Función de la flor,…o porqué las flores son tan bonitas

- Limitantes de la producción de semillas: **polen vs. recursos**
- Costos de la función masc vs. fem.
- Limitantes de la función masc. vs. fem.

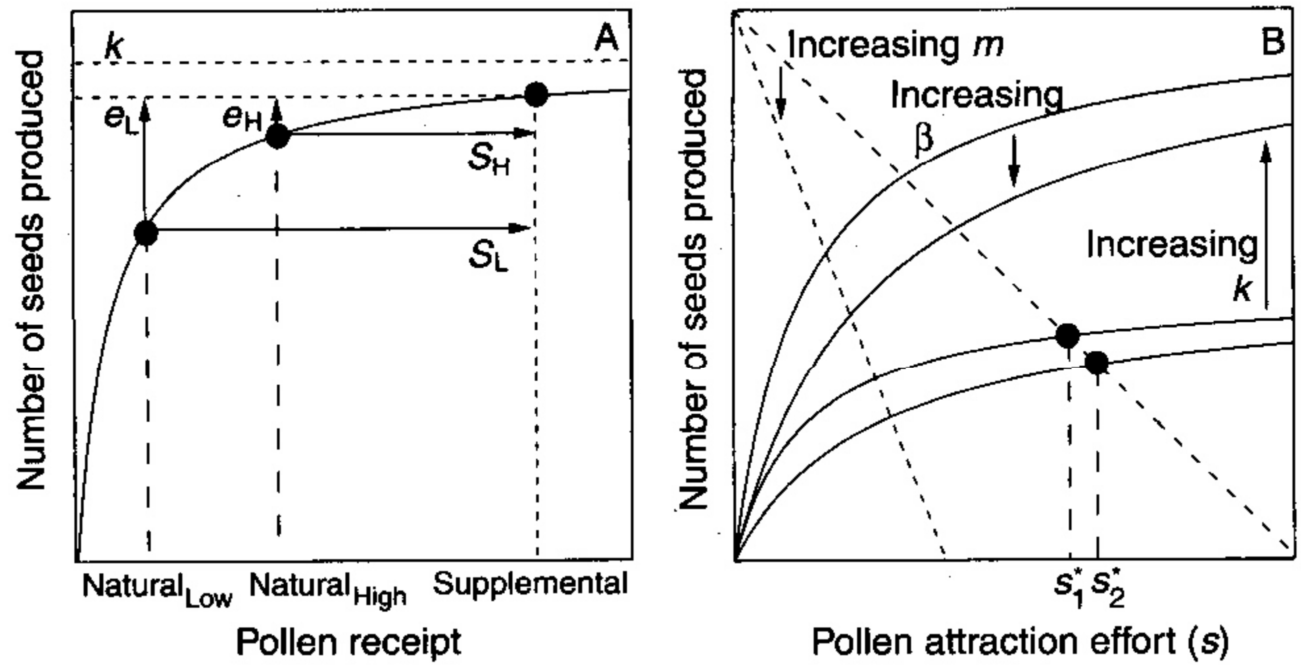


FIG. 1. Definition and theoretical representation of pollen limitation. (A) Operational definition of pollen limitation. Ovule fertilization increases with pollen receipt (self or outcross pollen) until resources become limiting at k. (Because these lines intersect the origin, apomixis is excluded.) Effect size (e) is the difference in seed production between supplemental and natural pollen receipt. Its magnitude depends in part on the difference (S) between the natural and supplemental levels of pollen receipt. Low natural levels of pollen receipt result in large effect sizes e_L; high levels result in small effect sizes, e_H. A decelerating gain curve is drawn for convenience. All discussions and conclusions could equally use a linear relation with a maximum. (B) An extension of the Haig and Westoby (1988) model to examine the effect of variation in fitness gain and cost on optimal allocation to attraction. Two "families" of fitness gain curves (solid lines) each with varying k and β values (high k reflects greater total resources; low β, the pollination half-saturation constant, reflects rapid pollen accumulation), and two resource cost curves (dashed lines) with different m values (low m, the cost of reproductive strategy, reflects cheap attraction costs) are depicted. Variation in fitness gain and attraction cost curves determines the point at which they intersect and thus predicts different optimal allocations to attraction (s_1^* vs. s_2^*).

Ashman, T-L, et al. 2004. Pollen limitation of plant reproduction : ecological and evolutionary consequences. Ecology 85: 2408-2421.

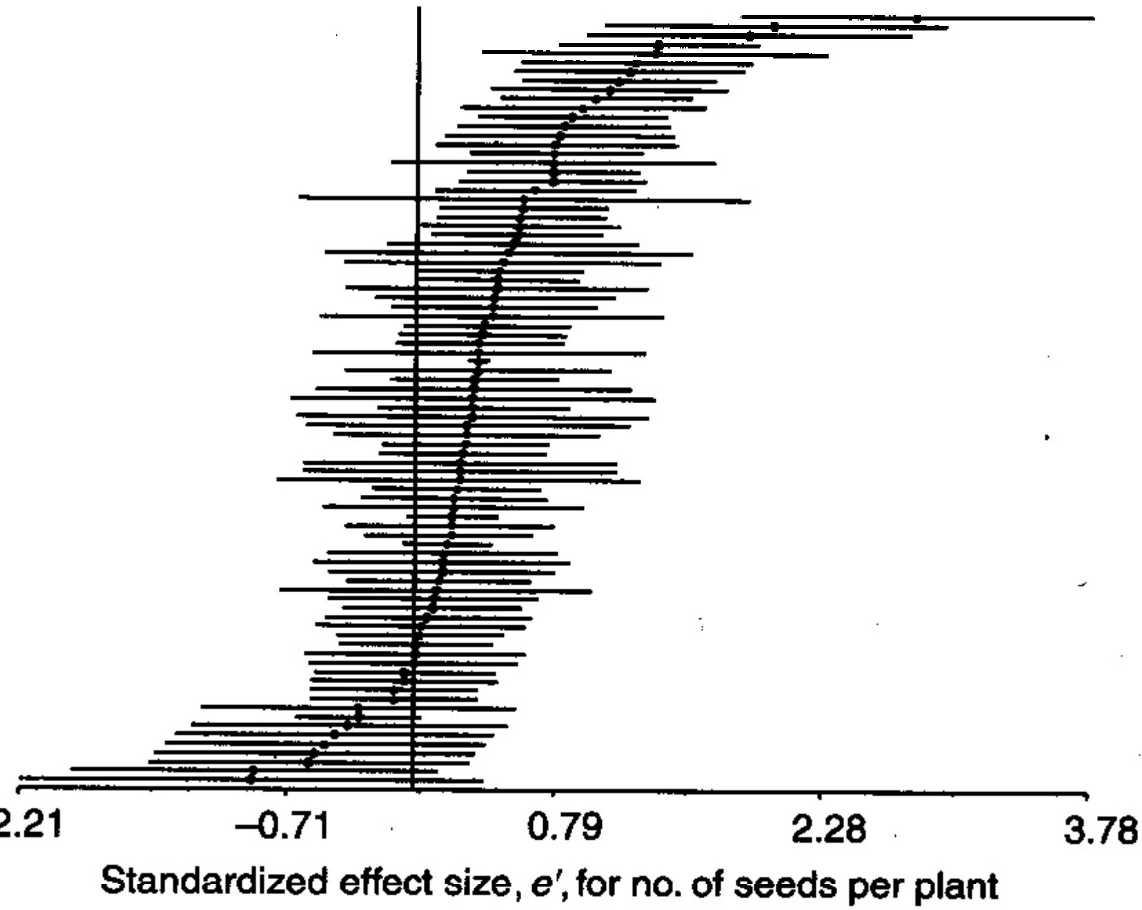
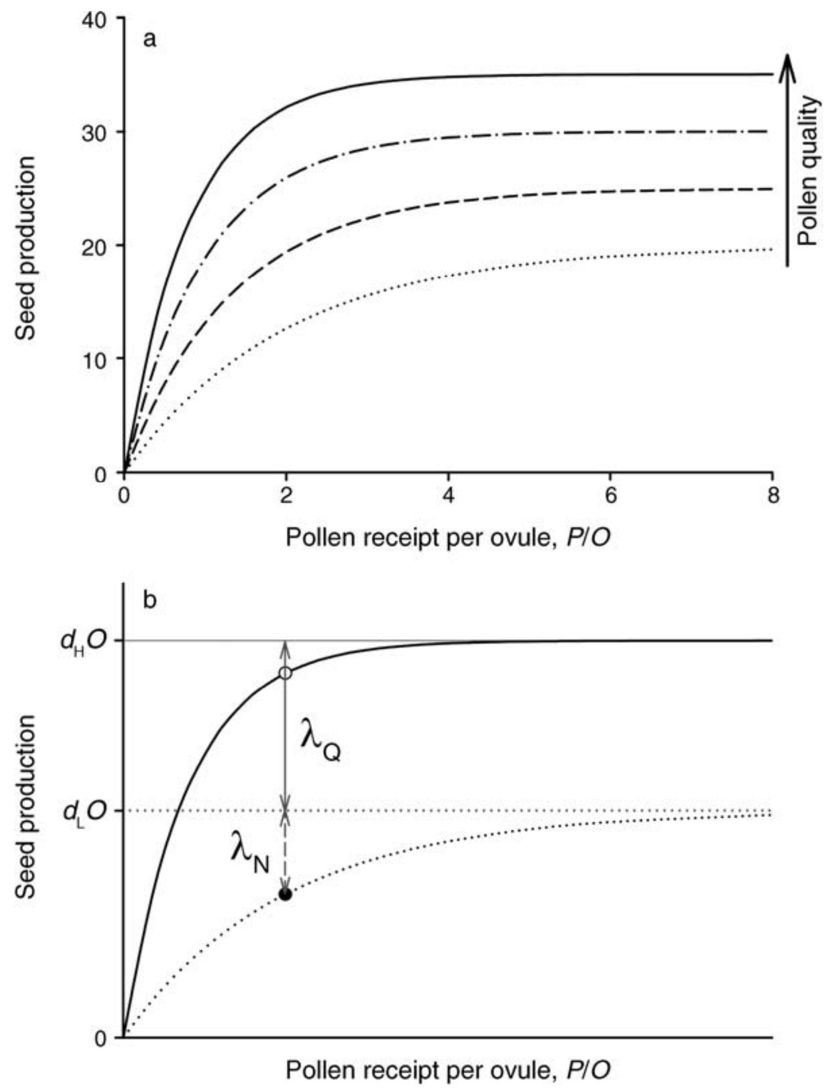
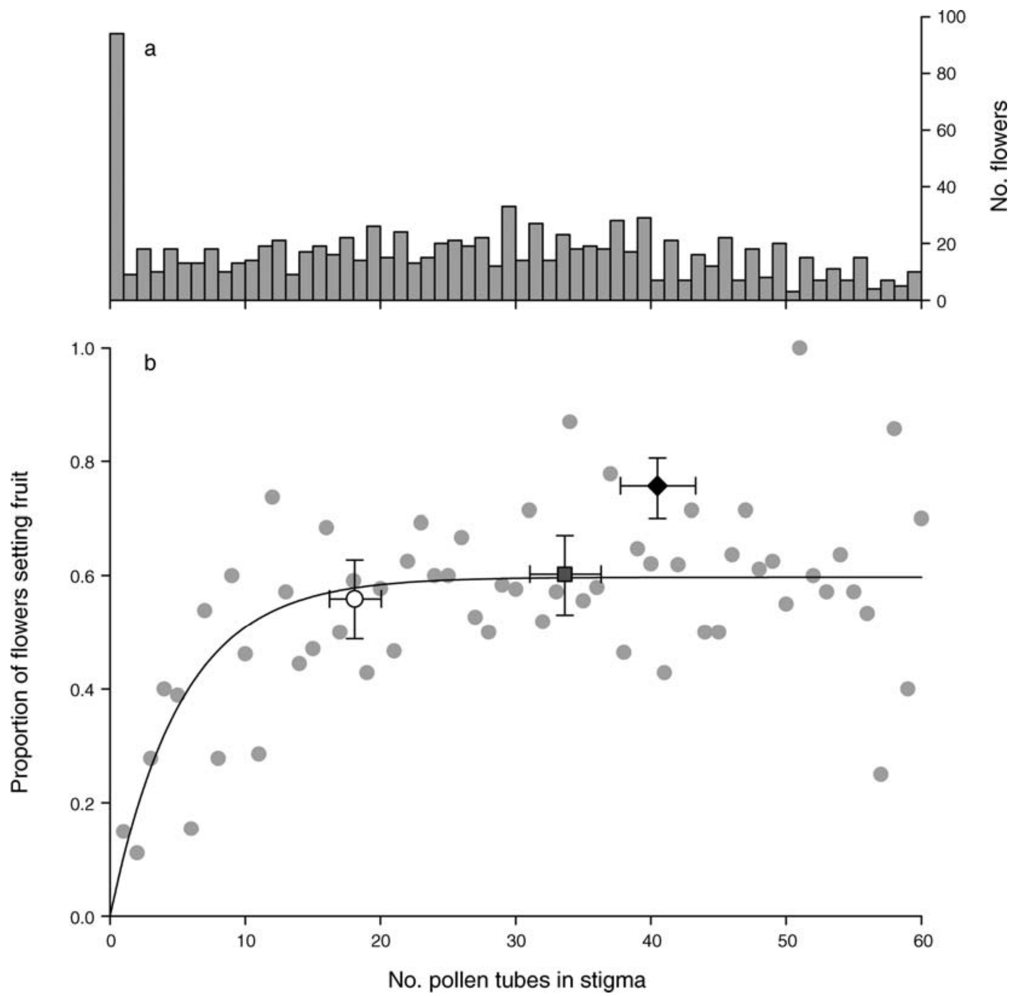
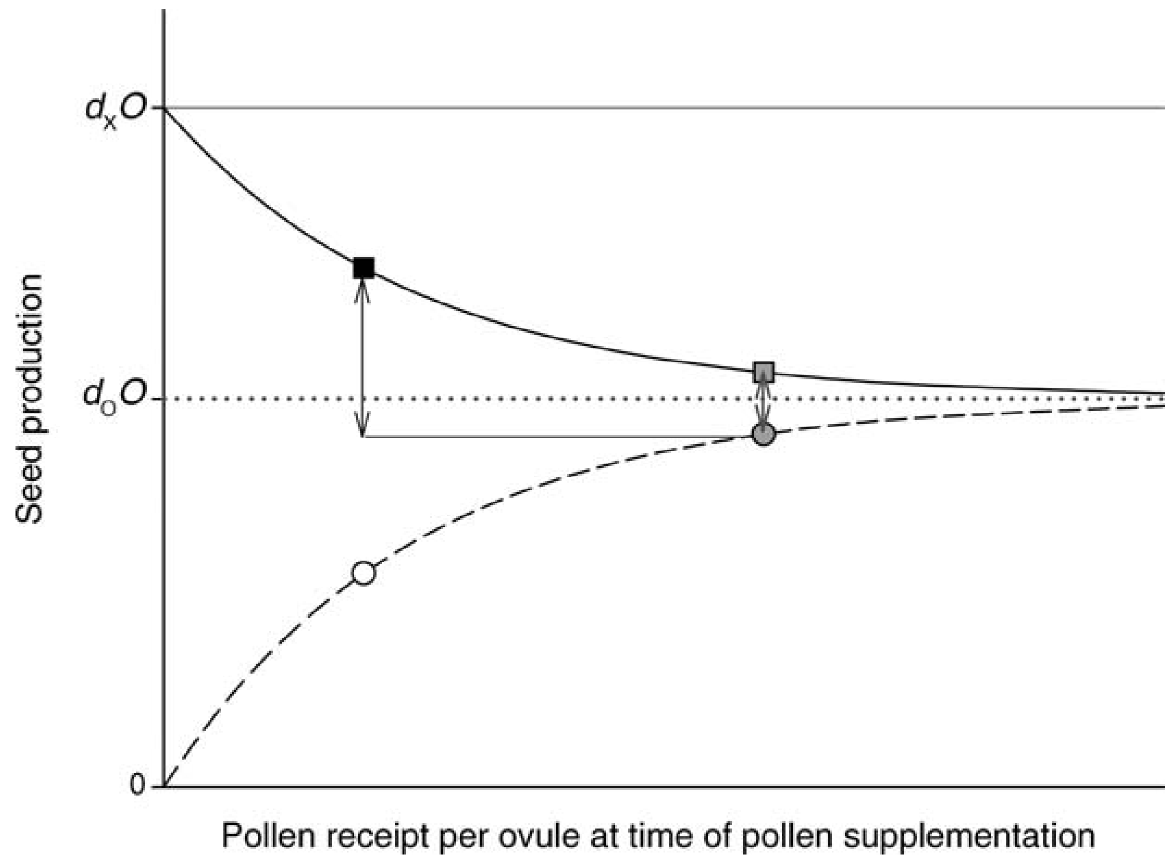


FIG. 2. Distribution of standardized effect sizes (e'; solid dots) and sampling variances ($v_{e'}$) for 85 cases where pollen supplementation was conducted at the whole-plant level (studies included are listed in the Appendix). Individual effect sizes that do not overlap 0 are significant at $P < 0.05$. We calculate e' as Hedges' d (i.e., the difference between the means of the supplement and control treatments, standardized by their pooled standard deviation and corrected for sample size bias, and sampling variance ($v_{e'}$) following Rosenberg et al. (2000:14–15).

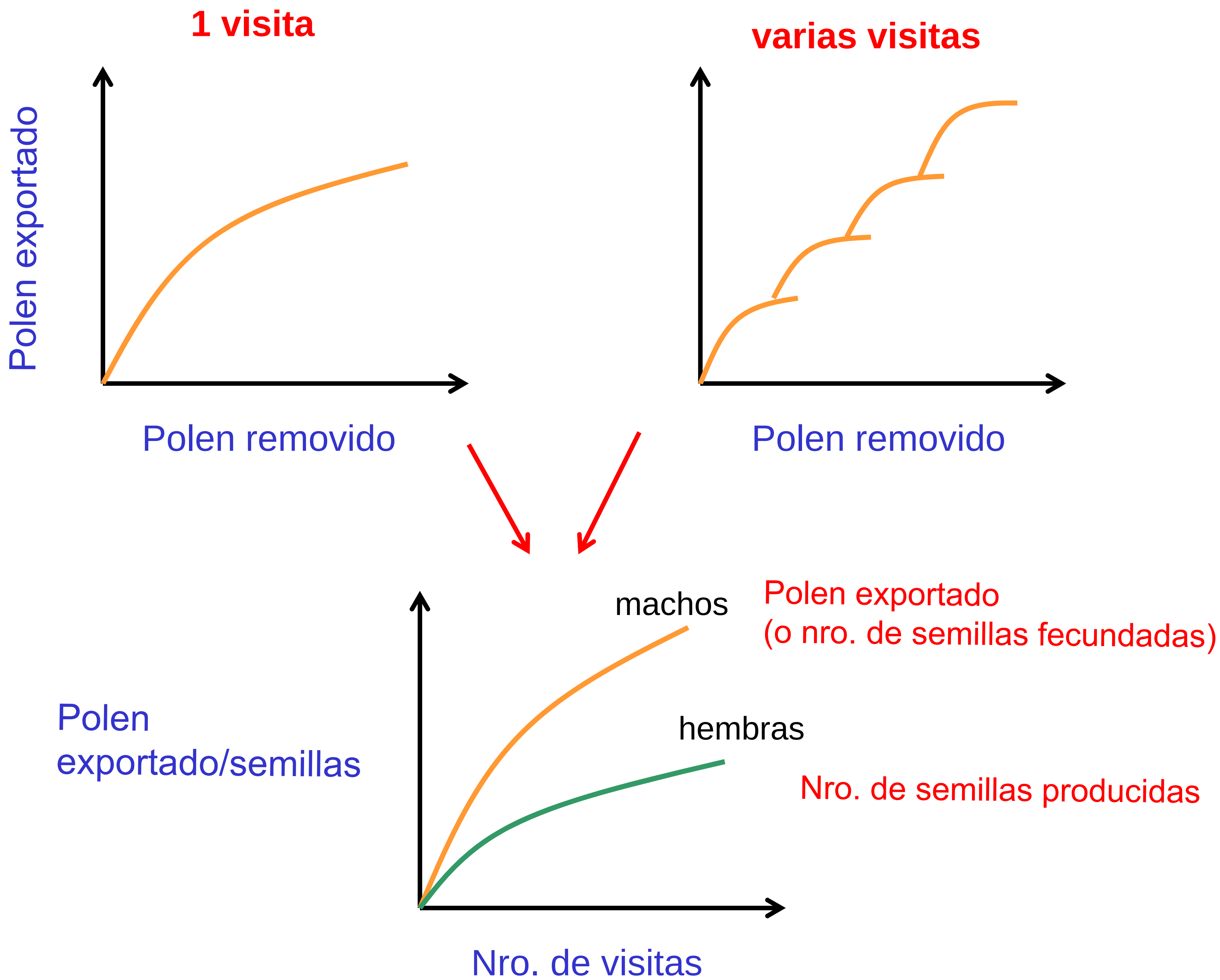


Aizen, M.A. y L.D. Harder. 2007. Expanding the limits of the pollen-limitation concept: effects of pollen quantity and quality. *Ecology* 88: 271-281.


a
b
100
80
60
40
20
0
No. flowers
1.0
0.8
0.6
0.4
0.2
0.0
Proportion of flowers setting fruit
0
10
20
30
40
50
60
No. pollen tubes in stigma



$d_x O$
$d_o O$
0
Seed production
Pollen receipt per ovule at time of pollen supplementation


1 visita
varias visitas
Polen exportado
Polen removido
Polen removido
machos
Polen exportado
(o nro. de semillas fecundadas)
hembras
Nro. de semillas producidas
Polen
exportado/semillas
Nro. de visitas

Rasgos que podrían ser explicados por selección sexual

- Nectar
- “Display” floral
- Polinias y poliadas
- Andromonoicismo
- Mimetismo intraspecífico
- Dimorfismo sexual

Table 1. Percentage of bees bearing *C. ochraceum* pollinaria (= loaded) and total number of bees foraging at different sources. *Euglossa* collecting chemical attractants were counted with binoculars for 1 of every 15 minutes from 0800 to 1200 on 20 days at cineole-saturated cotton wicks and from 0900 to 1100 on 5 days for each of 20 male and 20 female inflorescences in July and August 1984. Only *C. ochraceum* was in flower. ($\chi^2 = 31.48$, $P < 0.005$ for male versus female.)

Source	Bees	
	% Loaded	Total no.
C. ochraceum inflorescences		
Male	1.3	389
Female	10.8	592
Cineole baits	8.2	147

Romero, G.A. y D.E. Nelson. 1986. Sexual dimorphism in *Catasetum* orchids: forcible emplacement and male flower competition. Science 232: 1538-40.

Catasetum barbatum

Table 2. Pollinator size, extent of sexual dimorphism, and load* for *Catasetum* species from southern Venezuela. Values are means ± 95% confidence interval. One-tailed Fisher's exact test (*24*) ($P < 0.04$) was conducted on the number of species for level of dimorphism by pollinator taxon.

Pollinators		*Catasetum* dimorphism			
		Moderate dimorphism: hooded male flowers		Strong dimorphism: open male flowers	
Taxon	Live weight (mg)	No. of species	Load (mg)	No. of species	Load (mg)
Euglossa spp.	93.2 ± 3.4	1	9.6 ± 0.4	5	16.2 ± 0.9 to 21.7 ± 1.5
Eulaema cingulata†	615.1 ± 30.8	5	64.3 ± 1.6 to 129.7 ± 0.6	1	149.4 ± 2.1

*Mean wet weight of pollinarium and anther immediately after discharge. †The only frequent pollinator of these six species.

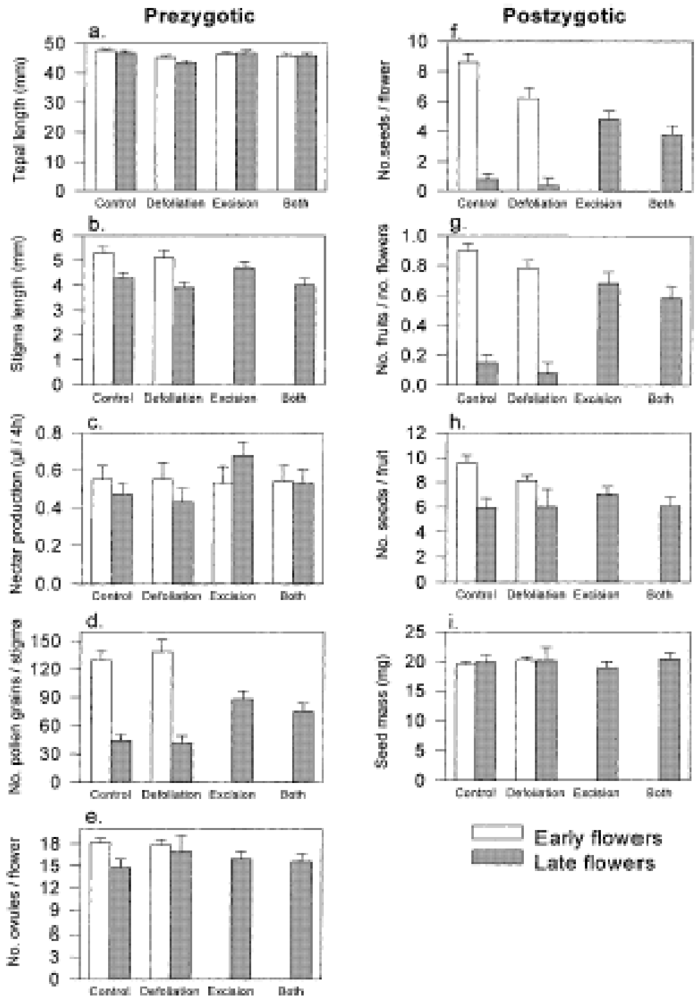


Fig. 1 Least-squares means ± 1 SE for each of the 2 × 2 combination categories of defoliation and stigma excision treatments for the different measured pre- and postzygotic characteristics of early- and late-opening flowers: **a** flower size (tepal length), **b** stigma size (stigma branch length), **c** nectar production rate (volume secreted/4 h), **d** pollen receipt (no. pollen grains/stigma), **e** ovule number (no. ovules/flower), **f** seed output (no. seeds/flower), **g** fruit set (no. fruits/flower), **h** seed set (no. seeds/fruit), and **i** seed size (individual seed mass) (*Control* no manipulation, *Defoliation* leaves removed only, *Excision* stigmas removed only, *Both* both leaves and stigmas removed). Effects due to defoliation are evaluated by comparing the Control vs. Defoliation, and Excision vs. Both means, and those due to stigma excision by comparing the Control vs. Excision and Defoliation vs. Both means. *F*-values associated with the defoliation and stigma excision factors are shown in Table 1

Ladio, A.H. y M.A. Aizen. 1999. Early reproductive failure increases nectar reward and pollination success of late-produced flowers in Alstroemeria aurea (Alstroemeriaceae). Oecologia 120: 235-241

Table 1a–i ANOVA results for effects of leaf removal, stigma excision of early flowers, and their interaction on pre- and postzygotic characteristics of early- and late-opening flowers. Flowering patch was included as a blocking factor. *F*-values were estimated from type III sums of squares (SAS 1988). See Fig. 1 for treatment means and variable definitions. Only the defoliation factor was included in the analysis of stigma size, pollen receipt, ovule number, and fruit and seed variables of early flowers

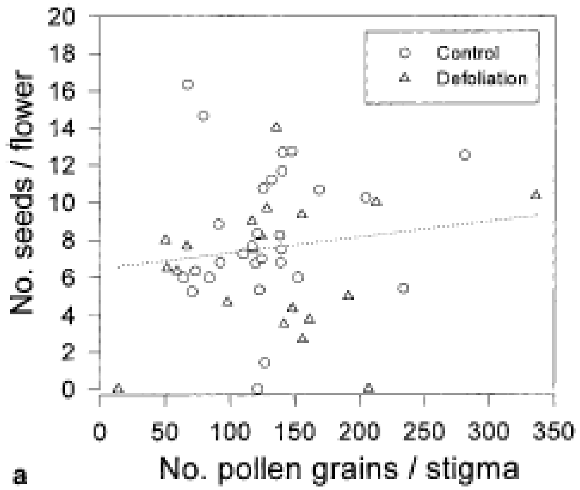
Prezygotic

Variable/Source	Early flowers			Late flowers		
	df	MS	*F*	*df*	MS	*F*
a Tepal length						
Defoliation (D)	1	47.79	3.48(*)	1	95.54	6.65^{*1}
Excision (E)	1	1.22	0.09	1	34.52	2.40
D × E	1	17.51	1.27	1	33.36	2.32
Block	2	30.34	2.21	2	0.87	0.06
Error	91	13.74		82	14.36	
b Stigma length						
Defoliation (D)	1	0.005	0.27	1	0.074	6.13^{*1}
Excision (E)	–	–	–	1	0.015	1.24
D × E	–	–	–	1	0.002	0.20
Block	2	0.062	3.69^{*1}	2	0.013	1.08
Error	46	0.017		85	0.012	
c Nectar production						
Defoliation (D)	1	0.189	1.14	1	0.192	2.01
Excision (E)	1	0.285	1.72	1	0.481	5.03^{*1}
D × E	1	0.213	1.28	1	0.058	0.60
Block	2	0.180	1.09	2	0.009	0.10
Error	87	0.166		76	0.096	
d Pollen receipt						
Defoliation (D)	1	988.2	0.30	1	1425.8	1.03
Excision (E)	–	–	–	1	31387.6	22.59^{*4}
D × E	–	–	–	1	647.2	0.47
Block	2	7011.3	2.16	2	2280.6	1.64
Error	46	3247.2		84	1389.3	
e Ovule number						
Defoliation (D)	1	0.65	0.05	1	5.95	0.43
Excision (E)	–	–	–	1	0.04	0.00
D × E	–	–	–	1	10.78	0.78
Block	2	2.18	0.17	2	11.98	0.86
Error	57	12.77		34	13.88	

Postzygotic

Variable/Source	Early flowers			Late flowers		
	df	MS	*F*	*df*	MS	*F*
f Seed output						
Defoliation (D)	1	88.99	7.01^{*1}	1	14.84	2.34
Excision (E)	–	–	–	1	305.71	48.28^{*4}
D × E	–	–	–	1	3.87	0.61
Block	2	31.51	2.48(*)	2	1.13	0.18
Error	61	12.69		97	6.33	
g Fruit set						
Defoliation (D)	1	0.232	2.78(*)	1	0.172	1.42
Excision (E)	–	–	–	1	6.110	50.42^{*4}
D × E	–	–	–	1	0.009	0.07
Block	2	0.049	0.59	2	0.100	0.83
Error	62	0.083		97	0.121	
h Seed set						
Defoliation (D)	1	31.75	4.09^{*1}	1	0.97	0.17
Excision (E)	–	–	–	1	2.42	0.41
D × E	–	–	–	1	1.73	0.29
Block	2	12.84	1.66	2	5.68	0.97
Error	57	7.75		34	5.85	
i Seed mass						
Defoliation (D)	1	4.28	0.45	1	7.78	0.53
Excision (E)	–	–	–	1	3.11	0.21
D × E	–	–	–	1	0.73	0.05
Block	2	29.86	3.17^{*1}	2	5.48	0.37
Error	57	9.42		34	14.76	

(*)$0.05 < P < 0.10$, $^{*1}P < 0.05$, $^{*2}P < 0.01$, $^{*3}P < 0.001$, $^{*4}P < 0.0001$



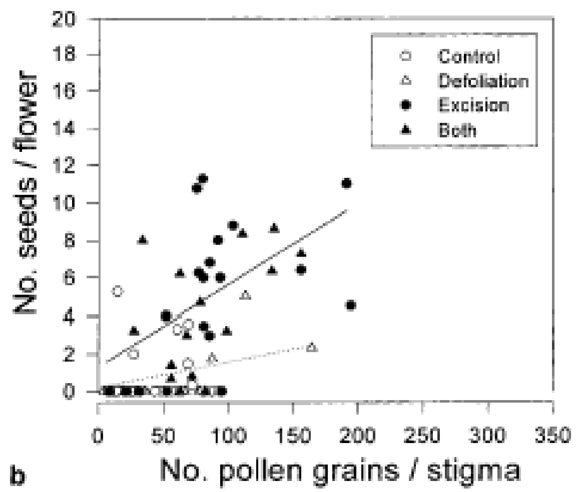


Fig. 2 Scatter plots of mean number of seeds per flower vs. pollen receipt for **a** early (primary) flowers and **b** late (secondary) flowers. Different *symbols* are used to identify ramets receiving the same defoliation and stigma excision treatment combination. *Lines* represent the least-squares regression equations: **a** $y = 6.47 + 0.0084x$ ($r^2 = 0.018$, $n = 49$, $P = 0.36$), and **b**, *dashed*, $y = -0.114 + 0.0138x$ ($r^2 = 0.127$, $n = 53$, $P < 0.01$) for ramets with untouched early flowers (i.e., Control and Defoliation categories pooled) and, *continuous*, $y = 0.946 + 0.0430x$ ($r^2 = 0.285$, $n = 35$, $P < 0.001$) for early flowers of which the stigmas were excised before receptivity (i.e., Excision and Both categories pooled)