Electronic supplementary material

When to be a male? Role of resource-limitation and pollinators in determining gender in an andromonoecious spiderwort.

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Year-wise variation in the fruit set of *M. simplex* on the Kaas plateau: -

In 2017, the mean fruit set per plant was not affected by the mean number of hermaphrodite flowers (Fig. S4a: r^2 = -0.02284, df = 24, *p*-value = 0.5126) or mean number of male flowers (Fig. S4b: r^2 = 0.0405 , df = 24, *p*-value = 0.1646) respectively, but showed a positive effect with the total number of flowers present per plant (Fig. S4c: r^2 = 0.12, df = 24, *p*-value = 0.04642). However in 2019, the mean fruitset per plant showed no effect with the mean number of hermaphrodite flowers (Fig. S4d: r^2 = -0.01361, df = 38, *p*-value = 0.4943), mean number of male flowers (Fig. S4e: r^2 = 0.05935 , df = 38, *p*-value = 0.07059), or total number of flowers present per plant, respectively (Fig. S4f: r^2 = -0.002529, df = 38, *p*-value = 0.3484).

Tables

Table S1 Kruskal-Wallis test results of floral gender distribution (H = hermaphrodite, M = male, T = total flowers) in *M. simplex* across four weeks in 2018 showing the temporal variation in gender distribution (Fig. 2a; Kruskal-Wallis chi-squared = 38.7067, df = 7, *p*-value= 0.00; Fig 2a inset; Kruskal-Wallis chi-squared = 3.2847, df = 3, *p*-value = 0.3498; P<0.025).

Week	Week	1			2			3			4
	Gender/total	H	M	T	H	M	T	H	M	T	H
1	M	**0.0154***									
2	H	0.2843	-	-							
	M	-	0.1181	-	**0.0000***						
	T	-	-	0.4066	-	-					
3	H	0.2218	-	-	0.4222	-	-				
	M	-	0.1549	-	-	0.4328	-	**0.0000***			
	T	-	-	0.2566	-	-	0.3382	-	-		
4	H	0.4669	-	-	0.3131	-	-	0.2472	-	-	
	M	-	0.1762	-	-	**0.0172***	-	-	0.0258	-	0.0947
	T	-	-	0.1399	-	-	0.0939	-	-	0.0414	-

Table S2 Kruskal-Wallis test results of floral gender distribution (H = hermaphrodite, M = male) in *M. simplex* between two populations (Fig. 3; Kruskal-Wallis chi-squared = 123.5274, df = 3, *p*-value = 0; P<0.025).

Comparative groups	*p*-value
Plateau_pop M: Plateau_pop H	**0.0000***
Stream_pop H: Plateau_pop H	**0.0000***
Stream_pop M: Plateau_pop M	**0.0000***
Stream_pop M: Stream_pop H	0.1614

Table S3 Kruskal-Wallis test results of temporal variation in floral gender distribution within an inflorescence in *M. simplex* (Fig. 2b-e; P<0.025). Floral gender was quantified at three positions within an inflorescence: basal, middle (mid) and apical (see Fig. 1c).

Comparative groups	Week 1	Week 2	Week 3	Week 4
	p-value	*p*-value	*p*-value	*p*-value
Basal H: Basal M	**0.0014***	0.0252	0.0377	0.3547
Basal H: Mid H	0.3912	0.3744	0.2759	0.1844
Basal M: Mid M	**0.0216***	0.0373	0.0377	**0.0027***
Mid H: Mid M	0.2472	**0.0003***	**0.0015***	0.0661
Basal H: Apical H	0.0590	0.5000	0.4543	0.4132
Mid H: Apical H	0.0329	0.3744	0.3155	0.1318
Basal M: Apical M	**0.0000***	0.2817	0.4686	0.0700
Mid M: Apical M	**0.0058***	**0.0091***	0.0316	0.0967
Apical H: Apical M	0.5000	0.0840	0.0565	0.0930

Table S4 Mean±SE for the distribution of floral gender (M- male, H- hermaphrodite) at three positions- basal, middle, and apical- within an inflorescence in *M. simplex* (Fig. 2b-e).

Position	Week / Gender	Week 1	Week 2	Week 3	Week 4
Basal	M	0	1±0.39	1.1±0.48	0.8±0.33
	H	0	0.3±0.21	0.2±0.13	0.3±0.21
Middle	M	1.2±0.36	2.7±0.6	3.1±0.74	1.6±0.48
	H	1.1±0.53	0.4±0.22	1±0.73	0.6±0.22
Apical	M	2.8±0.59	1.1±0.31	1±0.3	0.2±0.13
	H	0.7±0.3	0.3±0.21	0.3±0.3	0.3±0.15

Table S5 Kruskal-Wallis test results of mean pollinator visitation rate per flower per hour from the manipulative experiments in *M. simplex* (Fig. 6; Kruskal-Wallis test chi-squared= 63.4196, df=7, *p*-value=3.122^{e-11}; P<0.025).

Treatment		Natural		T1		T2		T3
	Gender	H	M	H	M	H	M	H
Natural	M	**0.0000***						
T1	H	0.0545						
	M		0.0412	**0.0060***				
T2	H	**0.0106***		0.3611				
	M		0.1049		0.3053	**0.0248***		
T3	H	**0.0000***		0.0277		0.0457		
	M		0.2014		**0.0235***		0.0544	0.0884

Table S6 Kruskal-Wallis test results for pollinator-wise mean visitation rate per flower per hour in the manipulative experiments for *M. simplex* (Fig. 7; P<0.025).

Comparative groups		*Amegilla spp.* H	*Amegilla spp.* M	*A. florea* H	*A. florea* M	*A. cerana* H	*A. cerana* M	UnID sp 3 H	UnID sp 3 M	UnID sp 4 H	UnID sp 4 M	Hoverfly H
*Amegilla spp.*M	H<M	0.0912										
	H=M	0.1086										
	H>M	0.0795										
A. florea H	H<M	0.3952	-									
	H=M	0.4422	-									
	H>M	-	-									
A. florea M	H<M	-	0.3616	0.0414								
	H=M	-	0.4710	0.2966								
	H>M	-	-	-								
A. cerana H	H<M	0.3398	-	0.2533	-							
	H=M	0.1175	-	0.2744	-							
	H>M	0.1509	-	-	-							
A. cerana M	H<M	-	0.1650	-	0.3063	**0.0119***						
	H=M	-	0.0606	-	0.1426	**0.0061***						
	H>M	-	0.0663	-	-	0.0544						
UnID sp 3 H	H<M	0.4181	-	0.4896	-	0.2926	-					-
	H=M	0.3419	-	0.4154	-	0.3765	-					0.2724
	H>M	-	-	-	-	-	-					-
UnID sp 3 M	H<M	-	0.1743	-	0.1179	-	0.0389	0.3781				-
	H=M	-	-	-	-	-	-	-				-
	H>M	-	-	-	-	-	-	-				-
UnID sp 4 H	H<M	0.3365	-	0.2600	-	0.4686	-	0.2914	-			-
	H=M	0.0385	-	0.1346	-	0.1722	-	0.1995	-			0.4595
	H>M	0.3363	-	-	-	0.0621	-	-	-			-
UnID sp 4 M	H<M	-	0.4338	-	0.4304	-	0.2392	-	0.1518	0.1798		-
	H=M	-	0.3711	-	0.3800	-	0.1244	-	-	0.4185		-
	H>M	-	0.2708	-	-	-	0.2193	-	-	0.3536		-
Hoverfly H	H<M	-	-	-	-	-	-	-	-	-	-	-
	H=M	0.1253	-	0.2063	-	0.3111	-	-	-	-	-	-
	H>M	-	-	-	-	-	-	-	-	-	-	-
Hoverfly M	H<M	-	-	-	-	-	-	-	-	-	-	-
	H=M	-	0.3105	-	0.3217	-	0.3259	-	-	-	0.3968	0.4293
	H>M	-	-	-	-	-	-	-	-	-	-	-

Fig. S1 Measurement of (a) floral width of male and hermaphrodite *M. simplex* flower, (b) 15 pairs arranged on a laminated graph sheet to observe sexual dimorphism (Photo courtesy: Azad G).

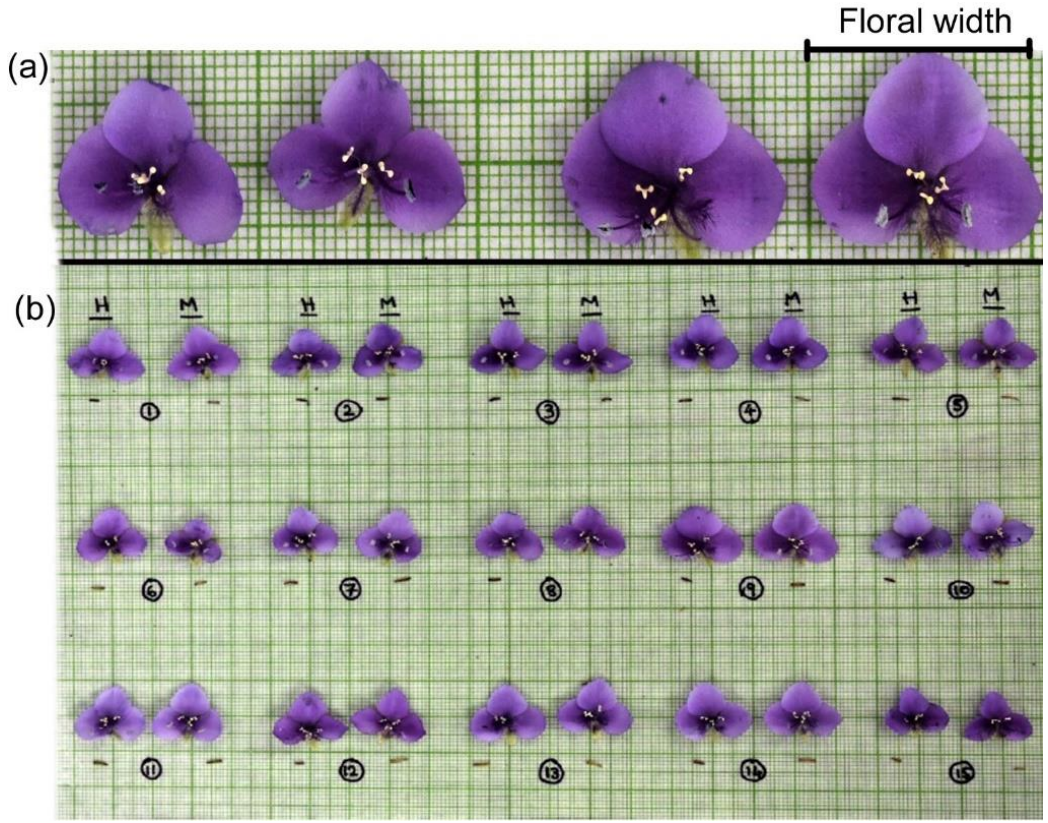

Fig. S2 Manipulative choice experiment setup: (a) Treatment 1: H < M, (b) Treatment 2: H = M, (c) Treatment 3: H > M; (d) Experimental setup, 8-20 flowers in total; N = 8 trials. Illustration: Asawari Albal

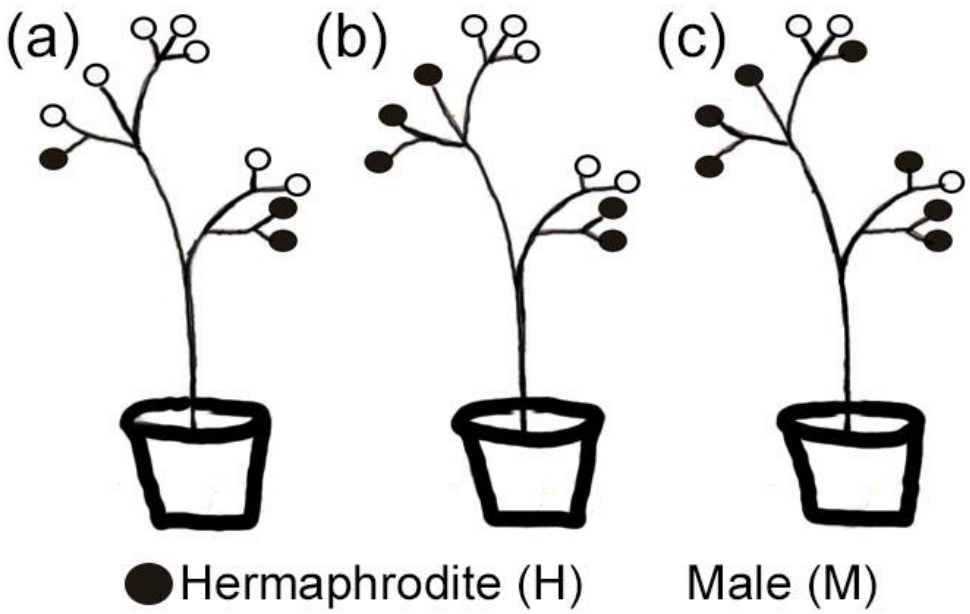

Fig. S3 Effect of the total number of flowers on display and the mean visitation rate per hour (r^2 = -0.03245, df = 21, p-value = 0.5845, N = 22) in 2018. The filled circles with solid line represent treatment 1: H < M, filled triangles with dotted line represent treatment 2: H = M and filled squares with dash-dotted line represent treatment 3: H > M for the choice experiment.

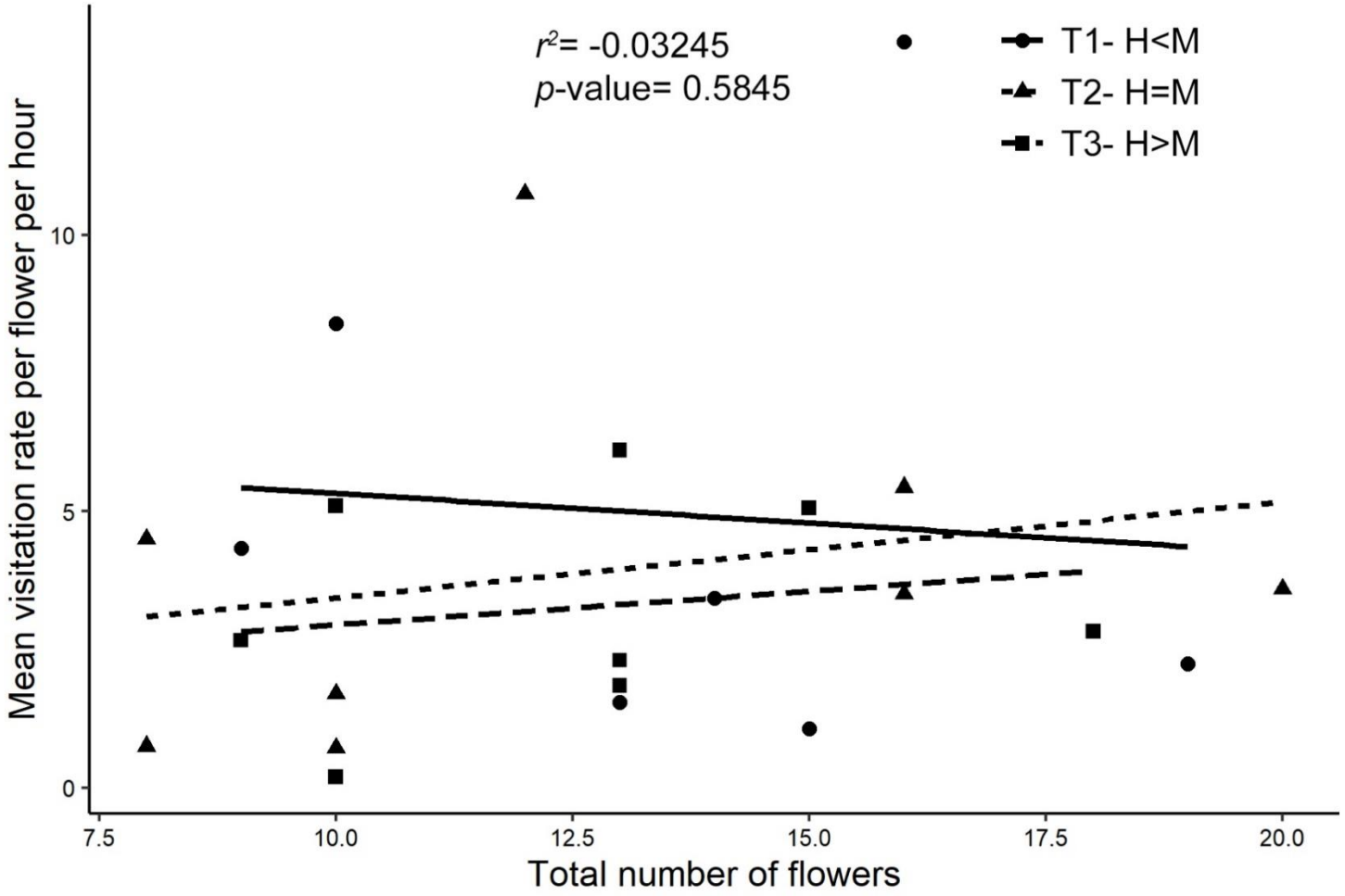

Fig. S4 Effect on mean fruitset in 2017- (a) by mean number of male flowers (r^2 = 0.0405 , df = 24, *p*-value = 0.1646, N = 26), (b) by mean number of hermaphrodite flowers (r^2 = -0.02284, df = 24, *p*-value = 0.5126, N = 26) and (c) by mean number of total flowers per plant in (r^2 = 0.12, df = 24, *p*-value = 0.04642, N = 26). Effect of mean fruitset in 2019- (d) by mean number of male flowers (r^2 = -0.01361, df = 38, *p*-value = 0.4943, N = 40), (e) by mean number of hermaphrodite flowers (r^2 = 0.05935, df = 38, *p*-value = 0.07059, N = 40), (f) by mean number of total flowers (r^2 = -0.002529, df = 38, *p*-value = 0.3484, N = 40).

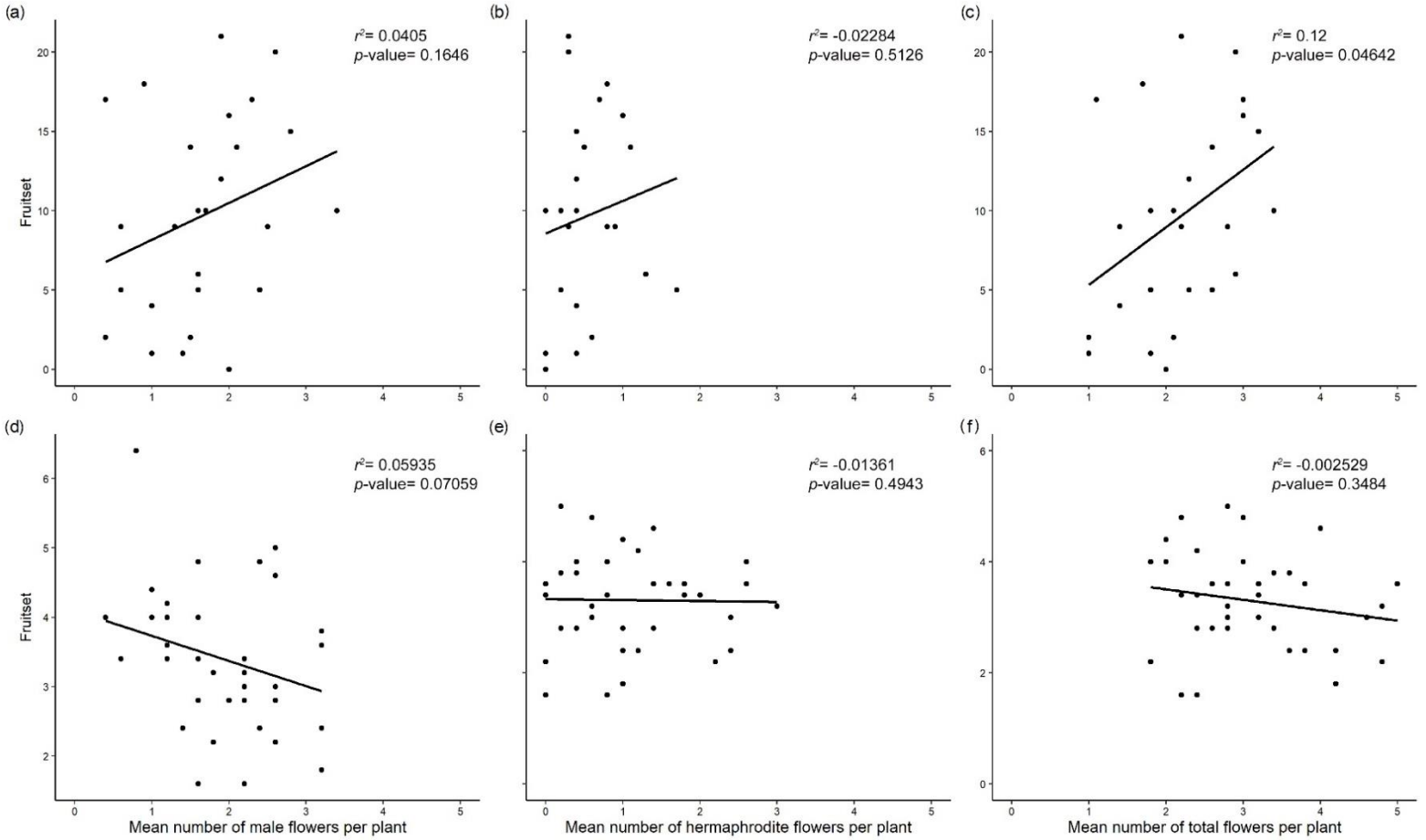

Fig. S5 Variation in gender in *M. simplex* across two years 2017 and 2018 (Pooled data; Kruskal-Wallis chi-squared = 281.61, df = 7, *p*-value $<2.2^{e-16}$). Columns to be compared within the week and within gender across all 4 weeks (Mean±SE). Significant *p*-values depicted by different alphabets.