

Supporting information:

Recipient and donor characteristics govern the hierarchical structure of heterospecific pollen competition networks

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The following Supporting Information is available for this article:

Table S1. Species names, common names, varieties and sources of the different seeds.

Table S2. Numerical values of all the traits measured for each species.

Table S3. Seed set in percentage for hand cross-pollination, hand self-pollination, natural selfing and apomixis for all species.

Table S4. Species x species matrix with the significance of effect “yes” or “no” of the different donors on the seed set of the different recipient species.

Table S5. Estimates, standard error, t-value and P-value of the effect of the different 9 donors on each recipient species.

Table S6. Number of seeds produced with 100% foreign pollen treatments for the different recipient species.

Table S7. Phylogenetic signal and significance for all the different traits

Table S8. Procrustes analysis results.

Figure S1. Total amount of pollen deposited per stigma.

Figure S2. Pollen ratios for the different recipient species.

Figure S3. Pollen ratios for the different recipient species by family.

Figure S4. Statistical comparison of the pollen ratios by family.

Figure S5. Unipartite bidirectional network with asymmetrical effect.

Figure S6. Correlation matrix for all the different traits.

Figure S7. Species reproductive biology.

Figure S8. Grouped effect sizes by family for each recipient species.

#TABLE S1

Species	Common_names	Variety	Source
Brassica oleracea	Wild cabbage	Capitata	https://www.mrfothergills.com.au/
Brassica rapa	Pak choi	Chinensis	https://www.mrfothergills.com.au/
Eruca sativa	Rocket		https://www.mrfothergills.com.au/
Sinapis alba	White mustard		https://www.mrfothergills.com.au/
Ipomoea aquatica	Water spinach		https://www.theseedcollection.com.au/
Ipomoea purpurea	Morning glory		http://www.shaman-australis.com.au
Capsicum annuum	Capsicum	California Wonder	https://www.edenseeds.com.au
Petunia integrifolia	Petunia		https://www.dianeseeds.com/
Solanum lycopersicum	Tomato	Tommy Toe	https://www.mrfothergills.com.au/
Solanum melongena	Eggplant	Little Fingers	https://www.4seasonsseeds.com.au/

TABLE S2

Species	Pollen size μm	Pollen grains per anther	Ovule number	Pollen:ovule ratio	Stigma area μm^2	Stigma length (mm)	Stigma width (mm)	Style length (mm)	Style width (mm)	Ovary length (mm)	Ovary width (mm)	Selfing rate	SI index
Brassica oleracea	27.72	42033	29	8696.48	0.62	0.53	0.88	2.32	0.65	5.93	1.11	0.0	0.00
Brassica rapa	25.35	7133	26	1646.08	0.36	0.37	0.73	1.08	0.52	3.53	0.88	0.0	0.00
Capsicum annuum	32.46	30761	241	765.83	1.06	0.72	1.18	3.24	1.06	3.15	5.80	0.8	0.64
Eruca versicaria	24.95	22151	24	5537.75	0.35	0.73	0.67	6.60	0.73	4.42	0.94	0.1	0.02
Ipomoea aquatica	70.10	858	4	1072.50	3.26	1.43	2.25	19.44	0.45	2.38	1.42	0.6	0.75
Ipomoea purpurea	97.59	654	6	545.00	2.27	1.24	1.88	28.23	0.58	1.06	1.57	1.0	2.74
Petunia integrifolia	24.74	34657	220	787.66	1.17	0.80	1.32	14.65	0.45	3.13	1.77	0.9	0.26
Sinapis alba	33.59	3507	6	3507.00	0.55	0.63	0.91	3.62	0.77	1.98	1.07	0.7	1.12
Solanum lycopersicum	22.00	28915	92	1885.76	0.09	0.19	0.35	6.47	0.31	1.16	1.13	0.7	0.48
Solanum melongena	25.18	166989	1010	992.01	1.14	0.96	1.33	11.33	0.94	4.02	3.55	1.0	1.45

TABLE S3

Species	Hand cross-pollination	Hand self-pollination	Spontaneous selfing	Apomixis
Brassica oleracea	32.07	0.00	0.00	0
Brassica rapa	44.97	0.00	0.00	0
Capsicum annuum	80.00	56.47	19.34	0
Eruca sativa	23.75	0.42	0.00	0
Ipomoea aquatica	40.00	30.00	20.00	0
Ipomoea purpurea	31.67	86.67	31.67	0
Petunia integrifolia	80.16	24.77	0.00	0
Sinapis alba	41.67	48.33	5.00	15
Solanum lycopersium	85.65	41.20	68.48	0
Solanum melongena	60.48	74.87	21.56	0

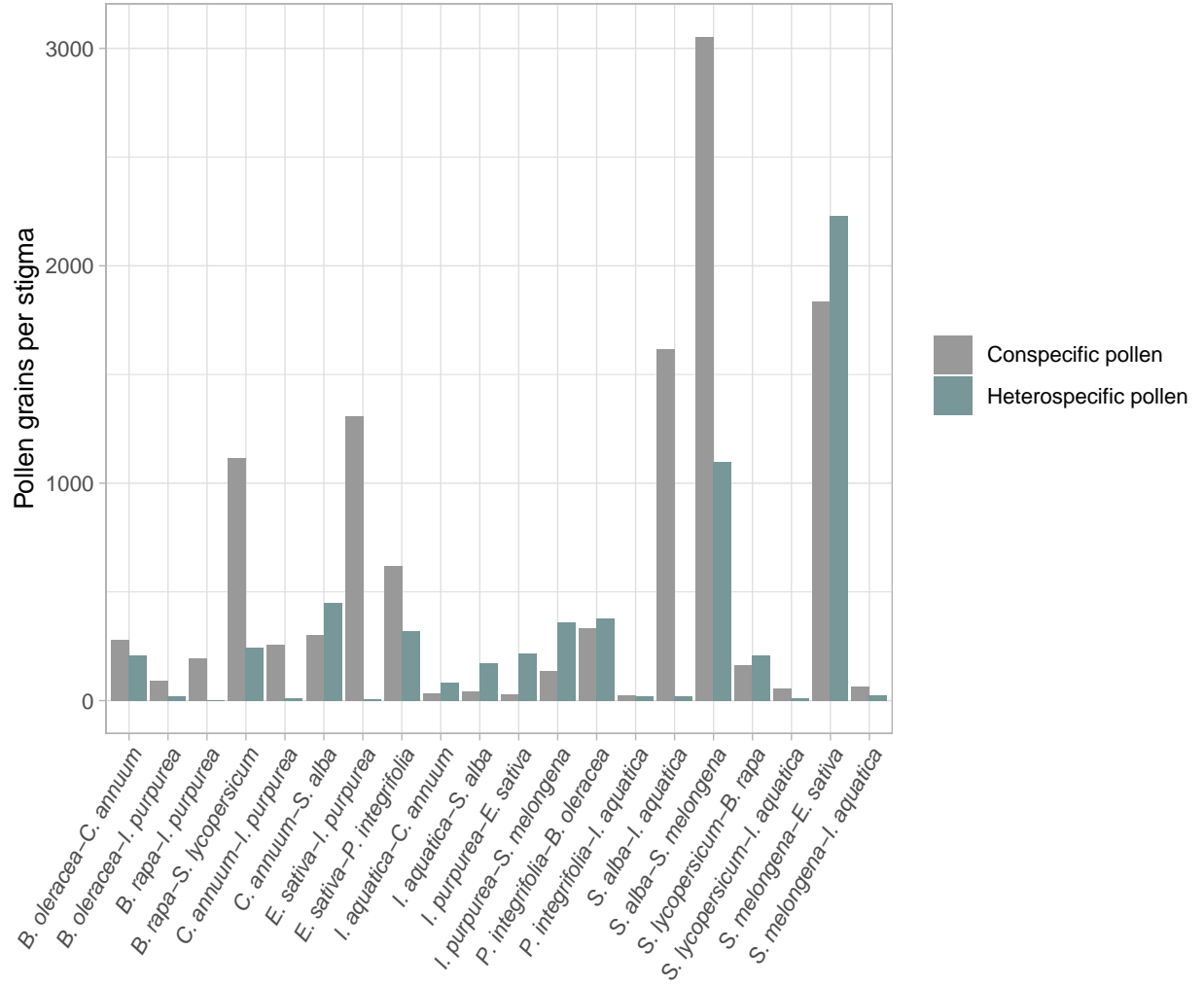


Fig. S1 Average number of pollen grains per stigma for 20 different treatments (3 replicates per treatment). For each treatment, we show the average number of conspecific pollen grains (grey) and heterospecific pollen grains (light blue) per stigma. For each pair of species on the x-axis, the first species is the recipient species, and the second, the donor species.

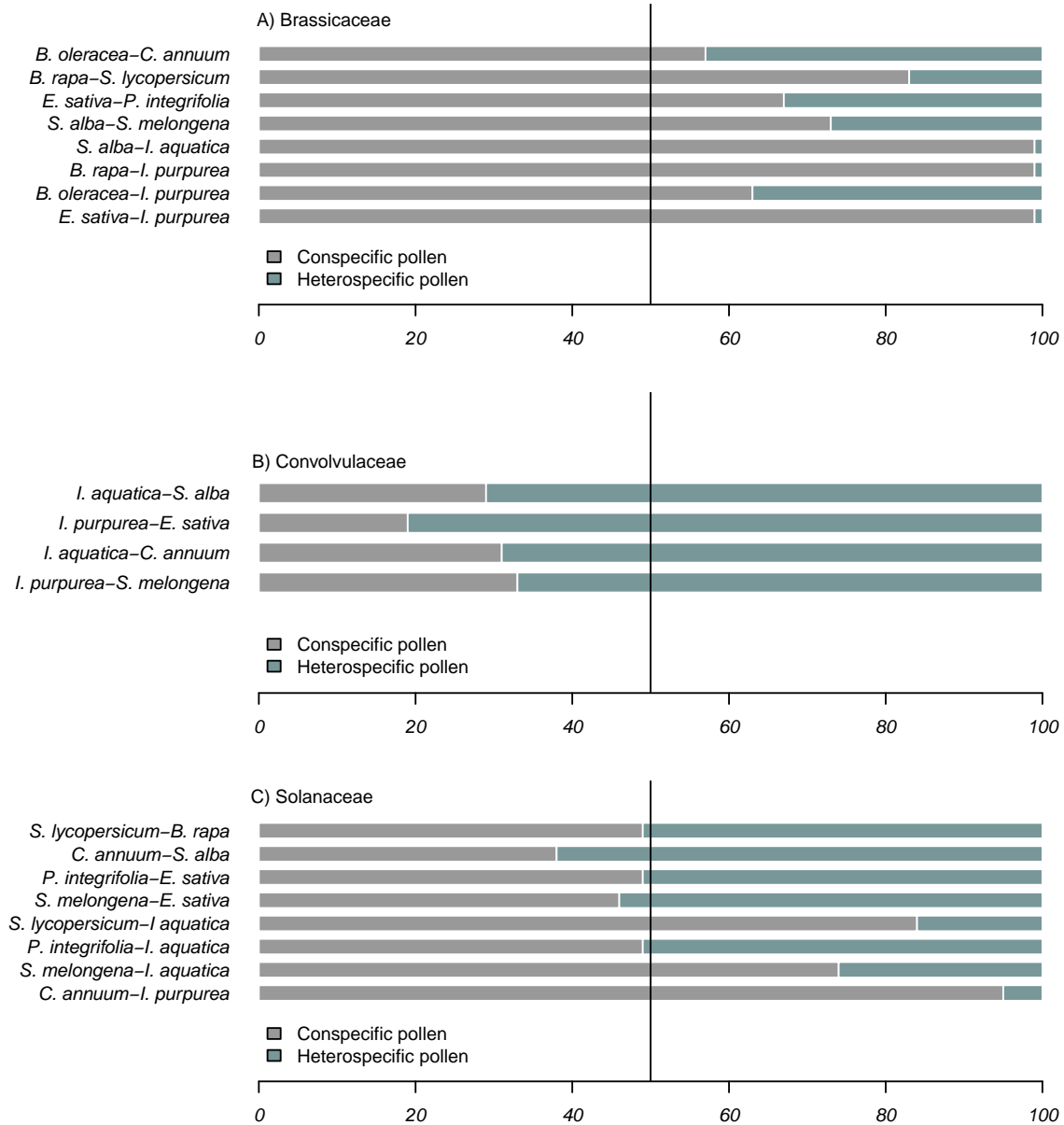


Fig. S2 Average proportion of conspecific and heterospecific pollen per stigma grouped by family, A) Brassicaceae, B) Solanaceae and C) Convolvulaceae. These proportions (%) are the number of conspecific pollen grains or heterospecific pollen grains divided by the total number of pollen grains per stigma for 20 different treatments. We conducted 3 count replicates per treatment and then we calculated the average number of pollen grains for these treatments. The proportion of conspecific and heterospecific pollen are shown in grey and light blue respectively. For each pair of species on the y-axis, the first species is the pollen recipient and the second the pollen donor. The vertical black line represents 50% pollen of both donor and recipient.

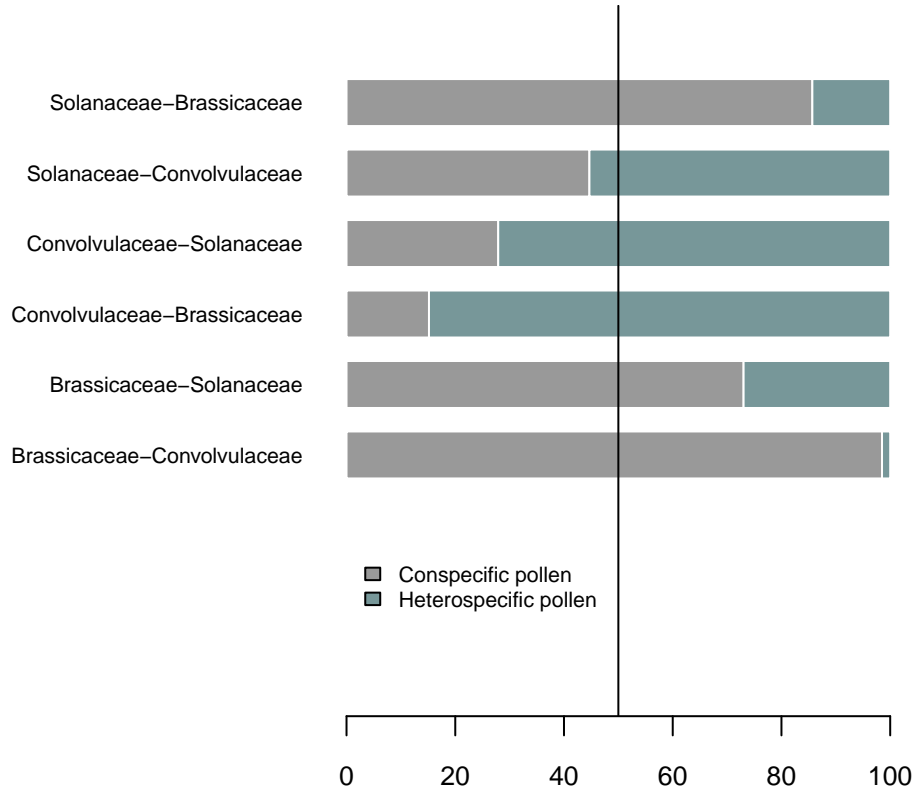


Fig. S3 Average proportion (%) of heterospecific and conspecific pollen per family for the different 20 treatments counted. We conducted 3 count replicates per treatment and then we calculated the average number of pollen grains for these different 20 treatments. Finally, we grouped by family these treatments in order to see general tendencies across families as pollen donor and as pollen recipient. Pollen ratios were considered as the number of conspecific or heterospecific pollen grains divided by the total number of pollen grains per stigma. On the y-axis, the first family on each pair of plant families is the recipient one, and the second, the family of the donor. The vertical bar on intercept 50, represents equal proportions of both recipient (grey) and donor (light blue) pollen.

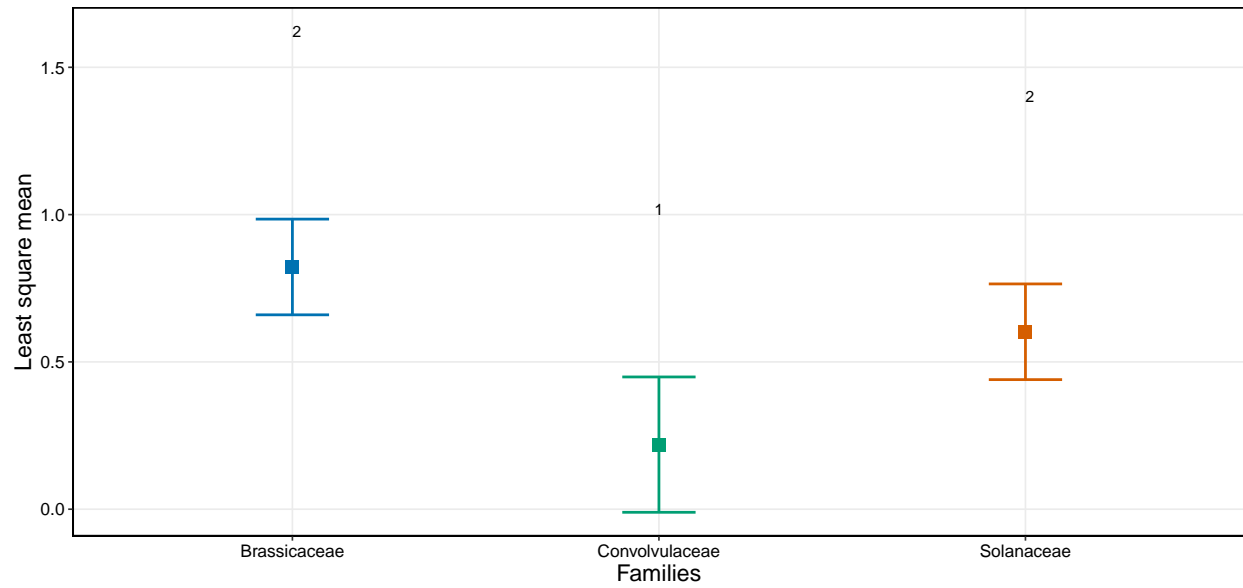


Fig. S4 Pollen ratios comparisons between the different pollen recipient families where the boxes represent least square means, the error bars, confidence intervals 95%, and sharing numbers indicate no significant differences between groups (Tukey adjusted comparisons). These pollen ratios (%) are the total number of heterospecific pollen grains divided by the total quantity of pollen (conspecific pollen + heterospecific pollen), and then compared by family (N=20). Brassicacea family is coloured in blue, Convolvulaceae in green and Solanaceae in orange.

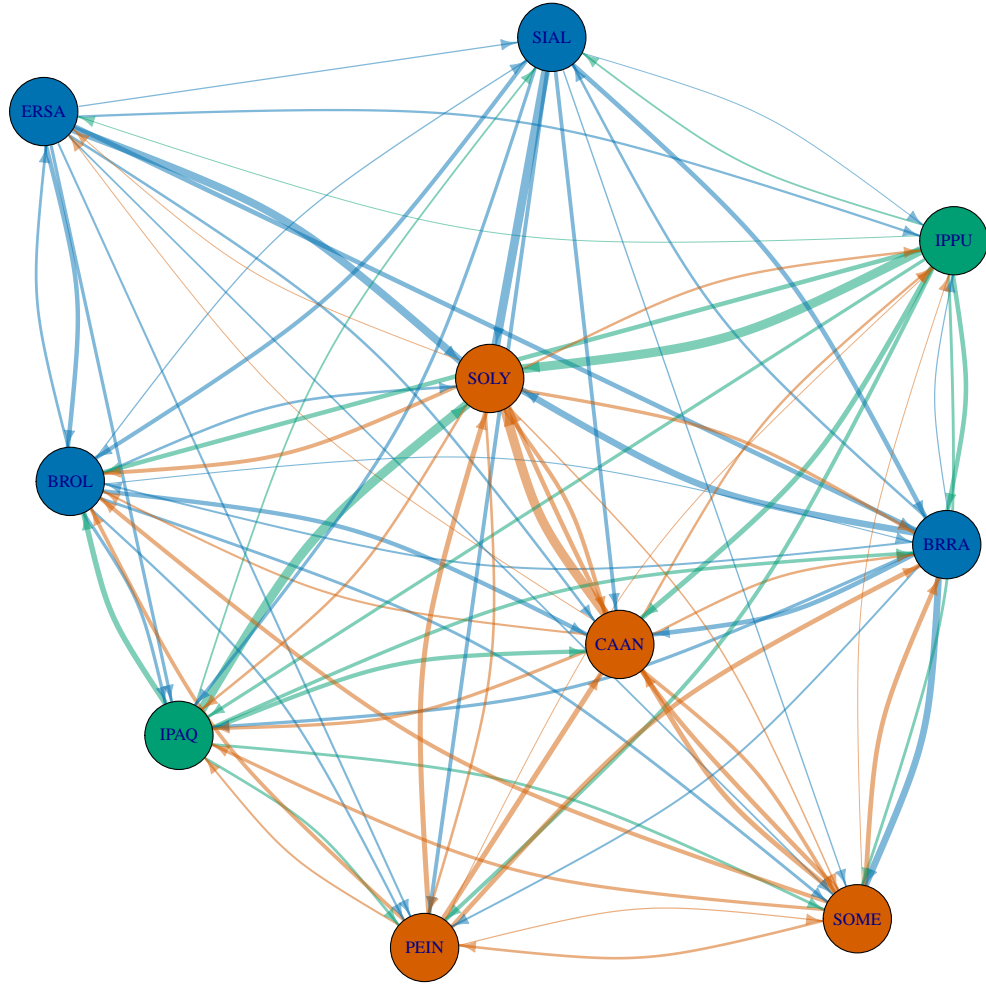


Fig. S5 Unipartite bidirectional network with asymmetrical effect. The lines with the arrow heads connect the impact of foreign pollen (effect size) of each pollen donor species on each recipient species. All the arrow heads point to the recipient species of the reciprocal interaction. Lines of species that did not have a negative impact are not represented. The different nodes and the effect of the donor species on the recipient species appear coloured by family: Solanaceae (orange), Brassicaceae (blue) and Convolvulaceae (green). The intensity of the effect is represented by the line's size where a larger effect size corresponds to a thicker line and a thinner line to a smaller effect size. Species code: BROL: *Brassica oleracea*, BRRA: *Brassica rapa*, ERSA: *Eruca sativa*, SIAL: *Sinapis alba*, IPAQ: *Ipomoea aquatica*, IPPU: *Ipomoea purpurea*, CAAN: *Capsicum annuum*, PEIN: *Petunia integrifolia*, SOLY: *Solanum lycopersicum*, SOME: *Solanum melongena*.

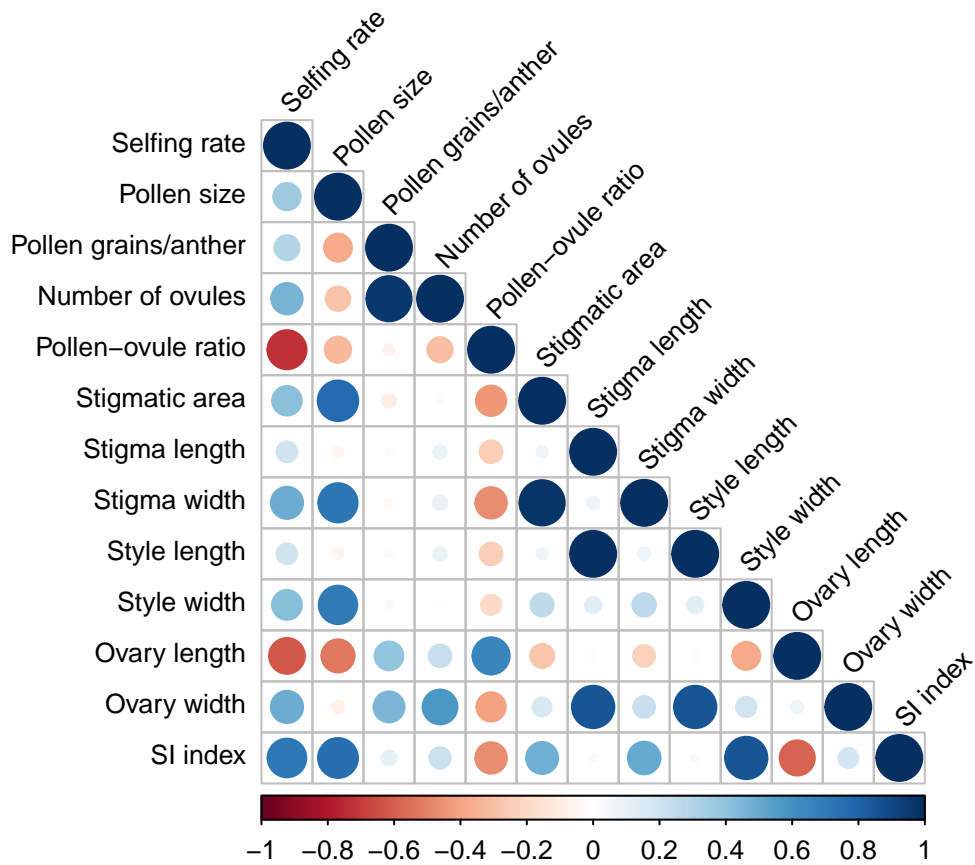


Fig. S6 Graphical representation of the correlation matrix of the different reproductive traits considered in the experiment. Positive correlations are displayed in blue and negative in red. The intensity, size and colour of the circles are proportional to the correlation coefficient from Pearson's r .

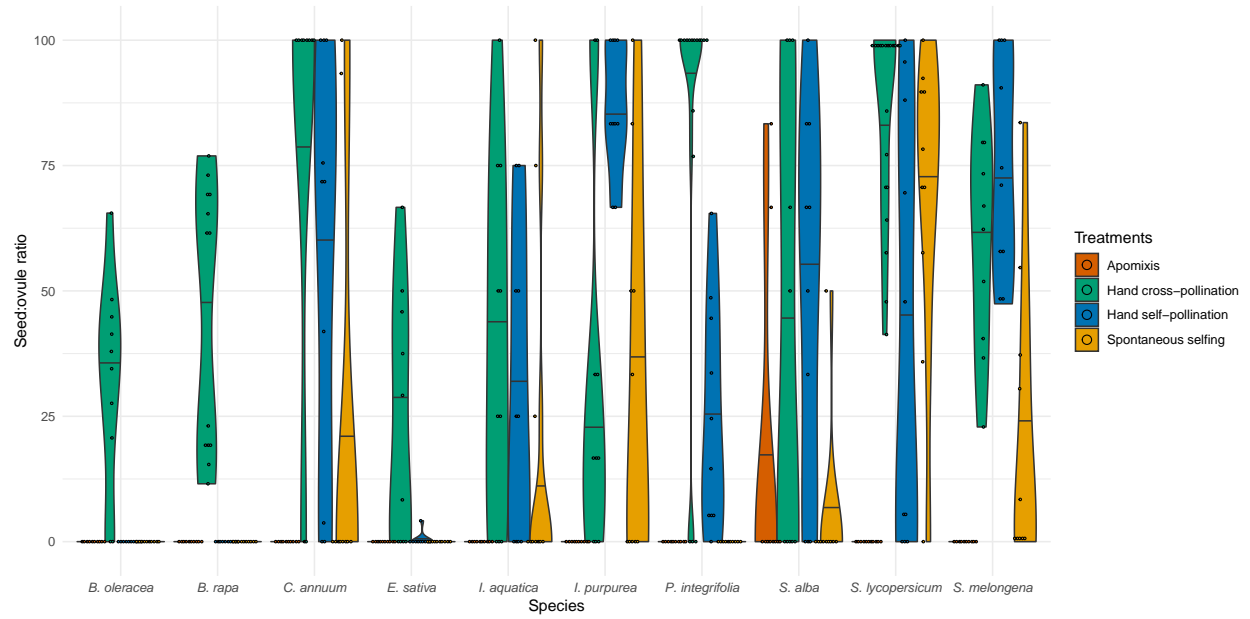


Fig. S7 Violin plot of the proportion of seeds covered to ovule (%) for all species with four different hand-pollination treatments: apomixis (orange), hand cross pollination (green), hand self pollination (blue) and spontaneous selfing (yellow). The coloured dots, represent the different values of seed set for each treatment.

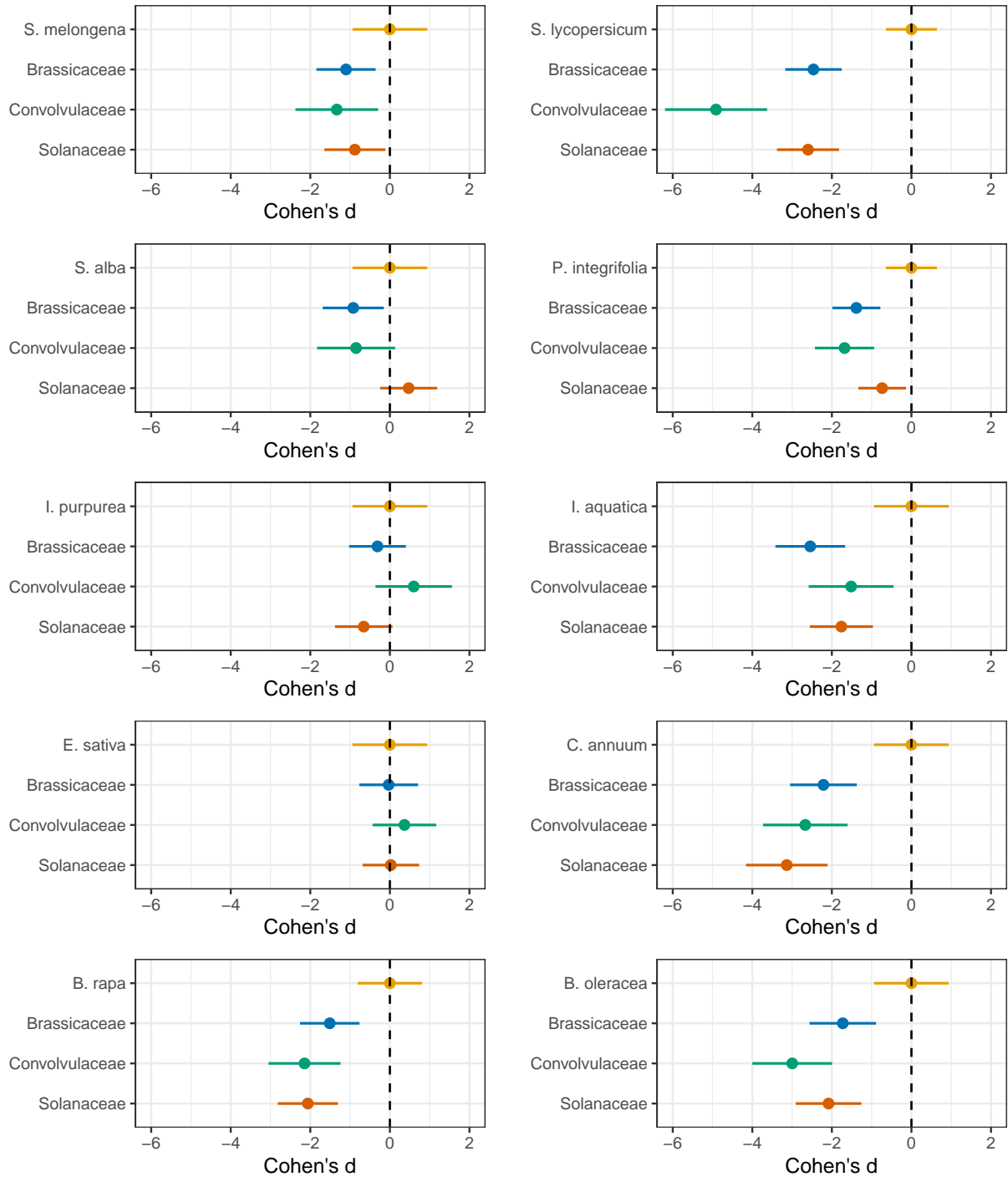


Fig. S8 Grouped effect sizes (95% confidence intervals) of the different families on each focal species. For each species, the grouped effect by family is compared with the control treatment of hand cross pollination with conspecific pollen. The control treatment is represented in yellow and vertically intersected with a dashed line through the mean effect size in order to help the visual interpretation of the effect sizes. Any value to the left of the vertical dashed line represents a negative impact of foreign pollen. The different effect sizes and confidence intervals are coloured by family: Solanaceae (orange), Brassicaceae (blue) and Convolvulaceae (green).