SUPPLEMENTARY DATA 2

Expanded conceptual model

We examined how assumptions about the within-plant schedule of flower deployment (Fig. S2.1), the within-plant pattern of fruit set decline (Fig. S2.2), flower longevity, self-compatibility, and the shape of the male fitness gain curve affect model results. Effects of flower deployment, fruit set decline, and flower longevity were qualitative in nature: under most conditions, expected siring success decreases from first to last flowers on a plant, and from the first to last plants to flower in the population. Self-incompatibility, however, reduces the expected male success of the first plant to flower, and can therefore alter model outcomes depending on the strength of fruit set decline and the strength of phenological isolation at the beginning of the season. A diminishing relationship between number of flowers displayed and contribution to the pollen pool can also alter model outcomes, though effects vary with the schedule of flower production and with flower longevity. Our modifications to the baseline illustrative model presented in the main text, and effects of these modifications on model results, are summarized in Table S2.1. A figure similar to Fig. 1 in the main text can be generated for any model parameterization by entering the settings listed in Table S2.1 into the model code provided in Supplementary Information 1. Below, we provide brief descriptions of effects of model parameters.

Fruit set decline

(Table S2.1 cases 1A – 1B)

As anticipated, a stronger temporal decline in fruit set leads to stronger effects on male success, though even a weak decline in fruit set probability has a detectable effect on male success. Male success and functional femaleness are invariant when fruit set does not decline, unless plants are self-incompatible or the male gain curve decelerates more rapidly than the female (see below).

Within-plant flower opening schedule

(Table S2.1 cases 2A – 2D)

The within- and among-plant temporal decline in male success is strongest when the within-plant pattern of flower deployment is right-skewed, and weakest when flower deployment is left-skewed. We examined male success when individuals vary in their schedule of flower deployment (FL sched. = mixed, Table S2.1), and found that within- and among-plant temporal decline in male success remained, even when the within-plant fruit set decline was weak (results not shown).

Flower longevity

(Table S2.1 cases 3A – 3C)

We examined two types of cases in which flowers persist three days. First, we assumed that flowers produced and received pollen evenly across their lifespan (cases 3A, 3B). Second, we assumed that both pollen dispersal is equally distributed across the three-day flower lifespan, but female function (pollen receipt and fruit set) is saturated on the day of flower opening (case 3C). Neither scenario qualitatively altered functional femaleness among plants. However, in the first type of case, functional femaleness of last flowers can be *greater* than that of first flowers if the strength of fruit set decline is moderate (case 3B).

Self-incompatibility

(Table S2.1 cases 4A – 4D)

Self-incompatibility reduces the mating opportunities available to the first plant to flower and the last flowers of the last plant to flower. It can therefore reduce or reverse the decrease in male success among flowers on the first plant to flower, depending on the strength of the within-plant decline in fruit set, and can induce within-plant variation in expected male success in the absence of fruit set decline (case 4A). It also reduced the total expected male success of the first plant to flower, introducing curvature to the relationship between male success and flowering onset. The effects of self-incompatibility are magnified by the small populations size of our model: if we instead assume the 16 plants are drawn as a representative sample from a larger population, effects of self-incompatibility are alleviated (case 4D).

Diminishing relationship between flowers displayed and contribution to pollen pool

(Table S2.1 cases 5A – 5F)

When coupled with variation in the number of flowers a plant deploys per day, $k < 1$ can induce variation in the expected male success of the flowers on a plant, even if fruit set does not decline (case 5B). The effects of this modification depended on flower production schedules. $k < 1$ caused expected male fitness to increase from first to last flowers within the earliest plants to flower when flower production follows a symmetric distribution (case 5C), but did not alter the baseline within-plant decline in expected male success when schedules follow an uniform distribution (case 5A) and had only a minor effect on within-plant expectations under right- or left-skewed flower production schedules (cases 5D, 5E). $k < 1$ had no effect when flower opening schedules were mixed (case 5F).

Varying multiple parameters

(Table S2.1 case 6)

We applied the following conditions simultaneously: (1) plants are self-incompatible, (2) individuals vary in their flower production schedules, (3) fruit set declines moderately from first to last flowers on plants, (4) flowers persist two days, but only receive pollen to sire fruit on their first day of opening, (5) the number of plants beginning flowering on any day is doubled, so that no flower is phenologically isolated from others, and (6) a diminishing relationship between the number of flowers displayed and realized contribution to the pollen pool. Under these conditions, expected male success declines from first to last flowers on plants, regardless of day of flowering onset, and the expected male success of plants decreases with later flowering onset.

Conclusions

In most cases where fruit set declines, the functional femaleness of first flowers is greater than that of last flowers. However, certain combinations of factors can lead to lower functional femaleness of first flowers (e.g. cases 3B, 6), suggesting that several factors can interact to determine relative male and female success at the within-plant level. Flower longevity (FL long,., Table S2.1), and the length of time over which effective pollen transfer can occur (FR dist., Table S2.1) seem to be particularly important in this regard. In contrast, the finding that declining fruit set probability within plants leads to decreasing functional femaleness with later flowering onset is robust to all conditions tested.

Table S2.1: Summary of additional parameterizations of numerical model testing effects of declining fruit set within plants on the male reproductive success and functional femaleness of first *versus* last flowers on plants, and early- *versus* late-flowering plants.

Case[1]	**FL sched.**[1]	**FR dec.**[1]	**FL long.**[1]	**FR dist.**[1]	**SC**[1]	**Pop**[1]	**k**[1]	**Male RS among**[2]	**Male RS within**[2]	**Femaleness among**[2]	**Femaleness within**[2]
Base	uni.	strong	1 day	NA	SC	16	1	Decreases +/- linearly from early to late plants	Decreases from class 1 to class 5 flowers, rate of decreases increases with day of onset	Increases +/- linearly from early to late plants	slight increase between classes 1,2,3, weak decline to class 4, strong decline to class 5
1A	uni.	**none**	1 day	NA	SC	16	1	No variation	No variation	No variation	No variation
1B	uni.	**mod.**	1 day	NA	SC	16	1	As for base, but weaker	As for base, but weaker	As for base, but weaker	As for base, but weaker
1C	uni.	**weak**	1 day	NA	SC	16	1	As for base, but very weak	As for base, but very weak	As for base, but very weak	~0.5 for classes 1,2,3,4, very weak decline for class 5
2A	**sym.**	strong	1 day	NA	SC	16	1	As for base	As for base	As for base, with slightly smaller range of femaleness	As for base, but decline from 3 to 4 stronger
2B	**r.s.**	strong	1 day	NA	SC	16	1	A for base, but larger range of RS	As for base	As for base, but larger range of femaleness	As for base
2C	**l.s.**	strong	1 day	NA	SC	16	1	As for base, but slightly accelerating, and smaller range of RS	As for base	As for base, but slightly accelerating, and smaller range of femaleness	As for base
2D	**mix**	strong	1 day	NA	SC	16	1	As for base	As for base	As for base	As for base

Case[1]	FL sched.[1]	FR dec.[1]	FL long.[1]	FR dist.[1]	SC[1]	Pop[1]	k[1]	Male RS among[2]	Male RS within[2]	Femaleness among[2]	Femaleness within[2]
3A	uni.	strong	**3 day**	**first**	SC	16	1	As for base, but larger range of RS	As for base, but larger range of RS (as high as 2 in first flowers of early plants)	As for base but larger range of femaleness	Increase between classes 1,2,3,4, strong decline to class 5
3B	uni.	**mod**	**3 day**	**first**	SC	16	1	As for case 3A	As for case 3A	As for case 3A	Increases between classes
3C	uni.	strong	**3 day**	**even**	SC	16	1	As for base	As for base	As for base	As for base
4A	uni.	**none**	1 day	NA	**SI**	16	1	Low for plants starting on day 1 and 5 (convex relationship to day of onset)	Low for class 1 flowers of plants that start flowering day 1, and for class 5 flowers of plants that start flowering day 5. Otherwise constant	Higher for plants starting on days 1 and 5 (concave relationship to day of onset)	+/- constant at 0.5 for all classes
4B	uni.	**weak**	1 day	NA	**SI**	16	1	As for case 4A	As for case 4A, but RS of last classes on plants that start flowering after day 1 decreases to varying degrees	As for case 4A	As for case 4A
4C	uni.	strong	1 day	NA	**SI**	16	1	Increases between plants starting day1 and day 2, then	RS increases between class 1 and 2 flowers on plants that start	Slight decrease from onset days 1 to 2, then increase to days	As for base

Case[1]	**FL sched.**[1]	**FR dec.**[1]	**FL long.**[1]	**FR dist.**[1]	**SC**[1]	**Pop**[1]	**k**[1]	**Male RS among**[2]	**Male RS within**[2]	**Femaleness among**[2]	**Femaleness within**[2]
								decreases from day 3,4,5	flowering day 1; otherwise as for base	3,4,5	
4D	uni.	strong	1 day	NA	**SI**	**32**	1	As for base	As for base	As for base	As for base
5A	uni.	strong	1 day	NA	SC	16	**0.8**	As for base	As for base	As for base	As for base
5B	**sym.**	**none**	1 day	NA	SC	16	**0.8**	+/- constant	Decreases between classes 1,2,3, increases to classes 4,5 (V-shape)	+/- constant	Increases between classes 1,2,3, decreases to classes 4,5
5C	**sym.**	strong	1 day	NA	SC	16	**0.8**	Accelerating decrease	V-shape for plants that start flowering day 1, decreasing between flower classes for all others	Accelerating increase	Slight increase between classes 1,2,3, decrease to class 4, strong decrease to class 5
5D	**r.s.**	strong	1 day	NA	SC	16	**0.8**	As for base	As for base	As for base	As for base
5E	**l.s.**	strong	1 day	NA	SC	16	**0.8**	As for base	Constant among classes in plants that start flowering day 1; decreasing between classes for other plants	As for base	As for base
5F	**mix**	strong	1 day	NA	SC	16	**0.8**	As for base	As for base	As for base	As for base
6	**mix**	**mod.**	**2 day**	**first**	**SI**	**32**	**0.8**	As for base	Decreasing between classes	As for base	Increases between classes 1,2,3, then +/- constant to 4,5

NOTES

[1]**Model settings.** Case = model parameterization (Base = Illustrative case in main text, all other cases describe in Supplemetnary Information 2 text). FL sched. = distribution of flower opening over each plant's five days of flowering (uni. = uniform, sym. = symmetrical, r.s. = right-skewed, l.s. = left-skewed, mix = individuals differ in schedule of deployment). FR dec. = strength of fruit set decline from first to last flowers on plants (none, weak, moderate, or strong). FL long. = flower longevity. FR dist. = temporal distribution of siring opportunity over flower's lifespan (first = all available ovules are fertilized by pollen arriving on the flower's day of opening, even = opportunities for fertilization are shared proportionately by pollen arriving across all days of the flower's lifespan, NA = not applicable when longevity is 1 day). SC = self-compatibility (SC = plants self-compatible, SI = plants self-incompatible). Pop = population size. k = exponent describing relationship between number of flowers displayed on a given day and contribution to the daily pollen pool ($k < 1$ = contribution to pollen pool decelerates with each added flower).

[2]**Model results.** Male RS among = change in expected male reproductive success with day of flowering onset. Male RS within = change in expected male reproductive success from first (class 1) to last (class 5) flowers on plants. Femaleness among = change in functional femaleness (relative reproductive success in female *versus* male role) with day of flowering onset. Femaleness within = direction of change in average expected functional femaleness from first (class 1) to last (class 5) flowers on plants

Figure S2.1: Four cases for within-plant patterns of flower deployment: (A) symmetrical distribution, (B) uniform distribution, (C) right-skewed distribution, and (D) left-skewed distribution.

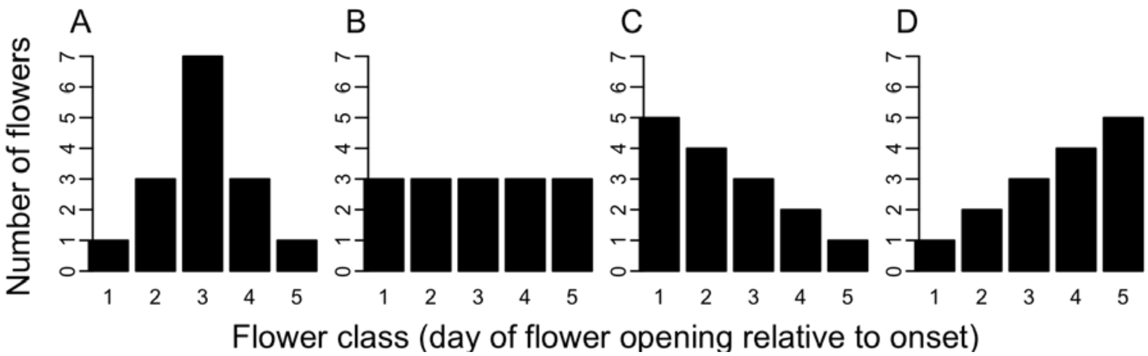

Figure S2.2: Four strengths of temporal fruit set decline from first to last flowers within plants. Lines are vertically offset to aid presentation.