Ast: *Glebionis segetum*



Ast: *Coreopsis tinctoria*



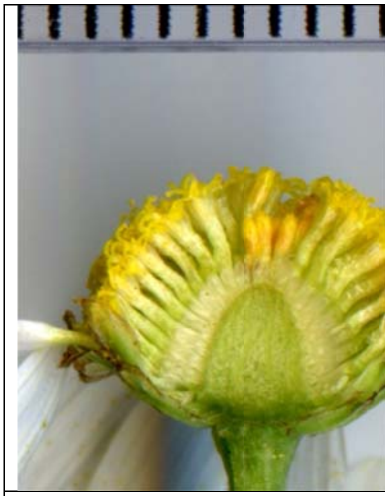
Ast: *Cosmos bipinnatus*



Ast: *Helianthus annuus*

Ast: *Jacobaea vulgaris*

Ast: *Leucanthemum vulgare*



Ast: *Matricaria recutita*

Ast: *Tanacetum vulgare*

Ast: *Tripleurospermum maritimum*

Car: *Centaurea cyanus*

Car: *Centaurea jacea*

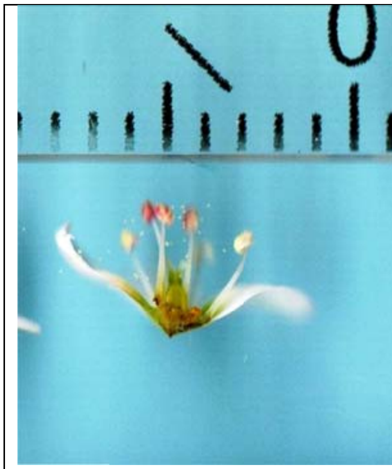
Car: *Circium arvense*

Cic: *Cichorium intybus*

Cic: *Crepis capillaris*

Cic: *Sonchus arvensis*

B. **Other plant families**: Polygonaceae (Pol), Caryophyllaceae (Car), Ranunculaceae (Ran), Polemoniaceae (Pol), Fabaceae (Fab).


Pol: *Fagopyrum esculentum*


Car: *Gypsophila elegans*


Ran: *Ranunculus acris*


Bor: *Borago officinalis*


Bor: *Phacelia tanacetifolia*


Pol: *Gilia capitata*


Fab: *Medicago sativa*


Fab: *Lotus corniculatus*


Fab: *Trifolium pratense*

Appendix S3. Defining effective flower depth, when opening of corolla > insect head

When the opening of the corolla exceeds the width of the head of the hoverfly, the hoverfly will be able to enter the corolla to some extent, making the corolla depth no useful measure for nectar accessibility. In this case, the deepest position of the head and its distance to the nectar source (*a*) is estimated according the geometry depicted in figure S3. When representing the cross section of the insect head as a circle with radius *r*, and the part of the flower to be entered by a triangle, the distance between the centre of the circle and the lower corner A of the triangle equals

$$\mathrm{r + a = \frac{r}{\sin\alpha}}.$$

Sin α is the sinus of half the angle of the corolla projection, and can be measured as

$$\sin\alpha = \frac{w}{2s}\ ,$$

i.e. half the width of corolla opening (*w*) divided by the side of the corolla projection (*s*), which allows us to calculate *a*. When the actual nectar source is some distance above or below the projected corner A, this distance (d) should be subtracted or added to *a* to yield the minimum distance between head and nectar source (a' in figure S3A), or

$$a' = \frac{r}{sin\,\alpha} - r + d\ . \qquad \text{(equation 1)}$$

For our study *r* is taken to be 1.3 mm, defined as half the width of the head of female *Episyrphus balteatus*, which is 2.55 (±0.22) mm (n=9).

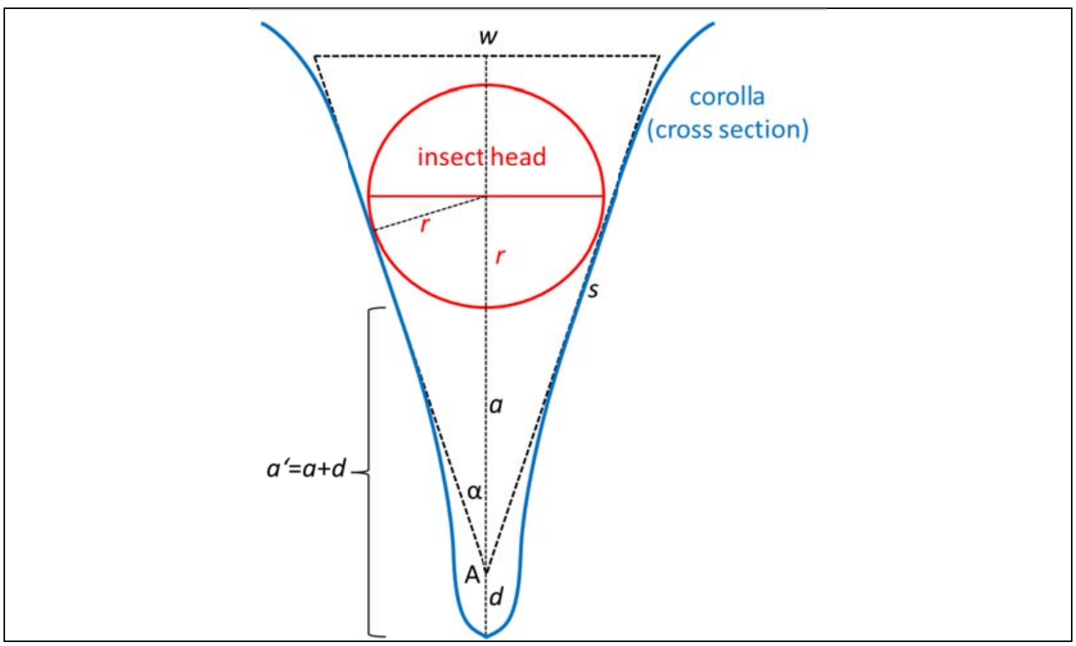


Figure S3. Geometry of effective flower depth in case the corolla opening is larger than the head of the hoverfly. Solid blue line: cross-section of corolla. Fat dotted line: linear projection of corolla sides to crossing point (*s*= long side of triangle, *w*= short side of triangle representing flower opening). Circle: representation of hoverfly head (*r*= radius). Thin dotted line: triangle connecting centre of circle, line perpendicular to corolla side and projected crossing point A (α= angle at crossing point).

Appendix S4. Results from statistical tests

Table S4.1. Hoverfly survival time. Cox proportional hazard model (R function ‘coxph‘). Analysis of deviance; terms sequentially added. *N* = 841, number of events= 790, R^2= 0.665.

factor	loglik	Chi-square	DF	*P*	
NULL	-4558.4				
plant species	-4334.3	448.0	31	< 2.20E-16	***
sex	-4328.4	11.9	1	0.000558	***
season	-4316.3	24.1	2	5.72E-06	***
year	-4299.0	34.7	5	1.72E-06	***
frailty (cage)	-4097.9	402.1	0	< 2.20E-16	***

*** indicates p < 0.001

Table S4.2. Hoverfly survival time (days): effect of plant species relative to control (water only). Cox proportional hazard model (R function ‘coxph’) according model of Table S4.1.

Plant species	Estimate	Std. Error	Chi-square	DF	*P*	
Achillea millefolium	-4.09	0.588	48.4	1	3.5E-12	***
Ammi majus	-4.57	0.551	68.9	1	1.1E-16	***
Anthemis tinctoria	-1.85	0.513	12.9	1	3.2E-04	***
Borago officinalis	-4.56	0.451	102.5	1	<1E-16	***
Calendula officinalis	-0.57	0.542	1.1	1	2.9E-01	
Centaurea cyanus	-3.76	0.462	66.4	1	3.3E-16	***
Cichorium intybus	-0.35	0.626	0.3	1	5.7E-01	
Circium arvense	-2.60	0.577	20.3	1	6.6E-06	***
Coreopsis tinctoria	-2.19	0.577	14.4	1	1.5E-04	***
Coriandrum sativum	-3.66	0.439	69.4	1	1.1E-16	***
Cosmos bipinnatus	-1.04	0.634	2.7	1	1.0E-01	
Crepis capillaris	-1.16	0.655	3.2	1	7.6E-02	
Daucus carota	-4.23	0.569	55.1	1	1.2E-13	***
Fagopyrum esculentum	-4.49	0.428	110.1	1	0.0E+00	***
Foeniculum vulgare	-3.43	0.488	49.6	1	1.9E-12	***
Glebionis segetum	-2.95	0.460	41.1	1	1.4E-10	***
Gypsophila elegans	-3.89	0.606	41.3	1	1.3E-10	***
Heracleum spondylium	-4.08	0.657	38.6	1	5.2E-10	***
Jacobaea vulgaris	-2.64	0.553	22.8	1	1.8E-06	***
Leucanthemum vulgare	-1.34	0.503	7.1	1	7.8E-03	***
Lotus corniculatus	-0.64	0.608	1.1	1	3.0E-01	
Matricaria recutita	-2.79	0.484	33.2	1	8.5E-09	***
Medicago sativa	-1.27	0.527	5.8	1	1.6E-02	*
Pastinaca sativa	-4.76	0.561	72.1	1	<1E-16	***
Phacelia tanacetifolia	-1.55	0.519	8.9	1	2.9E-03	***
Ranunculus acris	-1.91	0.608	9.8	1	1.7E-03	***
Tanacetum vulgare	-1.37	0.598	5.3	1	2.2E-02	*
Tripleurospermum maritimum	-2.09	0.588	12.6	1	3.8E-04	***
Vicia cracca	-1.35	0.556	5.9	1	1.5E-02	*
Vicia sativa	-4.03	0.476	71.6	1	<1E-16	***
sucrose	-4.30	0.448	91.9	1	<1E-16	***

* indicates p < 0.05, *** indicates p < 0.001

Table S4.3. Hoverfly survival (species-specific Cox PH coefficient, absolute value) as linear or logistic function of effective flower depth (mm) and plant family (Asteraceae or other) (n=27). The most parsimonious model (lowest AICc indicated in bold) is logis B, which includes a separate shift parameter for Asteraceae.

		model							
	parameter	linear A	linear B	linear C	logis A	logis B	logis C	Logis D	Logis E
general	intercept/max	3.93	4.19	4.28	3.65	4.15	4.14	4.18	4.14
	slope (mm^{-1})	-0.826	-0.785	-0.864	-157.3	-19.3	-20.9	-24.0	-22.3
	shift (mm)				1.577	1.616	1.645	1.626	1.624
	min.				1.48	1.49	1.20	1.50	1.49
Asteraceae	intercept/max		3.48	3.24				3.74	
	slope (mm^{-1})			-0.636					-18.2
	shift (mm)					0.928	0.919	0.951	0.929
	min.						1.66		
fit	*k*	2	3	4	4	5	6	6	6
	R^2	0.628	0.705	0.716	0.615	0.840	0.852	0.844	0.841
	R^2_{adj}	0.581	0.627	0.610	0.524	0.685	0.662	0.657	0.654
	AICc	-6.30	-9.11	-7.36	-0.20	**-21.03**	-19.78	-18.48	-17.86

Table S4.4. Proportion hoverflies selecting flowers of plant species (lab study) as predicted by flower depth (n=18) or hoverfly survival (-Cox coefficient, n=19) related to plant species. Generalized linear model (R function 'glm') for binomial data with logis link function.

Factor	Estimate	Std. Error	z value	*P*	
(Intercept)	-0.178	0.154	-1.16	2.5E-01	
Effective Flower Depth	-0.435	0.126	-3.44	5.8E-04	***
(Intercept)	-2.057	0.361	-5.69	1.3E-08	***
Adult survival (-Cox Coeff.)	0.445	0.101	4.38	1.2E-05	***

*** indicates $P < 0.001$

Table S4.5. Proportion zoophagous hoverflies within pollination guild on flowers (field study) as predicted by flower depth (n=14) or plant specific hoverfly survival (Cox coefficient, n=15), as well as plant specific values. Generalized linear model (R function 'glm') for binomial data with logis link function.

Factor	Estimate	Std. Error	z-value	*P*	
(Intercept)	1.165	0.123	9.46	<2e-16	***
Effective Flower Depth	-0.652	0.075	-8.69	<2e-16	***
(Intercept)	-1.469	0.247	5.93	3.0E-09	***
Adult survival (Cox Coeff.)	0.623	0.076	8.17	3.1E-16	***
(Intercept)	0.255	0.074	3.45	5.7E-04	***
Achillea millefolium	0.819	0.318	2.57	1.0E-02	*
Ammi majus	1.200	0.426	2.82	4.9E-03	**
Anthemis tinctoria	0.398	0.350	1.14	2.5E-01	
Centaurea cyanus	-0.021	0.241	-0.09	9.3E-01	
Centaurea jacea	-1.865	0.495	-3.76	1.7E-04	***
Coreopsis tinctoria	-2.005	0.547	-3.67	2.5E-04	***
Cosmos bipinnatus	-2.698	0.741	-3.64	2.7E-04	***
Daucus carota	2.229	1.043	2.14	3.3E-02	*
Fagopyrum esculentum	0.949	0.387	2.45	1.4E-02	*
Foeniculum vulgare	0.733	0.302	2.43	1.5E-02	*
Glebionis segetum	-0.686	0.364	-1.89	5.9E-02	.
Gypsophila elegans	2.119	0.528	4.01	6.0E-05	***
Helianthus annuus	-3.391	1.024	-3.31	9.3E-04	***
Heracleum spondylium	-0.088	0.299	-0.30	7.7E-01	
Lotus corniculatus	-1.054	0.408	-2.58	9.8E-03	**
Matricaria recutita	2.384	0.523	4.56	5.1E-06	***
Papaver rhoeas	-0.558	0.328	-1.70	8.9E-02	.
Phacelia tanacetifolia	-1.160	0.297	-3.91	9.3E-05	***

* indicates $P < 0.05$, *** indicates $P < 0.001$

Table S4.6. Number of zoophagous hoverflies in field margins as affected by time of day and by coverage of flowers of type A and B (n=33), according the most parsimonious model (lowest AICc indicated in bold). Generalized linear model, assuming Negative Binomial distribution and log link function (R function 'glm-nb', theta = 14.5±8.1).

	Models (df)				Coefficients Model 'c'				
Predictor	a	b	c	d	Estimate	Std.Error	z-value	*P*	
(Intercept)	1	1	1	1	1.42	0.20	7.00	2.5E-12	***
Year (factor)	2	-	-	-					
Hour (noon=0)	1	1	1	1	-0.112	0.036	-3.06	2.2E-03	**
Flowers group A	1	1	1	1	0.0187	0.0038	4.90	9.4E-07	***
Flowers group B	1	1	1	-	0.0180	0.0056	3.23	1.2E-03	**
Flowers group C	1	1	-	-					
parameters (*k*)	7	5	4	3					
AIC	185.9	184.3	182.6	189.9					
AICc	189.9	186.3	**183.9**	190.7					
pseudo R^2	0.629	0.593	0.595	0.446					

* indicates $P < 0.05$, ** indicates $P < 0.01$, *** indicates $P < 0.001$

Table S4.7. Number of non-zoophagous hoverflies and bees in field margins as affected by coverage of flowers and other factors (n=33), according the most parsimonious model (minimizing AICc). Generalized linear model, assuming Negative Binomial distribution and log link function (R function 'glm-nb').

Predictor	Estimate	Std. Error	z-value	*P*	
(Intercept)	0.375	0.481	0.78	0.436	
Year2010	-0.815	0.249	-3.27	0.001	**
Year2011	-0.997	0.309	-3.23	0.001	**
Hour (noon=0)	0.076	0.051	1.47	0.141	
Flowers group A	0.015	0.006	2.48	0.013	*
Flowers group B	0.023	0.008	2.85	0.004	**
Flowers group C	0.031	0.011	2.93	0.003	**

Appendix S5. Species composition of hoverflies (Syrphidae) in field margin strips

Table S5. Species composition* of hoverflies (Syrphidae) in net samples taken at field margin strips in Hoeksche Waard (NL), collected in July 2009 (n=21), 2010 (n=26) and 2011 (n=14): total numbers per year. Three genera that have only been recovered once (all Eristalinae) are not shown. The Syrphinae are zoophagous; the Eristalinae are saprophagous or phytophagous (Reemer *et al.* 2009).

Subfamily - Tribe		Year		
Genus - species	2009	2010	2011	**All**
Eristalinae				
Eristalini				
Eristalis				
abusive			1	**1**
arbustorum		4	2	**6**
horticola		1	1	**2**
Eumerini				
Eumerus				
strigatus/ sogdianus			2	**2**
Xylotini				
Syritta				
pipiens	2	4	2	**8**
Syrphinae				
Bacchini				
Platycheirus				
albimanus		2		**2**
manicatus			1	**1**
peltatus	1		3	**4**
scutatus	1			**1**
Sphaerophoria				
scripta	6	37	45	**88**
taeniata	1	6		**7**
Melanostomatini				
Melanostoma				
mellinum	35	20	35	**90**
scalare		1	1	**2**
Syrphini				
Episyrphus				
balteatus	34	49	15	**98**
Eupeodes				
corollae	13	4	9	**26**
latifasciatus			1	**1**
luniger	1	1		**2**
Scaeva				
pyrastri	2	3		**5**
Syrphus				
ribesii	2	2		**4**
vitripennis		5	1	**6**
Total	**98**	**139**	**119**	**356**

*) Species identification by Gerard Pennards (MITOX Consultants, Amsterdam)