Tsuzuki, Y., & Ohara, M. Temporal skewness of pollination success in the spring ephemeral *Trillium camschaticense*

— Supplementary information —

Contents

A. Study sites

In May 2018, we selected 24 *Trillium camschatcense* populations in the Tokachi region. We established one to three 5 m × 5 m quadrats in each population and recorded the number of flowering individuals within the quadrats. We found a significant positive correlation between the logarithm of habitat area and flowering density (correlation coefficient = 0.602, $P = 0.002$). The two study sites, Obihiro and Hiroo, were relatively large compared to the other populations (Figure S1 and S2).

Figure S1 A positive correlation between habitat area and flowering density. Dots of Obihiro and Hiroo are shown in dark

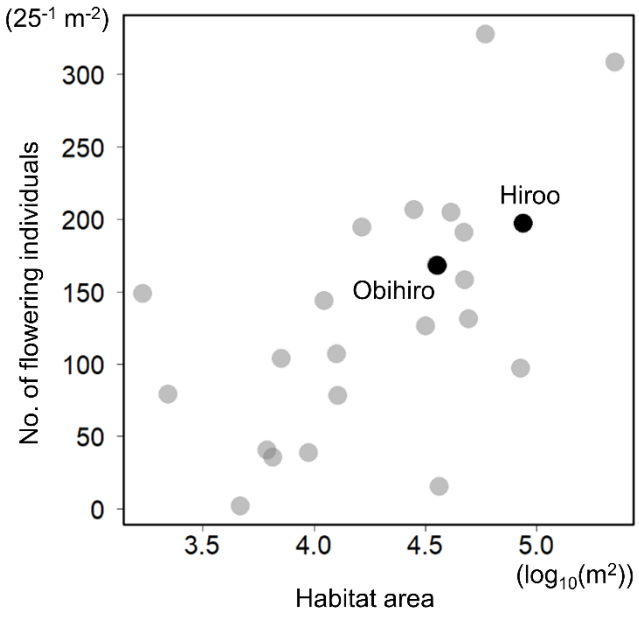
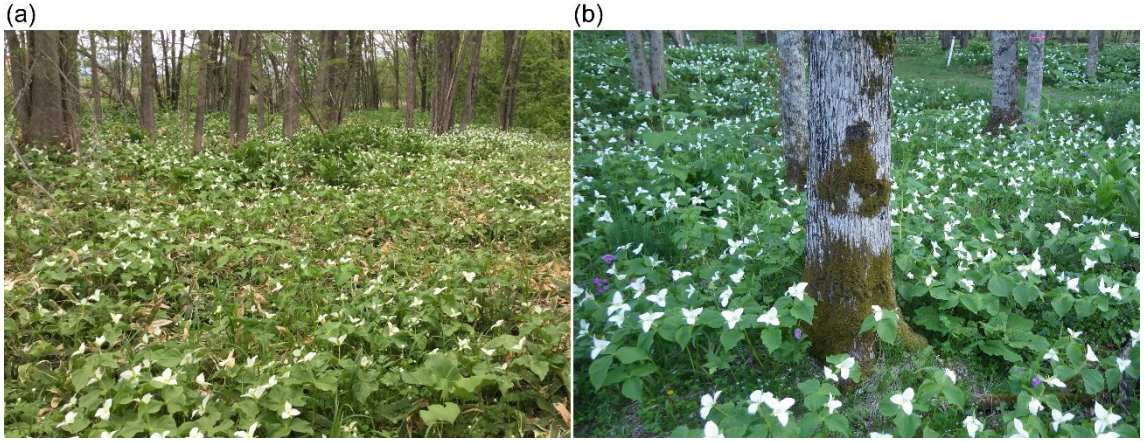


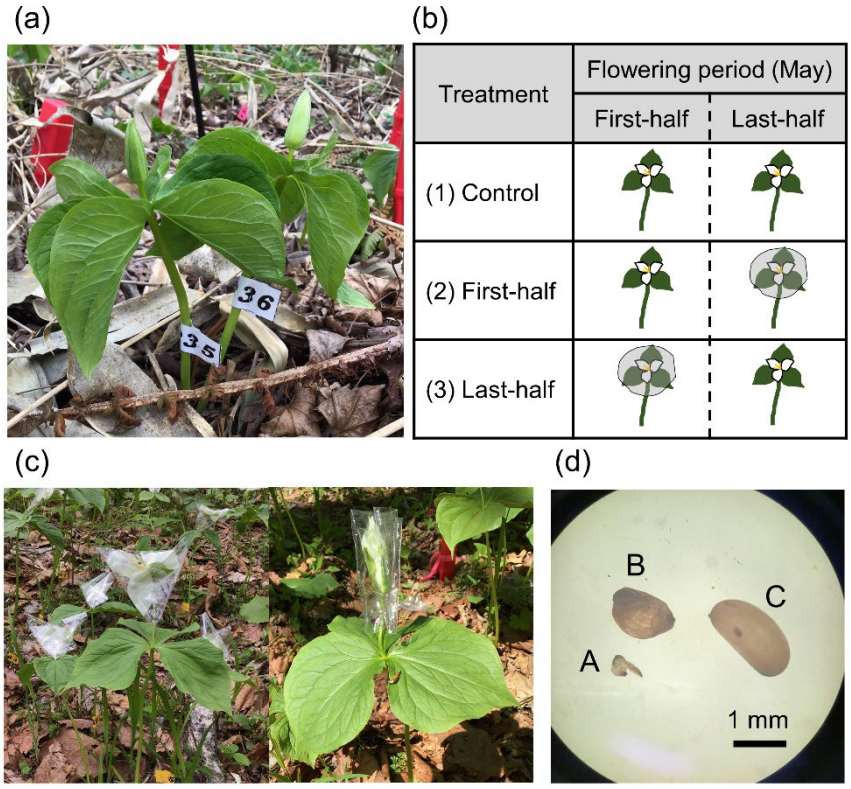
Figure S2 The study sites during the flowering season. a: Obihiro; b: Hiroo. One flower of *Trillium camschatcense* consists of three white petals, forming a white triangular shape. In both sites, flowering individuals of *T. camschatcense* distributed thoroughly on the forest floor

(a) (b)



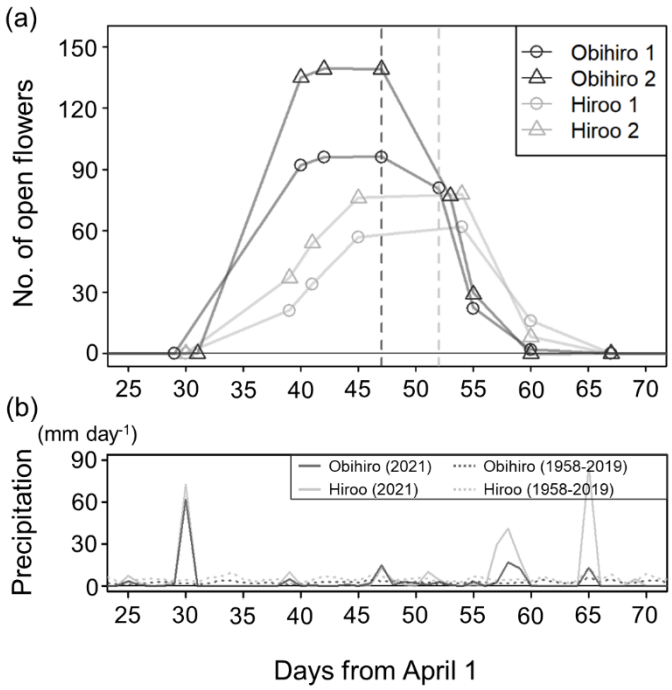
B. Graphical view of the experiments

Figure S3 (a) Flower buds were labeled by attaching number tags to stems. (b) A schematic view of the three treatments of the bagging experiments. Translucent circles overlayed on flowers stand for cellophane bags, which keep pollinators away from flowers. (c) Individuals bagged with cellophane bags. Left and right images show first- and last-half treatment, respectively. (d) Three types of ovule/seed in fruits. A: an unfertilized ovule; B: a fertilized ovule that did not developed to seed; C: a seed



C. Results of flowering phenology and precipitation during the flowering period

Figure S4 (a) Flowering phenology of the four quadrats: two in Obihiro (dark) and in Hiroo (light), respectively. The intervals between observations (dots) are connected by straight lines. Two quadrats in the same population are distinguished by the shape of dots. Dotted vertical lines show the turning point days on which bagging was ceased in the last-half treatment but was applied to the first-half instead. We labeled all flowering stems on the first observation day. As for the two quadrats in Obihiro, 71 and 106 individuals with 98 and 141 flowers were found in each, while 54 and 70 individuals with 62 and 79 flowers were found in Hiroo. In each quadrat, only one or two flowering stems sprouted later than the first observation (in Obihiro 1, one stem on May 10; in Obihiro 2, two on May 10; in Hiroo 1, one on May 11; in Hiroo 2, one on May 15). We confirmed the start of anthesis for these delayed flowers on the same day as we first noticed their sprouting. (b) Daily precipitation during flowering period. Two solid lines represent precipitation in the study year (2021) in Obihiro (dark) and Hiroo (light). Two dotted lines represent the average from 1958 to 2019 in Obihiro (dark) and Hiroo (light). Precipitation remained low during flowering season in the study year, which was the same as in the past years



D. Detailed results of bagging experiments

Table S1 The number of flowers used for experiments and the average number of total ovules, fertilized ovules, and seeds per fruit (flower) for each quadrat and treatment

Quadrat	Treatment	The number of flowers used for experiments	Average of the sum of ovules and seeds per fruit	Average number of fertilized ovules per fruit	Average number of seeds per fruit
Obihiro 1	Control	45	145.3	86.6	68.4
	First-half	45	152.0	61.3	52.4
	Last-half	45	164.4	11.5	6.4
Obihiro 2	Control	43	126.9	45.7	27.4
	First-half	43	148.7	64.1	44.7
	Last-half	42	141.5	27.7	17.7
Hiroo 1	Control	38	144.6	72.1	67.9
	First-half	38	120.1	44.6	38.3
	Last-half	39	160.5	90.8	83.0
Hiroo 2	Control	33	138.1	93.9	90.6
	First-half	33	102.8	52.6	32.3
	Last-half	33	88.2	47.7	43.4

Table S2 Output of the generalized linear mixed model (GLMM) for the effects of treatment, size, stem injury, and herbivory on fertilization rate in Obihiro and Hiroo. Bold lines are statistically significant ($P < 0.05$)

	Estimate	Std. Error	z value	Pr(>|z|)
Obihiro				
Intercept (control)	**6.2733**	**0.7449**	**8.4211**	**3.730e-17**
First-half	-0.5657	0.6364	-0.8888	3.741e-01
Last-half	**-3.1997**	**0.7783**	**-4.1114**	**3.932e-05**
Size	**-0.0398**	**0.0030**	**-13.1518**	**1.661e-39**
Stem injury	**-0.8522**	**0.1808**	**-4.7129**	**2.442e-06**
Herbivory	**-1.2506**	**0.1567**	**-7.9835**	**1.422e-15**
Hiroo				
Intercept (control)	-0.0462	0.4871	-0.0949	9.244e-01
First-half	-0.1515	0.3876	-0.3909	6.959e-01
Last-half	-0.0049	0.3917	-0.0126	9.900e-01
Size	0.0062	0.0041	1.4971	1.344e-01
Stem injury	**-2.0740**	**0.5914**	**-3.5069**	**4.534e-04**
Herbivory	-0.4180	0.2276	-1.8364	6.630e-02

Table S3 Output of the generalized linear mixed model (GLMM) for the effects of treatment, size, stem injury, and herbivory on seed set in Obihiro and Hiroo. Bold lines are statistically significant ($P < 0.05$)

	Estimate	Std. Error	z value	Pr(>|z|)
Obihiro				
Intercept (control)	**5.2129**	**0.9966**	**5.2306**	**1.690e-07**
First-half	-0.4774	0.8159	-0.5851	5.585e-01
Last-half	**-3.7779**	**1.0060**	**-3.7552**	**1.732e-04**
Size	**-0.0417**	**0.0030**	**-13.8004**	**2.534e-43**
Stem injury	-0.1508	0.1757	-0.8583	3.907e-01
Herbivory	**-1.3949**	**0.1595**	**-8.7459**	**2.212e-18**
Hiroo				
Intercept (control)	0.4499	0.4413	1.0195	3.080e-01
First-half	-0.5991	0.3461	-1.7312	8.342e-02
Last-half	-0.1165	0.3492	-0.3336	7.387e-01
Size	-0.0013	0.0038	-0.3461	7.292e-01
Stem injury	**-6.5696**	**0.8795**	**-7.4693**	**8.063e-14**
Herbivory	**-0.6166**	**0.2257**	**-2.7313**	**6.309e-03**