

Determination of the parameters for a day-degree method to predict the flight of host populations of *Hyalesthes obsoletus*



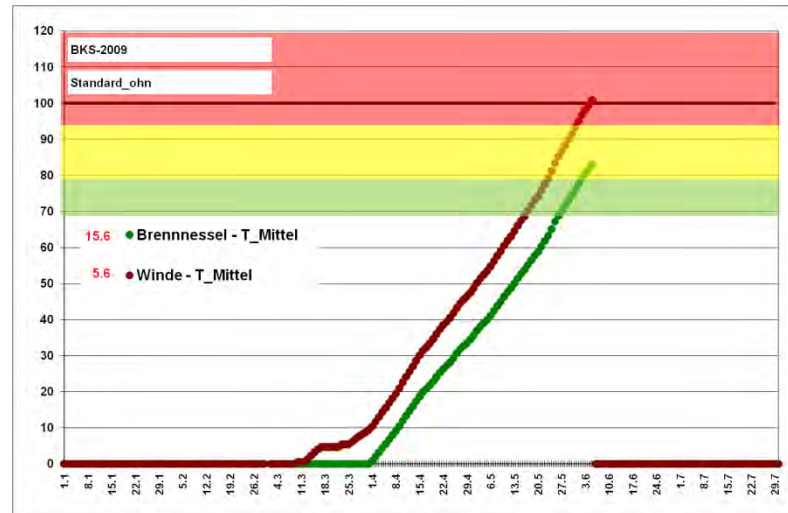
Michael Maixner

JKI – Julius Kühn-Institute

Federal Research Centre for Cultivated Plants

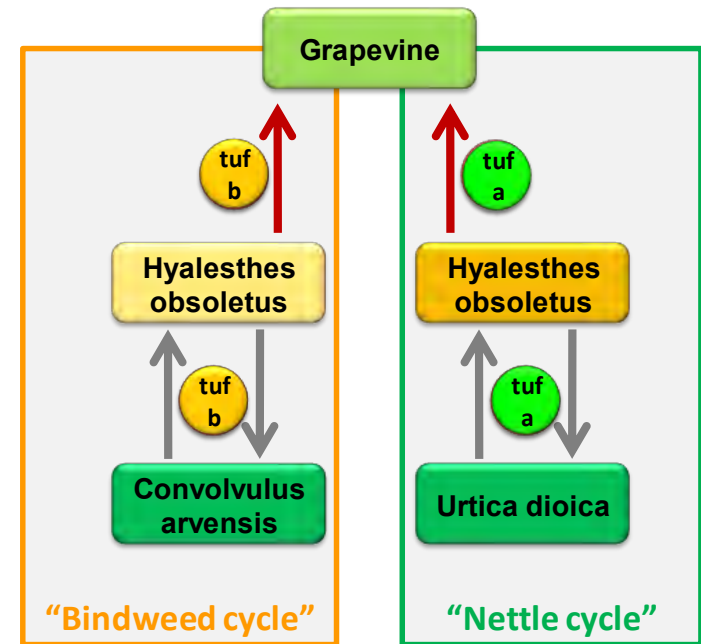
Institute for Plant Protection in Fruit Crops and Viticulture

Bernkastel-Kues, Germany



Life history of *Hyalesthes obsoletus*

- Soil inhabiting Cixiid – only adult planthoppers occur above ground
- Specific host-populations are associated with bindweed and nettle



Temperature is a major abiotic determinant for the life history of arthropods

➤ Calculation of accumulated heat units allows prediction of life history parameters

- **Required parameters:**

- Starting date (Biofix)
- Temperature threshold (Basis)
- Temperature sums required for the occurrence of a particular event

- **Parameters are often unknown**

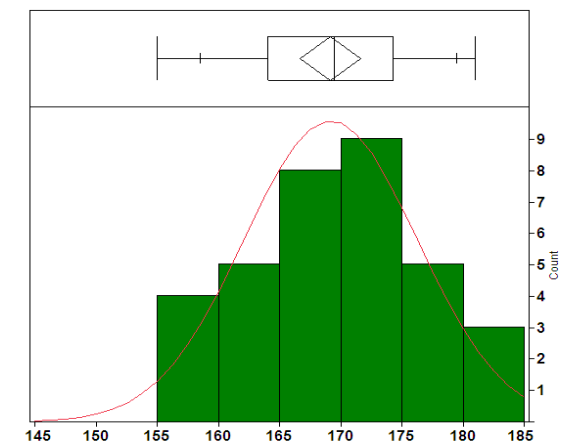
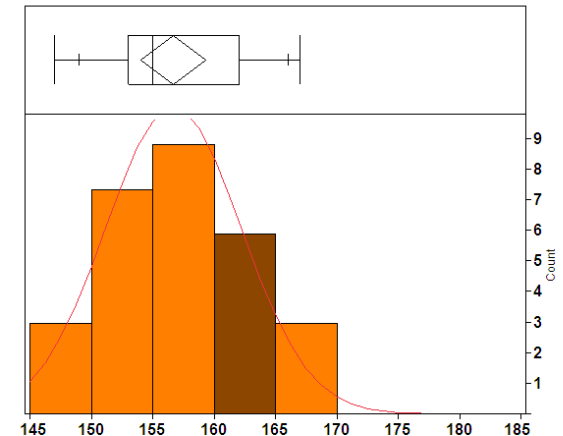
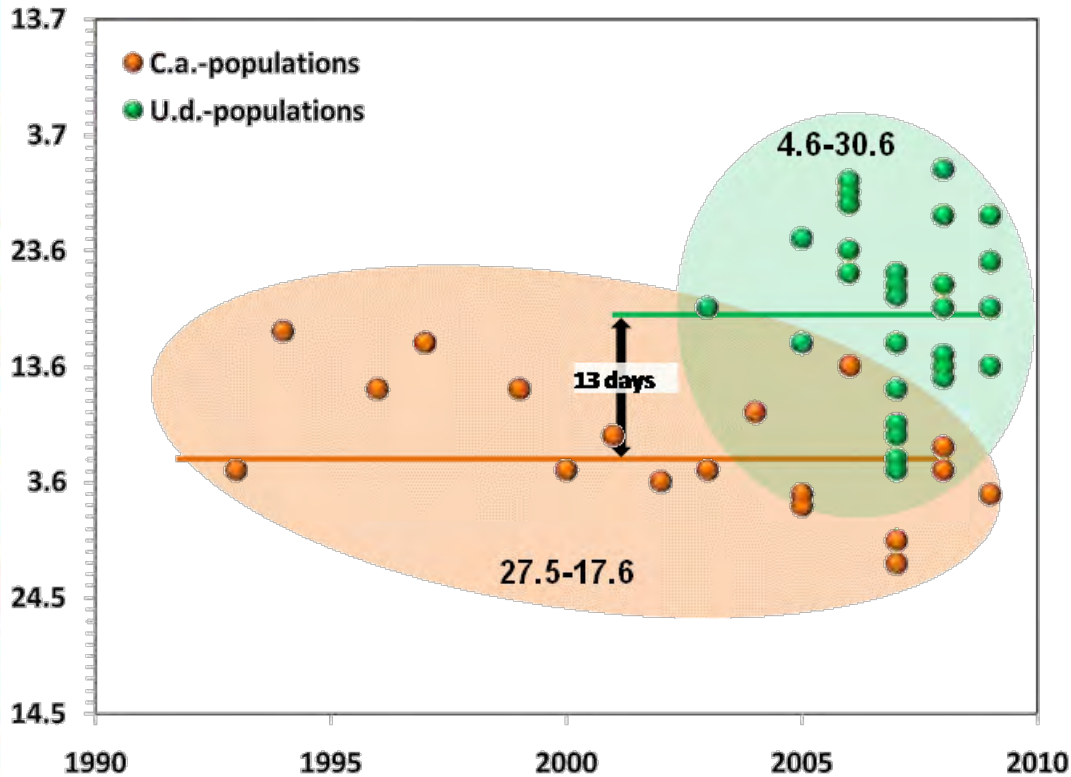
- Use of “standard” values
- “Trial and Error”
- Use of empirical field data to estimate appropriate combinations of parameters
(inverse modelling)



Flight activity data of *H. obsoletus*

including data of M. Breuer, U. Ipach and M. Stark-Urnau

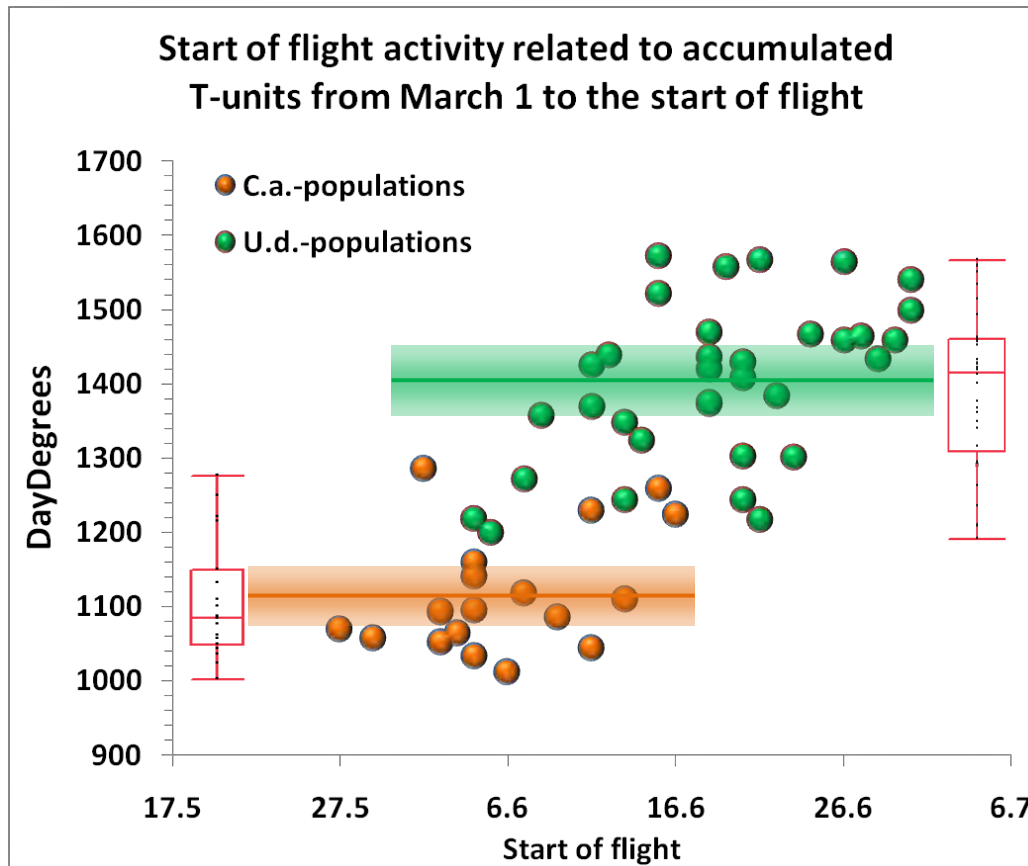
Start of flight activity of host populations of *Hyalesthes obsoletus*



Flugdaten von *H. obsolete*

Mit Daten von M. Breuer, U. Ipach and M. Stark-Urnau

Temperature dependence of the flight of adult *H. obsolete*



Calculation and optimization of the necessary parameters for a degree-day method

Field data on flight activity



Starting date:
 $d_{min} \dots d_{max}; \Delta d=1$
Threshold-Temp.:
 $T_{min} \dots T_{max}; \Delta T \text{ variabel}$

Weather-data

Year	Day	Temp	Humid	Wind	Cloud	...
19	17	18	57	74	10	...
19	18	18	58	74	10	...
19	19	18	59	74	10	...
19	20	18	60	74	10	...
19	21	18	61	74	10	...
19	22	18	62	74	10	...
19	23	18	63	74	10	...
19	24	18	64	74	10	...
19	25	18	65	74	10	...
19	26	18	66	74	10	...
19	27	18	67	74	10	...
19	28	18	68	74	10	...
19	29	18	69	74	10	...
19	30	18	70	74	10	...
19	31	18	71	74	10	...
19	1	18	72	74	10	...
19	2	18	73	74	10	...
19	3	18	74	74	10	...
19	4	18	75	74	10	...
19	5	18	76	74	10	...
19	6	18	77	74	10	...
19	7	18	78	74	10	...
19	8	18	79	74	10	...
19	9	18	80	74	10	...
19	10	18	81	74	10	...
19	11	18	82	74	10	...
19	12	18	83	74	10	...
19	13	18	84	74	10	...
19	14	18	85	74	10	...
19	15	18	86	74	10	...
19	16	18	87	74	10	...
19	17	18	88	74	10	...
19	18	18	89	74	10	...
19	19	18	90	74	10	...
19	20	18	91	74	10	...
19	21	18	92	74	10	...
19	22	18	93	74	10	...
19	23	18	94	74	10	...
19	24	18	95	74	10	...
19	25	18	96	74	10	...
19	26	18	97	74	10	...
19	27	18	98	74	10	...
19	28	18	99	74	10	...
19	29	18	100	74	10	...
19	30	18	101	74	10	...
19	31	18	102	74	10	...
19	1	18	103	74	10	...
19	2	18	104	74	10	...
19	3	18	105	74	10	...
19	4	18	106	74	10	...
19	5	18	107	74	10	...
19	6	18	108	74	10	...
19	7	18	109	74	10	...
19	8	18	110	74	10	...
19	9	18	111	74	10	...
19	10	18	112	74	10	...
19	11	18	113	74	10	...
19	12	18	114	74	10	...
19	13	18	115	74	10	...
19	14	18	116	74	10	...
19	15	18	117	74	10	...
19	16	18	118	74	10	...
19	17	18	119	74	10	...
19	18	18	120	74	10	...
19	19	18	121	74	10	...
19	20	18	122	74	10	...
19	21	18	123	74	10	...
19	22	18	124	74	10	...
19	23	18	125	74	10	...
19	24	18	126	74	10	...
19	25	18	127	74	10	...
19	26	18	128	74	10	...
19	27	18	129	74	10	...
19	28	18	130	74	10	...
19	29	18	131	74	10	...
19	30	18	132	74	10	...
19	31	18	133	74	10	...
19	1	18	134	74	10	...
19	2	18	135	74	10	...
19	3	18	136	74	10	...
19	4	18	137	74	10	...
19	5	18	138	74	10	...
19	6	18	139	74	10	...
19	7	18	140	74	10	...
19	8	18	141	74	10	...
19	9	18	142	74	10	...
19	10	18	143	74	10	...
19	11	18	144	74	10	...
19	12	18	145	74	10	...
19	13	18	146	74	10	...
19	14	18	147	74	10	...
19	15	18	148	74	10	...
19	16	18	149	74	10	...
19	17	18	150	74	10	...
19	18	18	151	74	10	...
19	19	18	152	74	10	...
19	20	18	153	74	10	...
19	21	18	154	74	10	...
19	22	18	155	74	10	...
19	23	18	156	74	10	...
19	24	18	157	74	10	...
19	25	18	158	74	10	...
19	26	18	159	74	10	...
19	27	18	160	74	10	...
19	28	18	161	74	10	...
19	29	18	162	74	10	...
19	30	18	163	74	10	...
19	31	18	164	74	10	...
19	1	18	165	74	10	...
19	2	18	166	74	10	...
19	3	18	167	74	10	...
19	4	18	168	74	10	...
19	5	18	169	74	10	...
19	6	18	170	74	10	...
19	7	18	171	74	10	...
19	8	18	172	74	10	...
19	9	18	173	74	10	...
19	10	18	174	74	10	...
19	11	18	175	74	10	...
19	12	18	176	74	10	...
19	13	18	177	74	10	...
19	14	18	178	74	10	...
19	15	18	179	74	10	...
19	16	18	180	74	10	...
19	17	18	181	74	10	...
19	18	18	182	74	10	...
19	19	18	183	74	10	...
19	20	18	184	74	10	...
19	21	18	185	74	10	...
19	22	18	186	74	10	...
19	23	18	187	74	10	...
19	24	18	188	74	10	...
19	25	18	189	74	10	...
19	26	18	190	74	10	...
19	27	18	191	74	10	...
19	28	18	192	74	10	...
19	29	18	193	74	10	...
19	30	18	194	74	10	...
19	31	18	195	74	10	...
19	1	18	196	74	10	...
19	2	18	197	74	10	...
19	3	18	198	74	10	...
19	4	18	199	74	10	...
19	5	18	200	74	10	...
19	6	18	201	74	10	...
19	7	18	202	74	10	...
19	8	18	203	74	10	...
19	9	18	204	74	10	...
19	10	18	205	74	10	...
19	11	18	206	74	10	...
19	12	18	207	74	10	...
19	13	18	208	74	10	...
19	14	18	209	74	10	...
19	15	18	210	74	10	...
19	16	18	211	74	10	...
19	17	18	212	74	10	...
19	18	18	213	74	10	...
19	19	18	214	74	10	...
19	20	18	215	74	10	...
19	21	18	216	74	10	...
19	22	18	217	74	10	...
19	23	18	218	74	10	...
19	24	18	219	74	10	...
19	25	18	220	74	10	...
19	26	18	221	74	10	...
19	27	18	222	74	10	...
19	28	18	223	74	10	...
19	29	18	224	74	10	...
19	30	18	225	74	10	...
19	31	18	226	74	10	...
19	1	18	227	74	10	...
19	2	18	228	74	10	...
19	3	18	229	74	10	...
19	4	18	230	74	10	...
19	5	18	231	74	10	...
19	6	18	232	74	10	...
19	7	18	233	74	10	...
19	8	18	234	74	10	...
19	9	18	235	74	10	...
19	10	18	236	74	10	...
19	11	18	237	74	10	...
19	12	18	238	74	10	...
19	13	18	239	74	10	...
19	14	18	240	74	10	...
19	15	18	241	74	10	...
19	16	18	242	74	10	...
19	17	18	243	74	10	...
19	18	18	244	74	10	...
19	19	18	245	74	10	...
19	20	18	246	74	10	...
19	21	18	247	74	10	...
19	22	18	248	74	10	...
19	23	18	249	74	10	...
19	24	18	250	74	10	...
19	25	18	251	74	10	...
19	26	18	252	74	10	...
19	27	18	253	74	10	...
19	28	18	254	74	10	...
19	29	18	255	74	10	...
19	30	18	256	74	10	...
19	31	18	257	74	10	...
19	1	18	258	74	10	...
19	2	18	259	74	10	...
19	3	18	260	74	10	...
19	4	18	261	74	10	...
19	5	18	262	74	10	...
19	6	18	263	74	10	...
19	7	18	264	74	10	...
19	8	18	265	74	10	...
19	9	18	266	74	10	...
19	10	18	267	74	10	...
19	11	18	268	74	10	...
19	12	18	269	74	10	...
19	13	18	270	74	10	...
19	14	18	271	74	10	...
19	15	18	272	74	10	...
19	16	18	273	74	10	...
19	17	18	274	74	10	...
19	18	18	275	74	10	...
19	19	18	276	74	10	...
19	20	18	277	74	10	...
19	21	18	278	74	10	...
19	22	18	279	74	10	...
19	23	18	280	74	10	...
19	24	18	281	74	10	...
19	25	18	282	74	10	...
19	26	18	283	74	10	

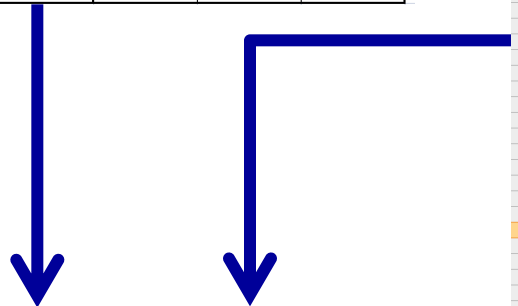
Calculation and optimization of the parameters for a degree-day method

Definition of parameter variation

	A	B	C	D	E	F	G
	Parameter	Start-Datum	End-Datum	Start-Param	End-Param	Inkrement	
1	WD_1	Tmean	1. Jan.	30. Apr.	0	12	0,10
2	WD_2	Tmin	1. Feb.	15. Mai.	0	8	0,50
3	WD_3	Tmax	1. Jan.	30. Apr.	5	15	0,25
4	WD_4	T_05	1. Mrz.	31. Mai.	0	10	0,10
5	WD_5						
6	WD_5						

Field observation and weather data

	A	B	C	D	E	F	G
	Satz	Bez	Verw	Beginn	Mitte	Ende	Leber
1				1	1	1	
2							
3	1	Bac-2005	1	21.6	24.6	28.6	
4	2	Bac-2006	1	21.6	24.6	28.6	
5	3	Bac-2007	1	5.6	8.6	12.6	
6	4	Bac-2008	1	20.6	23.6	27.6	
7	5	BKS-2003	1	18.6	21.6	25.6	
8	6	BKS-2005	1	24.6	27.6	1.7	
9	7	BKS-2006	1	28.6	1.7	5.7	
10	8	BKS-2007	1	4.6	7.6	11.6	
11	9	BKS-2008	1	13.6	16.6	20.6	
12	10	BKS-2009	1	18.6	21.6	25.6	
13	11	a-2008	1	30.6	3.7	7.7	
14	12	b-2006	1	29.6	2.7	6.7	
15	13	c-2008	1	26.6	29.6	3.7	
16	14	d-2008	1	13.6	16.6	20.6	
17	15	e-2008	1	26.6	29.6	3.7	
18	16	f-2008	1	30.6	3.7	7.7	
19	17	g-2008	1	18.6	21.6	25.6	
20	18	h-2008	1	22.6	25.6	29.6	
21	19	i-2009	1	15.6	18.6	22.6	
22	20	e-2009	1	12.6	15.6	19.6	
23	21	f-2009	1	14.6	17.6	21.6	
24	22	g-2009	1	15.6	18.6	22.6	
25	23	i-2006	0	27.6	30.6	4.7	
26	24	j-2007	0	19.6	22.6	26.6	
27	25	k-2007	0	8.6	11.6	15.6	
28	26	k-2008	0	20.6	23.6	27.6	
29	27	l-2007	0	15.6	18.6	22.6	
30	28	l-2008	0	22.6	25.6	29.6	
31	29	m-2008	0	20.6	23.6	27.6	
32	30	n-2007	0	11.6	14.6	18.6	
33	31	o-2007	0	11.6	14.6	18.6	
34	32	p-2006	0	23.6	26.6	30.6	
35	33	p-2007	0	21.6	24.6	28.6	
36	34	q-2006	0	20.6	23.6	27.6	
37	35	q-2007	0	7.6	10.6	14.6	
38	36						



Verwende Parametersatz
 Beginn
 Mitte
 Ende

Datenquellen
 Parameterfile: P_Ho_Urtica_gesamt.xls
 Datenbank: DB_Wetterdaten_Ho_Urtica.xls

Parameter	Start-Datum	End-Datum	Param-Start	Param-End	Inkrement
Tmean	1. Jan	30. Apr	0,0	12,0	0,1
Tmin	1. Feb	15. Mai	0,0	8,0	0,5
Tmax	1. Jan	30. Apr	5,0	15,0	0,3
T_05	1. Mrz	31. Mai	0,0	10,0	0,1
	1. Jan	30. Apr	0,0	10,0	0,1

List of results

Ohne Abschneiden der Schwellen / ParamSatz: Beginn - Faktor:Tmean / DatVon:01.Jan DatBis:30.Apr / FaktVon:0.0 FaktBis:12.0 Inkrement:0.1

Datum	Tag	VarPar	MW	K95%	STD	SE	RVK	N	dMIN	dMAX	dSPA	dMW	dSTD	dSE	lMIN	lMAX	lSPA	lSPA%	lMW	lMW%
01.01	1	0,00	1655,08	77,10	157,35	39,3374	2,4547	16	-12	18	30	5,81	4,72	1,1805	-357,5	268,5	625,9	37,8	118,74	7,17
01.01	1	0,10	1655,07	77,12	157,36	39,3388	2,4549	16	-12	18	30	5,81	4,72	1,1805	-357,5	268,5	625,9	37,8	118,75	7,17
01.01	1	0,20	1655,04	77,11	157,38	39,3443	2,4552	16	-12	18	30	5,81	4,72	1,1805	-357,5	268,5	625,9	37,8	118,76	7,18
01.01	1	0,30	1654,96	77,12	157,39	39,3473	2,4555	16	-12	18	30	5,81	4,72	1,1805	-357,4	268,4	625,8	37,8	118,77	7,18
01.01	1	0,40	1654,80	77,21	157,57	39,3930	2,4586	16	-12	18	30	5,81	4,72	1,1805	-357,9	268,5	626,4	37,9	118,90	7,18
01.01	1	0,50	1654,56	77,25	157,65	39,4135	2,4602	16	-12	18	30	5,81	4,72	1,1805	-358,1	268,8	626,8	37,9	118,93	7,19
01.01	1	0,60	1654,30	77,34	157,83	39,4572	2,4634	16	-13	18	31	5,88	4,81	1,2037	-358,9	269,0	627,9	38,0	119,01	7,19
01.01	1	0,70	1653,80	77,32	157,79	39,4482	2,4635	16	-13	18	31	5,88	4,81	1,2037	-358,9	269,0	627,9	38,0	119,06	7,20
01.01	1	0,80	1653,40	77,28	157,71	39,4281	2,4629	16	-13	18	31	5,88	4,81	1,2037	-359,4	269,9	629,3	38,1	118,84	7,19
01.01	1	0,90	1652,74	77,45	158,07	39,5189	2,4694	16	-13	18	31	5,88	4,81	1,2037	-361,2	270,6	631,8	38,2	119,00	7,20
01.01	1	1,00	1652,28	77,40	157,96	39,4906	2,4684	16	-13	18	31	5,88	4,81	1,2037	-360,8	271,1	631,8	38,2	118,79	7,19
01.01	1	1,10	1651,59	77,54	158,25	39,5628	2,4740	16	-13	18	31	5,88	4,81	1,2037	-362,1	271,8	633,9	38,4	118,85	7,20
01.01	1	1,20	1650,89	77,51	158,19	39,5488	2,4741	16	-13	18	31	5,81	4,85	1,2118	-361,4	271,3	632,7	38,3	119,00	7,21
01.01	1	1,30	1650,59	77,46	158,08	39,5198	2,4728	16	-13	18	31	5,88	4,81	1,2037	-361,1	271,6	632,7	38,3	118,85	7,20
01.01	1	1,40	1649,76	77,69	158,56	39,6395	2,4815	16	-13	18	31	5,81	4,85	1,2118	-363,0	272,4	635,4	38,5	119,03	7,21
01.01	1	1,50	1648,78	77,84	158,85	39,7134	2,4876	16	-13	18	31	5,81	4,85	1,2118	-364,9	273,4	638,3	38,7	119,13	7,23
01.01	1	1,60	1647,73	78,19	159,57	39,8933	2,5005	16	-13	18	31	5,88	4,81	1,2037	-367,0	274,4	641,4	38,9	119,62	7,26
01.01	1	1,70	1646,62	78,19	159,57	39,8934	2,5022	16	-13	18	31	5,88	4,81	1,2037	-367,6	275,5	643,1	39,1	119,52	7,26
01.01	1	1,80	1645,34	78,19	159,56	39,8908	2,5040	16	-13	18	31	5,81	4,85	1,2118	-366,3	276,8	643,1	39,1	119,53	7,26
01.01	1	1,90	1643,30	78,25	159,70	39,9247	2,5092	16	-13	18	31	5,75	4,84	1,2093	-369,8	277,0	646,7	39,4	119,54	7,27
01.01	1	2,00	1641,63	78,00	159,19	39,7980	2,5143	16	-13	18	31	5,81	4,83	1,2094	-368,1	277,7	644,8	39,3	119,30	7,27
01.01	1	2,10	1639,23	78,03	159,25	39,8137	2,5086	16	-13	18	31	5,88	4,84	1,2106	-367,7	279,1	648,8	39,5	118,96	7,26
01.01	1	2,20	1638,31	77,98	159,14	39,7846	2,5080	16	-13	18	31	5,75	4,89	1,2230	-366,8	280,0	646,8	39,5	118,82	7,25
01.01	1	2,30	1636,64	78,17	159,52	39,8811	2,5167	16	-13	18	31	5,75	4,89	1,2230	-367,4	279,5	646,9	39,5	119,11	7,28
01.01	1	2,40	1634,76	78,00	159,19	39,7980	2,5143	16	-13	18	31	5,75	4,91	1,2264	-370,1	279,0	649,2	39,7	118,40	7,24
01.01	1	2,50	1632,50	77,37	157,90	39,4762	2,4974	16	-13	18	31	5,75	4,85	1,2128	-367,9	278,9	646,7	39,6	117,36	7,19
01.01	1	2,60	1630,93	77,51	158,18	39,5439	2,5041	16	-13	18	31	5,69	4,90	1,2238	-368,3	280,4	646,7	39,7	117,99	7,23
01.01	1	2,70	1629,47	77,01	157,17	39,2928	2,4905	16	-13	18	31	5,69	4,79	1,1962	-364,9	279,3	644,1	39,5	117,18	7,19
01.01	1	2,80	1627,43	76,91	157,08	39,2702	2,4922	16	-13	18	31	5,75	4,85	1,2128	-362,8	278,6	641,4	39,4	117,18	7,20
01.01	1	2,90	1625,50	76,84	156,82	39,2042	2,4909	16	-13	18	31	5,63	4,86	1,2141	-360,9	280,5	641,4	39,5	117,02	7,20
01.01	1	3,00	1622,95	76,80	156,74	39,1857	2,4937	16	-13	18	31	5,63	4,86	1,2141	-361,2	280,1	641,4	39,5	116,66	7,19
01.01	1	3,10	1621,26	76,72	156,57	39,1418	2,4935	16	-13	18	31	5,63	4,86	1,2141	-359,6	281,8	641,4	39,6	116,48	7,18

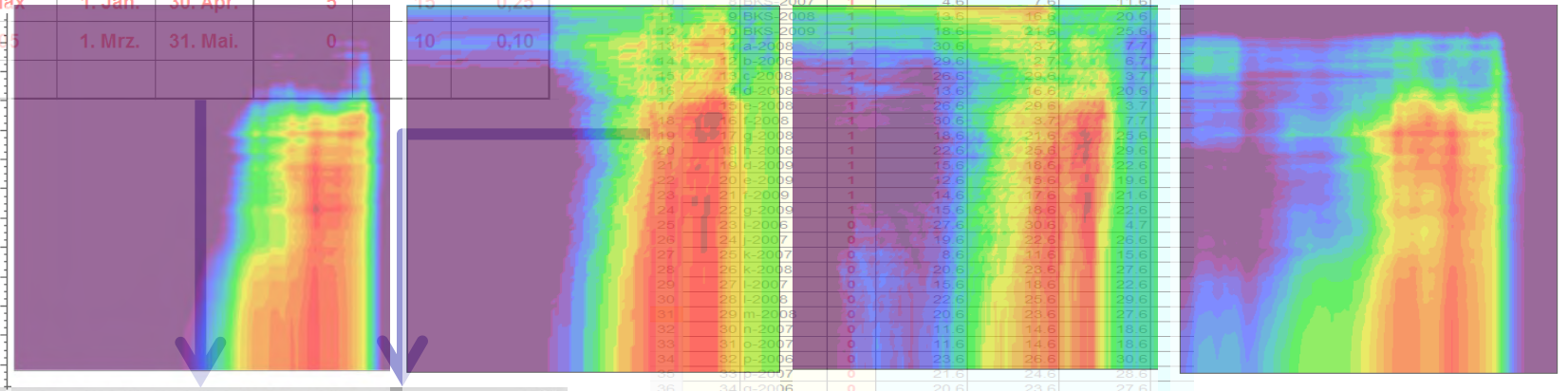
Calculation and optimization of the parameters for a degree-day method

Definition of parameter variation

	A	B	C	D	E	F	G
	Parameter	Start-Datum	End-Datum	Start-Param	End-Param	Inkrement	
1	WD_1	Tmean	1. Jan.	30. Apr.	0	12	0,10
2	WD_2	Tmin	1. Feb.	15. Mai.	0	8	0,50
3	WD_3	Tmax	1. Jan.	30. Apr.	5	15	0,25
4	WD_4	11,0	1. Mrz.	31. Mai.	0	10	0,10
5	WD_5	10,0					

Field observation data

	A	B	C	D	E	F	G
	Satz	Bez	Verw	Beginn	Mitte	Ende	Leber
1				1		1	
2							
3	1	Bac-2005	1	21.6	24.6	28.6	
4	2	Bac-2006	1	21.6	24.6	28.6	
5	3	Bac-2007	1	5.6	8.6	12.6	
6	4	Bac-2008	1	20.6	23.6	27.6	
7	5	BKS-2003	1	18.6	21.6	25.6	
8	6	BKS-2005	1	24.6	27.6	1.7	
9	7	BKS-2006	1	28.6	1.7	5.7	
10	8	BKS-2007	1	4.6	7.6	11.6	
11	9	BKS-2008	1	3.6	6.6	10.6	
12	10	BKS-2009	1	18.6	21.6	25.6	
13	11	a-2008	1	30.6	33.6	37.6	
14	12	b-2008	1	29.6	32.6	36.6	
15	13	c-2008	1	26.6	29.6	33.6	
16	14	d-2008	1	13.6	16.6	20.6	
17	15	e-2008	1	26.6	29.6	33.6	
18	16	f-2008	1	30.6	33.6	37.6	
19	17	g-2008	1	18.6	21.6	25.6	
20	18	h-2008	1	22.6	25.6	29.6	
21	19	i-2009	1	15.6	18.6	22.6	
22	20	j-2009	1	12.6	15.6	19.6	
23	21	k-2009	1	14.6	17.6	21.6	
24	22	l-2009	1	15.6	18.6	22.6	
25	23	m-2005	0	27.6	30.6	4.7	
26	24	n-2007	0	19.6	22.6	26.6	
27	25	o-2007	0	8.6	11.6	15.6	
28	26	p-2006	0	20.6	23.6	27.6	
29	27	q-2007	0	15.6	18.6	22.6	
30	28	r-2008	0	22.6	25.6	29.6	
31	29	s-2008	0	20.6	23.6	27.6	
32	30	t-2007	0	11.6	14.6	18.6	
33	31	u-2007	0	11.6	14.6	18.6	
34	32	v-2006	0	23.6	26.6	30.6	
35	33	w-2007	0	21.6	24.6	28.6	



RCV Tag

Parameterdatei: P_Ho_Urtica_gesamt.xls

Datenbank: DB_Wetterdaten_Ho_Urtica.xls

Parameter	Start-Datum	End-Datum	Param-Start	Param-End	Inkrement
Tmean	1. Jan	30. Apr	0,0	12,0	0,1
Tmin	1. Feb	15. Mai	0,0	8,0	0,5
Tmax	1. Jan	30. Apr	5,0	15,0	0,3
T_05	1. Mrz	31. Mai	0,0	10,0	0,1
	1. Jan	30. Apr	0,0	10,0	0,1

Range (d)

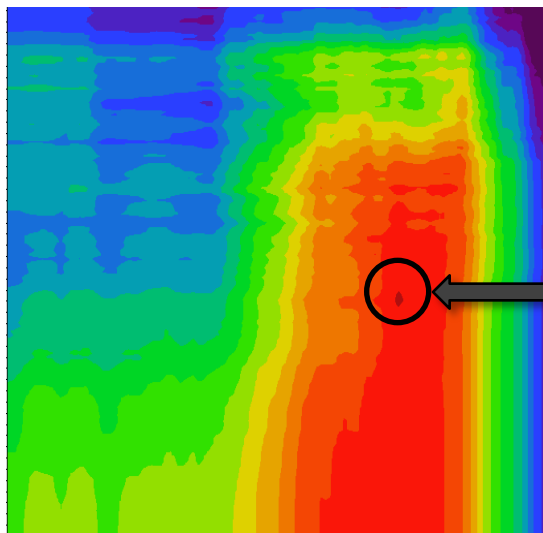
STD (d)

% mean dev. Tsum
List of results

Ohne Abschneiden der Schwellen / ParamSatz: Beginn - Faktor:Tmean / DatVon: 01.Jan DatBis: 30.Apr / FaktVon: 0.0 FaktBis: 12.0 Inkrement: 0.1																				
Datum	Tag	VarPar	MW	K95%	STD	SE	RVK	N	dMin	dMax	dSPA	dMW	dSTD	dSE	iMin	iMax	iSPA	iMW	iMW%	
01.01	1	0,00	1655,08	77,10	157,35	39,3374	2,4547	16	-12	18	30	5,81	4,72	1,1805	-357,5	268,5	625,9	37,8	118,74	7,17
01.01	1	0,10	1655,07	77,45	157,36	39,3388	2,4549	16	-12	18	30	5,81	4,72	1,1805	-357,5	268,5	625,9	37,8	118,75	7,17
01.01	1	0,20	1655,04	77,11	157,38	39,3443	2,4552	16	-12	18	30	5,81	4,72	1,1805	-357,5	268,5	625,9	37,8	118,76	7,18
01.01	1	0,30	1654,96	77,12	157,39	39,3473	2,4555	16	-12	18	30	5,81	4,72	1,1805	-357,4	268,4	625,8	37,8	118,77	7,18
01.01	1	0,40	1654,80	77,21	157,57	39,3930	2,4586	16	-12	18	30	5,81	4,72	1,1805	-357,9	268,5	626,4	37,9	118,90	7,18
01.01	1	0,50	1654,56	77,25	157,65	39,4185	2,4602	16	-12	18	30	5,81	4,72	1,1805	-358,1	268,8	626,8	37,9	118,93	7,19
01.01	1	0,60	1654,30	77,34	157,83	39,4572	2,4634	16	-13	18	31	5,88	4,81	1,2037	-358,9	269,0	627,9	38,0	119,01	7,19
01.01	1	0,70	1653,80	77,32	157,79	39,4482	2,4635	16	-13	18	31	5,88	4,81	1,2037	-359,1	269,5	628,6	38,0	119,06	7,20
01.01	1	0,80	1653,40	77,28	157,71	39,4281	2,4629	16	-13	18	31	5,88	4,81	1,2037	-359,4	269,9	629,3	38,1	118,84	7,19
01.01	1	0,90	1652,74	77,45	158,07	39,5189	2,4694	16	-13	18	31	5,88	4,81	1,2037	-361,2	270,6	631,8	38,2	119,00	7,20
01.01	1	1,00	1652,28	77,40	157,96	39,4906	2,4684	16	-13	18	31	5,88	4,81	1,2037	-360,8	271,1	631,8	38,2	118,79	7,19
01.01	1	1,10	1651,59	77,54	158,25	39,5628	2,4740	16	-13	18	31	5,88	4,81	1,2037	-362,1	271,8	633,9	38,4	118,85	7,20
01.01	1	1,20	1650,89	77,51	158,19	39,5488	2,4741	16	-13	18	31	5,81	4,85	1,2118	-361,4	271,3	632,7	38,3	119,00	7,21
01.01	1	1,30	1650,59	77,46	158,08	39,5198	2,4728	16	-13	18	31	5,88	4,81	1,2037	-361,1	271,6	632,7	38,3	118,85	7,20
01.01	1	1,40	1649,76	77,69	158,56	39,6395	2,4815	16	-13	18	31	5,81	4,85	1,2118	-363,0	272,4	635,4	38,5	119,03	7,21
01.01	1	1,50	1648,78	77,84	158,85	39,7134	2,4876	16	-13	18	31	5,81	4,85	1,2118	-364,9	273,4	638,3	38,7	119,13	7,23
01.01	1	1,60	1647,73	78,00	159,19	39,7980	2,5143	16	-13	18	31	5,75	4,81	1,2037	-367,0	274,4	641,4	38,9	119,62	7,26
01.01	1	1,70	1646,62	78,19	159,57	39,8934	2,5022	16	-13	18	31	5,88	4,81	1,2037	-367,6	275,5	643,1	39,1	119,52	7,26
01.01	1	1,80	1645,34	78,19	159,56	39,8908	2,5040	16	-13	18	31	5,81	4,85	1,2118	-366,3	276,8	643,1	39,1	119,53	7,26
01.01	1	1,90	1643,30	78,25	159,70	39,9247	2,5092	16	-13	18	31	5,75	4,84	1,2093	-369,6	277,0	646,7	39,4	119,54	7,27
01.01	1	2,00	1641,63	78,00	159,19	39,7980	2,5143	16	-13	18	31	5,81	4,85	1,2094	-368,1	276,7	644,9	39,3	119,30	7,27
01.01	1	2,10	1639,23	78,03	159,25	39,8137	2,5086	16	-13	18	31	5,88	4,84	1,2106	-367,7	279,1	648,8	39,5	118,85	7,26
01.01	1	2,20	1638,31	77,98	159,14	39,7846	2,5080	16	-13	18	31	5,75	4,89	1,2230	-366,8	280,0	646,8	39,5	118,82	7,25
01.01	1	2,30	1636,64	78,17	159,52	39,8811	2,5167	16	-13	18	31	5,75	4,89	1,2230	-367,4	279,5	646,9	39,5	119,11	7,28
01.01	1	2,40	1634,76	78,00	159,19	39,7980	2,5143	16	-13	18	31	5,75	4,91	1,2254	-370,1	279,0	649,2	39,7	118,40	7,24
01.01	1	2,50	1632,50	77,37	157,90	39,4762	2,4974	16	-13	18	31	5,75	4,85	1,2128	-367,9	278,9	646,7	39,6	117,36	7,19
01.01	1	2,60	1630,93	77,51	158,18	39,5439	2,5041	16	-13	18	31	5,69	4,90	1,2238	-366,4	280,4	646,7	39,7	117,99	7,23
01.01	1	2,70	1629,47	77,01	157,17	39,2928	2,4905	16	-13	18	31	5,69	4,79	1,1982	-364,9	279,3	644,1	39,5	117,18	7,19
01.01	1	2,80	1627,43	76,91	157,08	39,2705	2,4922	16	-13	18	31	5,75	4,85	1,2128	-362,6	278,6	641,4	39,4	117,18	7,20
01.01	1	2,90	1625,50	76,84	156,82	39,2042	2,4909	16	-13	18	31	5,63	4,88	1,2141	-360,9	280,3	641,4	39,5	117,02	7,20
01.01	1	3,00	1622,95	76,80	156,74	39,1857	2,4937	16	-13	18	31	5,63	4,86	1,2141	-361,2	280,1	641,4	39,5	116,66	7,19
01.01	1	3,10	1621,26	76,72	156,57	39,1418	2,4935	16	-13	18	31	5,63	4,86	1,2141	-359,6	281,8	641,4	39,6	116,48	7,18

Current parameters used to predict the flight of the host populations of *H. obsoletus*

Bindweed populations



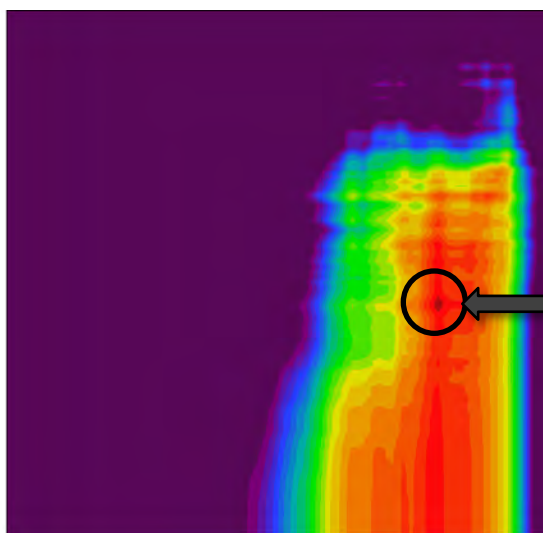
***C. arvensis* populations:**

Start of DD-summation: **March 9**

T-Threshold: **5.8 °C**

Start of flight: **1053 DD**

Nettle populations



***U. dioica* populations:**

Start of DD-summation: **April 1**

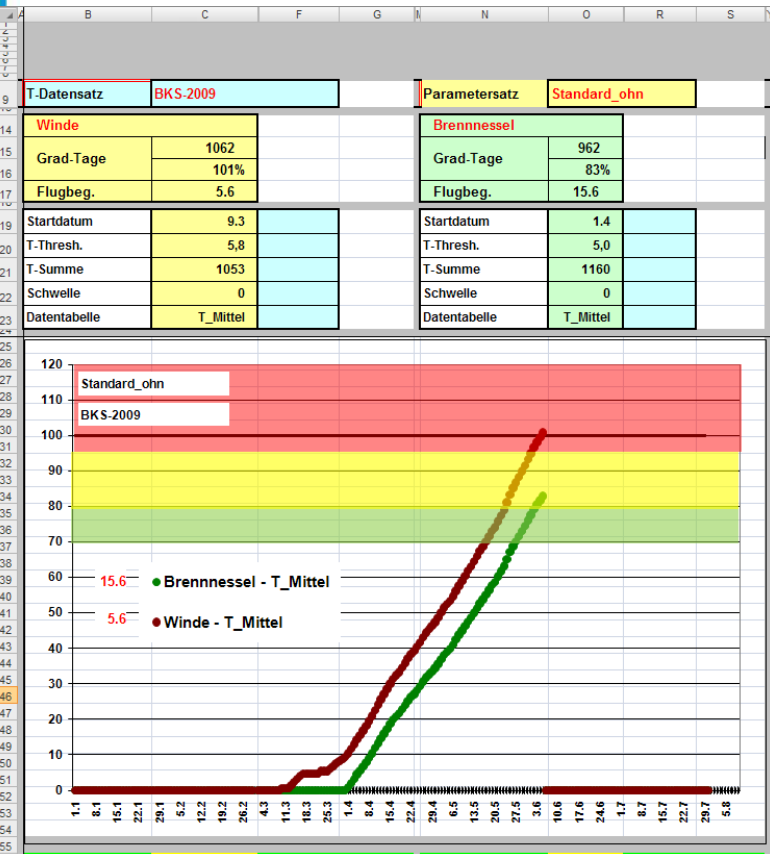
T-Threshold: **5 °C**

Start of flight: **1160 DD**



Current parameters used to predict the flight of the host populations of *H. obsoletus*

HyaProg.xls



Comparison of calculated and observed flight data

