

**IPPC Model Analysis Summary – Sept. 7, 2017 vers. 1.0**

**Japanese Knotweed Psyllid (*Aphalara itadori*) Phenology (degree-day) Model**

By Len Coop for use at Oregon State University's Integrated Plant Protection Center website

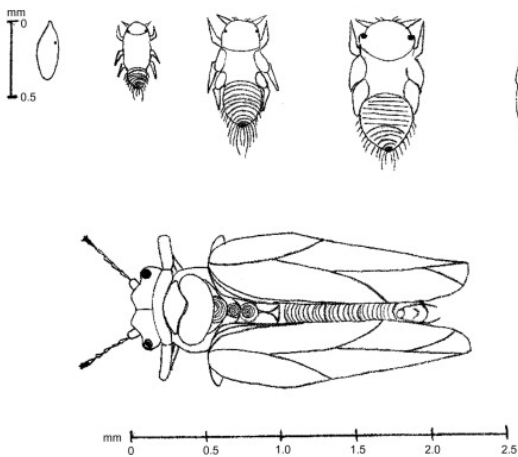
<http://uspest.org>

Developed for DoD SERDP weed biological control project (F. Grevstad, P.I.)

**Model abbrev: jkp**

note significant data used in final model in salmon background

note points added to force x-intercept method in yellow



<u>Parameter</u>	<u>Celsius</u>	<u>Fahrenheit</u>
Lower Threshold:	6.11	43
Upper Threshold:	35	95 (nominal based on limited survival at 30C)
Start Date:	Jan. 1 <sup>st</sup> (adults overwinter in repro. Diapause)	
Calculation type:	single sine (UC Davis default)	
Region of Known use:	Developed for use in the temperate regions of the U.S.	
Validation status:	1 <sup>st</sup> version based solely on analysis of sources below, mainly lab data from 1 study; more data needed for validation	

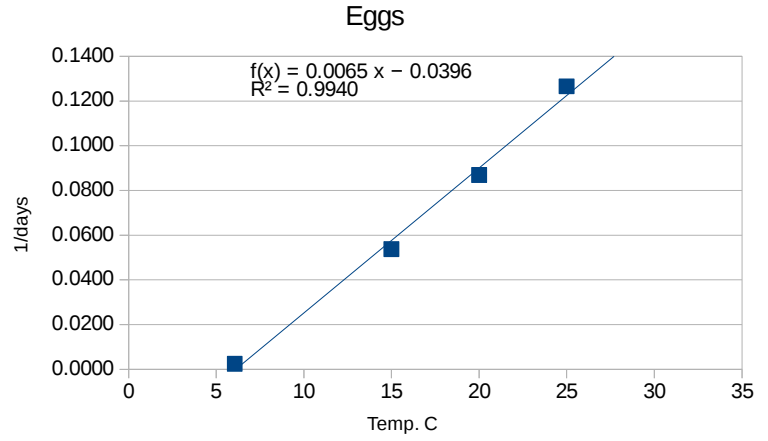
<u>Event</u>	<u>DDs6.11 (C)</u>	<u>DDs43 (F)</u>	<u>notes</u>
First appearance of springtime adults	234	420	
OW adult 2% oviposition	306	551	
OW adult 20% oviposition	444	799	
OW adult 90% oviposition	887	1596	
G1 adult 2% oviposition, peak G1 Nymphs	1204	2167	← using avg generation time (Egg to 20% OV)
G1 adult 20% oviposition	1342	2415	
G1 adult 90% oviposition; max. 3 gens.	1784	3212	← max generations using shortest gen. Time (Egg to 2% OV)
G2 adult 2% oviposition, peak G2 nymphs	2101	3783	
G2 adult 20% oviposition	2239	4031	
G2 adult 90% oviposition; max. 4 gens.	2682	4828	
G3 adult 2% oviposition, peak G3 nymphs	2999	5399	
G3 adult 20% oviposition; max. 5 gens.	3137	5647	
G3 adult 90% oviposition	3580	6444	
G4 adult 2% oviposition, peak G4 nymphs; max. 6 gens.	3897	7015	
G4 adult 20% oviposition	4035	7263	
G4 adult 90% oviposition	4478	8060	
Max 7 generations	4546	8182	

**Sources and analyses:**

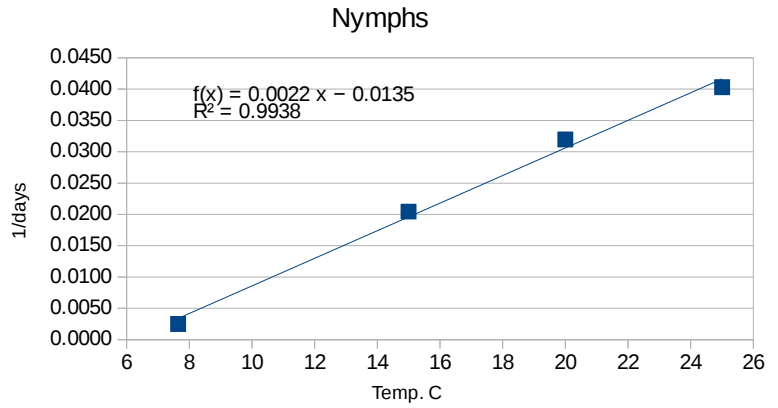
1. Myint, Y.Y., K. Nakahira, M. Takagi, N. Furuya, R.H. Shaw. 2012. Using life-history parameters and a degree-day model to predict climate suitability in England for the Japanese knotweed psyllid *Aphalara itadori* Shinji (Hemiptera: Psyllidae). *Biolog. Control* 63:129-134.

**Table 1. (females only)**

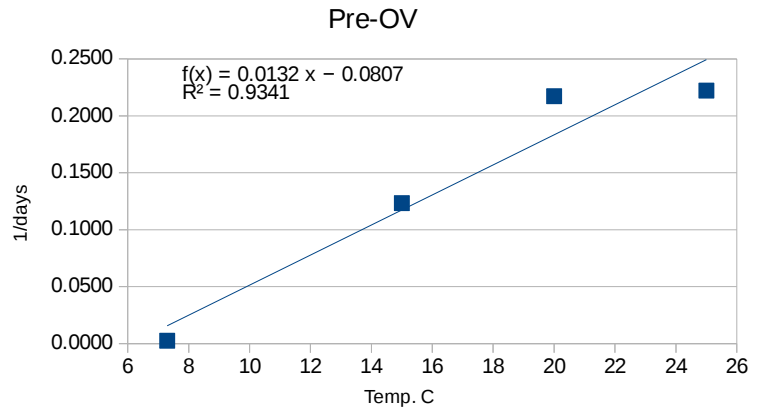
Eggs	Temp. C	1/days	Days
	6.055	0.0025	400
	15	0.0538	18.6
	20	0.0870	11.5
	25	0.1266	7.9
	30		8.1
	Slope=b	0.0065	
	intercept=	-0.0396	
Tlow	X-interc -a	6.1108	
DD-req	1/slope	154.23	
	RSQ	0.9940	



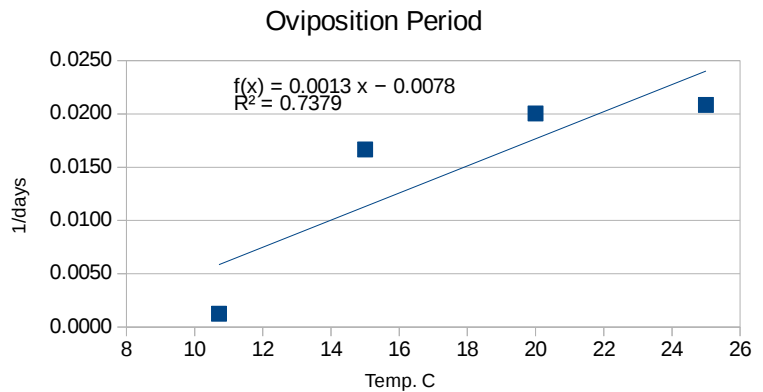
Nymphs	Temp. C	1/days	Days
	7.645	0.0025	400
	15	0.0204	48.9
	20	0.0319	31.3
	25	0.0403	24.8
	30		39.7
	Slope=b	0.0022	
	intercept=	-0.0135	
Tlow	X-interc -a	6.1123	
DD-req	1/slope	453.64	
	RSQ	0.9938	



Pre-OV	Temp. C	1/days	Days
	7.291	0.0025	400
	15	0.1235	8.1
	20	0.2174	4.6
	25	0.2222	4.5
	30		2.5
	Slope=b	0.0132	
	intercept=	-0.0807	
Tlow	X-interc -a	6.1111	
DD-req	1/slope	75.76	
	RSQ	0.9341	



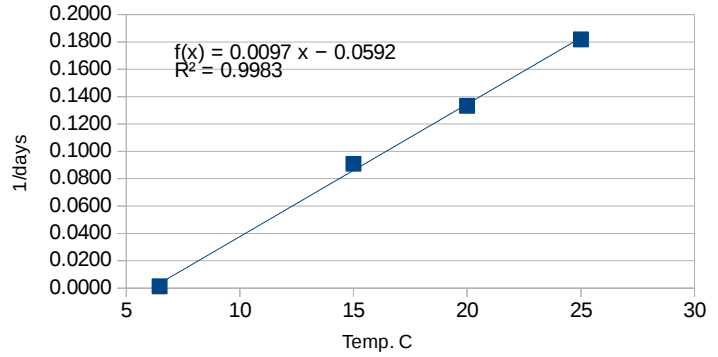
OV (100%)	Temp. C	1/days	Days
	10.714	0.0013	800
	15	0.0167	60
	20	0.0200	49.9
	25	0.0208	48
	30		12.1
	Slope=b	0.0013	
	intercept=	-0.0078	
Tlow	X-interc -a	6.1115	
DD-req	1/slope	787.01	
	RSQ	0.7379	



Oviposition schedule (From Fig. 1)

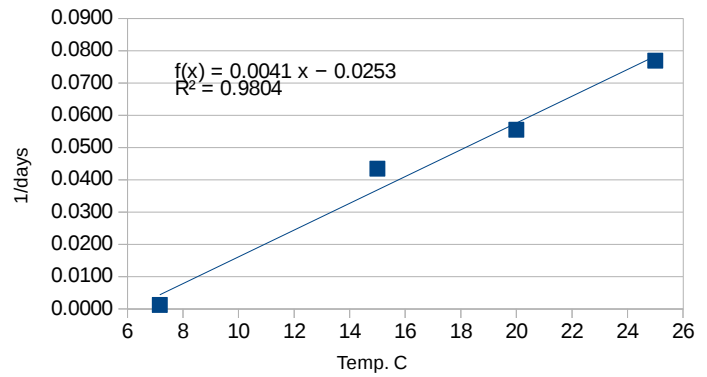
ca. 2% (1 <sup>st</sup> OV)	Temp. C	1/days	Days
	6.47	0.0013	800
	15	0.0909	11
	20	0.1333	7.5
	25	0.1818	5.5
	30		7
	Slope=b	0.0097	
	intercept=	-0.0592	
Tlow	X-interc -a	6.1117	
DD-req	1/slope	103.17	
	RSQ	0.9983	

ca. 1st Oviposition (check Pre-OV)



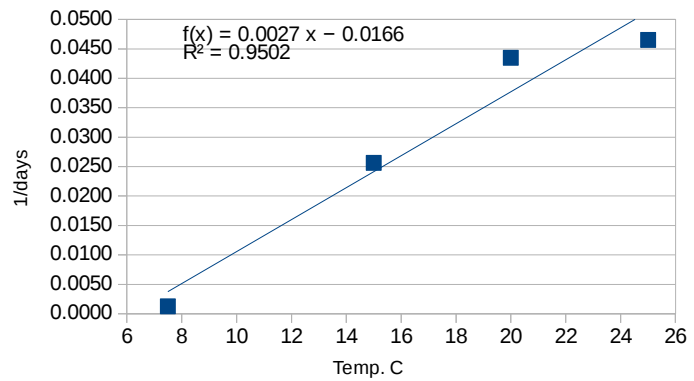
ca. 20%	Temp. C	1/days	Days
	7.1668	0.0013	800
	15	0.0435	23
	20	0.0556	18
	25	0.0769	13
	30		9
	Slope=b	0.0041	
	intercept=	-0.0253	
Tlow	X-interc -a	6.1109	
DD-req	1/slope	241.09	
	RSQ	0.9804	

ca. 20% Oviposition



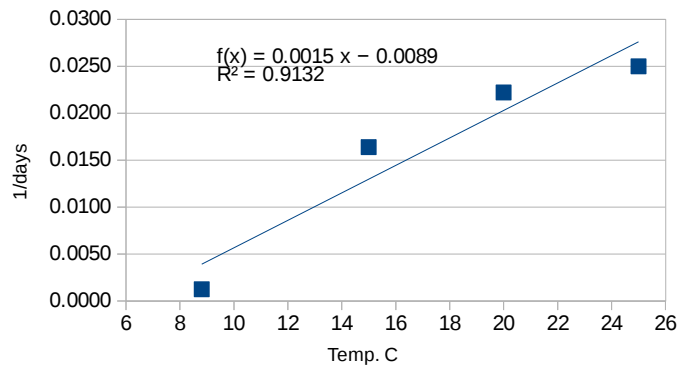
ca. 50%	Temp. C	1/days	Days
	7.496	0.0013	800
	15	0.0256	39
	20	0.0435	23
	25	0.0465	21.5
	30		18
	Slope=b	0.0027	
	intercept=	-0.0166	
Tlow	X-interc -a	6.1109	
DD-req	1/slope	368.34	
	RSQ	0.9502	

ca. 50% Oviposition



ca. 90%	Temp. C	1/days	Days
	8.804	0.0013	800
	15	0.0164	61
	20	0.0222	45
	25	0.0250	40
	30		24
	Slope=b	0.0015	
	intercept=	-0.0089	
Tlow	X-interc -a	6.1117	
DD-req	1/slope	683.83	
	RSQ	0.9132	

ca. 90% Oviposition



Summary of Life Stage Developmental Requirements (all at Tlow=6.11 C)

Stage	DD C	DD (F43)
Egg	154	278
Nymphs	454	817
Pre-OV	76	136
2% OV	103	186
20% OV	241	434
50% OV	368	663
90% OV	684	1231
100% OV	787	1417
Min. Generation Time (Egg, Nymph, Pre-O	684	1231
Avg. Generation Time (Egg to 20% OV)	898	1616

2. Estimated first spring adult appearance: Apr 15 reported for Kyushu Island (S. Japan); climate data not found for Kyushu but avail for Izumo, assumed to be ca. 5 days later; further assume 1<sup>st</sup> (2%) oviposition occurs 5 days later than 1<sup>st</sup> appearance (see notes)

DD6.11C data from Izumo (N. Coast S. Main Island; IZUMO13.txt & IZUMO14.txt)

	2013	2014	Avg	
Kyushu 1 <sup>st</sup> sampled: 04/15/20xx	232	235	233.5	← Use as "1st appearance springtime adults"
ca. adj. Izumo: 4/20/20xx	265	275	270	
2% OV Izumo: 4/25/20xx	295	317	306	← Use as "overwintering adult 2% oviposition"

notes: it is not known whether 1<sup>st</sup> spring adults observed was "late", i.e. egg laying was already occurring, so the estimated range of 233-305 DD6.11C might be a reasonable error bracket for first egg laying in the spring; more data is needed. As this insect is in overwintering repro. Diapause, we will begin using the later value (305 DD) initially to allow for the processes of diapause completion, pre-oviposition, host location and feeding, mating, egg maturation, oviposition host location, and actual egg deposition. We will "hedge" this by using the first value (233 DD) to represent "1st appearance of springtime adults"