

Supplementary material

Effectiveness of native nectar-feeding birds and the introduced *Apis mellifera* as pollinators of the kangaroo paw, *Anigozanthos manglesii* (Haemodoraceae)

Bronwyn M. Ayre^{A,B,F}, David G. Roberts^{B,E}, Ryan D. Phillips^{B,C,D}, Stephen D. Hopper^E
and Siegfried L. Krauss^{A,B}

^ASchool of Biological Sciences, University of Western Australia, 35 Stirling Highway,
Crawley, WA 6009, Australia.

^BKings Park Science, Department of Biodiversity, Conservation and Attractions,
2 Kattidj Close, Kings Park, WA 6005, Australia.

^CDepartment of Ecology, Environment and Evolution, La Trobe University,
Melbourne, Vic. 3086, Australia.

^DEcology and Evolution, Research School of Biology, The Australian National University,
Canberra, ACT 2600, Australia.

^ECentre for Excellence in Natural Resource Management, School of Agriculture and Environment,
University of Western Australia, 35 Stirling Terrace, Albany, WA 6330, Australia.

^FCorresponding author. Email: bronwyn.ayre@research.uwa.edu.au

Table S1. Measures of reproductive output following pollinator exclusion treatments on *Anigozanthos manglesii* flowers across four sites and 2 years

Means and standard deviations reported

Site	Treatment	Year	Total seeds	Total fruits	Flowers that produced fruit (%)	Seeds per fruit	Fruit volume (cm ³)	Seed mass (mg)	Viability (%)	Percentage germinated	Time to 50% germination
Kings Park 1	Total	2015	116	17	11.72 ± 4	6.50 ± 2.70	0.26 ± 0.08	0.87 ± 0.06	84 ± 6	82 ± 10%	19.60 ± 0.75
	Exclusion	2016	215	46	24.21 ± 6	4.67 ± 0.63	0.34 ± 0.02	0.71 ± 0.02	84 ± 6	73 ± 9%	19.00 ± 0.78
	Bird	2015	75	20	13.33 ± 3	9.40 ± 1.21	0.51 ± 0.13	0.81 ± 0.06	95 ± 4	87 ± 7%	17.9 ± 1.33
	Exclusion	2016	263	53	19.92 ± 6	4.96 ± 0.98	0.24 ± 0.01	0.77 ± 0.04	95 ± 4	74 ± 6%	15.69 ± 1.24
	Open	2015	1194	26	61.29 ± 8	22.58 ± 2.28	0.58 ± 0.03	0.85 ± 0.03	82 ± 4	83 ± 7%	16.87 ± 0.74
		2016	7432	124	62.94 ± 7	59.94 ± 5.37	0.45 ± 0.03	0.67 ± 0.04	86 ± 3	87 ± 5%	19.07 ± 0.73
Kings Park 2	Total	2015	10	2	1.39 ± 2	5.00 ± 1.0	0.24 ± 0.01	0.86 ± 0.01	88 ± 12	75 ± 25%	17.50 ± 0.5
	Exclusion	2016	62	23	11.33 ± 6	2.70 ± 3.04	0.32 ± 0.02	0.83 ± 0.08	100 ± 0.0	66 ± 9%	17.29 ± 0.81
	Bird	2015	314	42	25.3 ± 8	7.48 ± 2.25	0.33 ± 0.03	0.66 ± 0.04	90 ± 3	83 ± 6%	18.92 ± 0.45
	Exclusion	2016	1334	159	43.88 ± 6	8.39 ± 0.65	0.30 ± 0.02	0.77 ± 0.04	100 ± 0	85 ± 4%	17.00 ± 0.24
	Open	2015	3412	113	71.52 ± 9	30.19 ± 2.5	0.41 ± 0.02	0.82 ± 0.01	96 ± 1	90 ± 2%	18.73 ± 1.0
		2016	8501	221	72.46 ± 5	38.47 ± 3.04	0.82 ± 0.04	0.74 ± 0.03	99 ± 0.0	82 ± 5%	18.57 ± 0.42
Korung National Park 1	Total	2015	54	10	11.76 ± 3	5.4 ± 2.30	0.23 ± 0.07	0.82 ± 0.13	83 ± 15	78 ± 14%	18.50 ± 0.87
	Exclusion	2016	154	25	30.12 ± 9	6.16 ± 1.34	0.36 ± 0.03	1.1 ± 0.03	75 ± 19	74 ± 6%	18.75 ± 0.48
	Bird	2015	159	24	18.90 ± 5	6.63 ± 2.65	0.14 ± 0.01	0.93 ± 0.06	80 ± 7	63 ± 8%	19.82 ± 1.08
	Exclusion	2016	355	28	28.00 ± 4	12.68 ± 4.35	0.36 ± 0.04	0.93 ± 0.06	82 ± 8	75 ± 6%	17.08 ± 0.49
	Open	2015	3797	57	68.67 ± 8	66.61 ± 6.09	0.43 ± 0.06	0.97 ± 0.03	93 ± 2	88 ± 6%	16.53 ± 0.47
		2016	3295	70	67.96 ± 7	47.07 ± 5.05	0.45 ± 0.03	0.95 ± 0.06	100 ± 0.3	71 ± 5%	17.29 ± 0.31
Korung National Park 2	Total	2015	89	17	18.28 ± 7	5.24 ± 1.11	0.13 ± 0.01	1.04 ± 0.08	94 ± 5	59 ± 14%	19.75 ± 2.39
	Exclusion	2016	148	30	25.66 ± 5	5.10 ± 1.02	0.33 ± 0.03	1.03 ± 0.08	75 ± 7	72 ± 8%	16.00 ± 1.32
	Bird	2015	201	16	13.11 ± 6	12.58 ± 5.61	0.33 ± 0.05	1.0 ± 0.11	85 ± 8	81 ± 12%	17.29 ± 0.92
	Exclusion	2016	253	48	29.19 ± 5	5.38 ± 1.02	0.30 ± 0.03	1.09 ± 0.2	83 ± 2	72 ± 7%	18.62 ± 0.63
	Open	2015	2933	52	80.00 ± 5	57.49 ± 5.66	0.56 ± 0.05	0.85 ± 0.4	94 ± 1	91 ± 5%	16.00 ± 0.28
		2016	2229	95	77.97 ± 8	24.68 ± 2.78	0.42 ± 0.02	0.93 ± 0.4	94 ± 5	78 ± 7%	17.71 ± 0.82

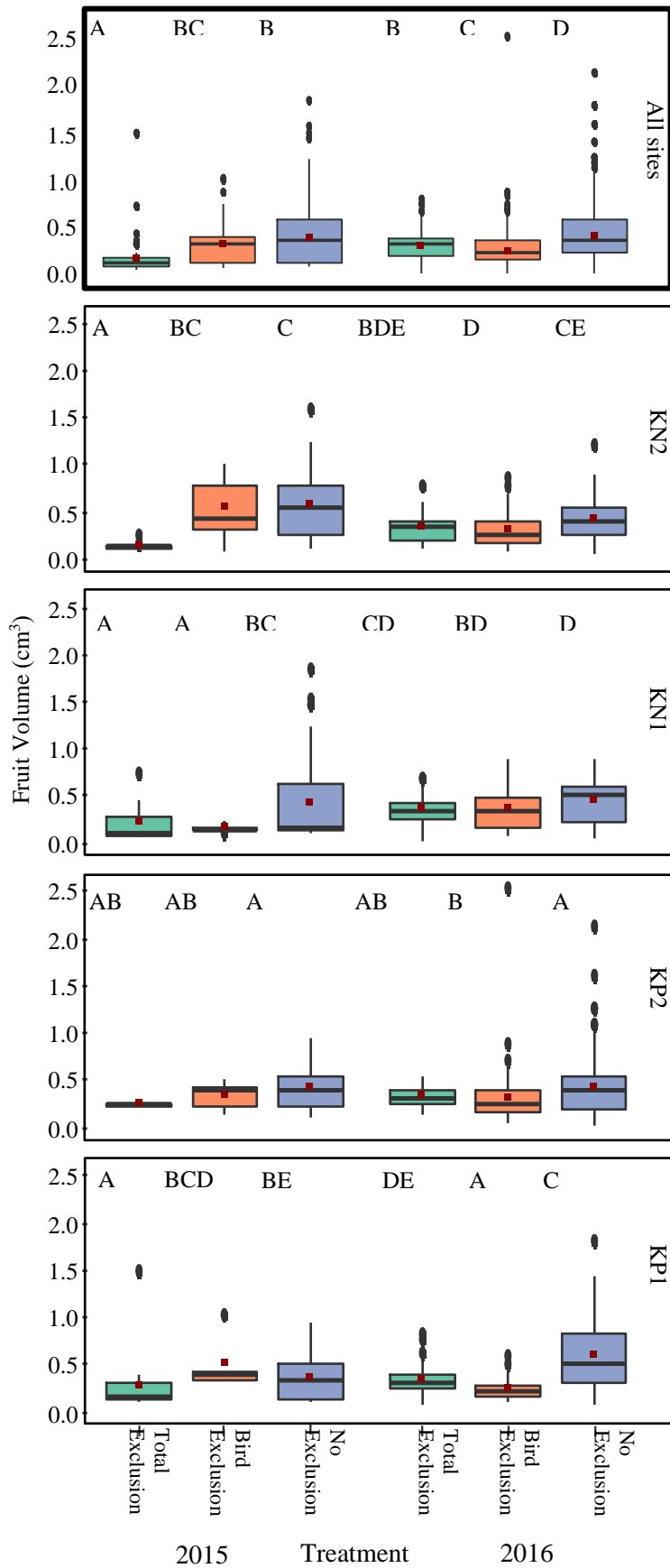


Fig. S1. Tukey's boxplots showing fruit volume following pollinator exclusion treatments on *Anigozanthos manglesii* flowers across four sites and 2 years. 'Total Exclusion', flowers excluded from all pollinators; 'Bird Exclusion', flowers excluded from all bird pollinators; and 'No exclusion', flowers that were left open and unmanipulated. Squares represent the mean, thick horizontal lines the median. The box represents the upper, median and lower quartiles and the whiskers indicate the 1.5× interquartile range. Black dots represent outliers. Letters indicate significance groupings with a $P < 0.05$ threshold. KN1, Korung National Park Site 1; KN2, Korung National Park Site 2; KP1, Kings Park Site 1; KP2, Kings Park Site 2.

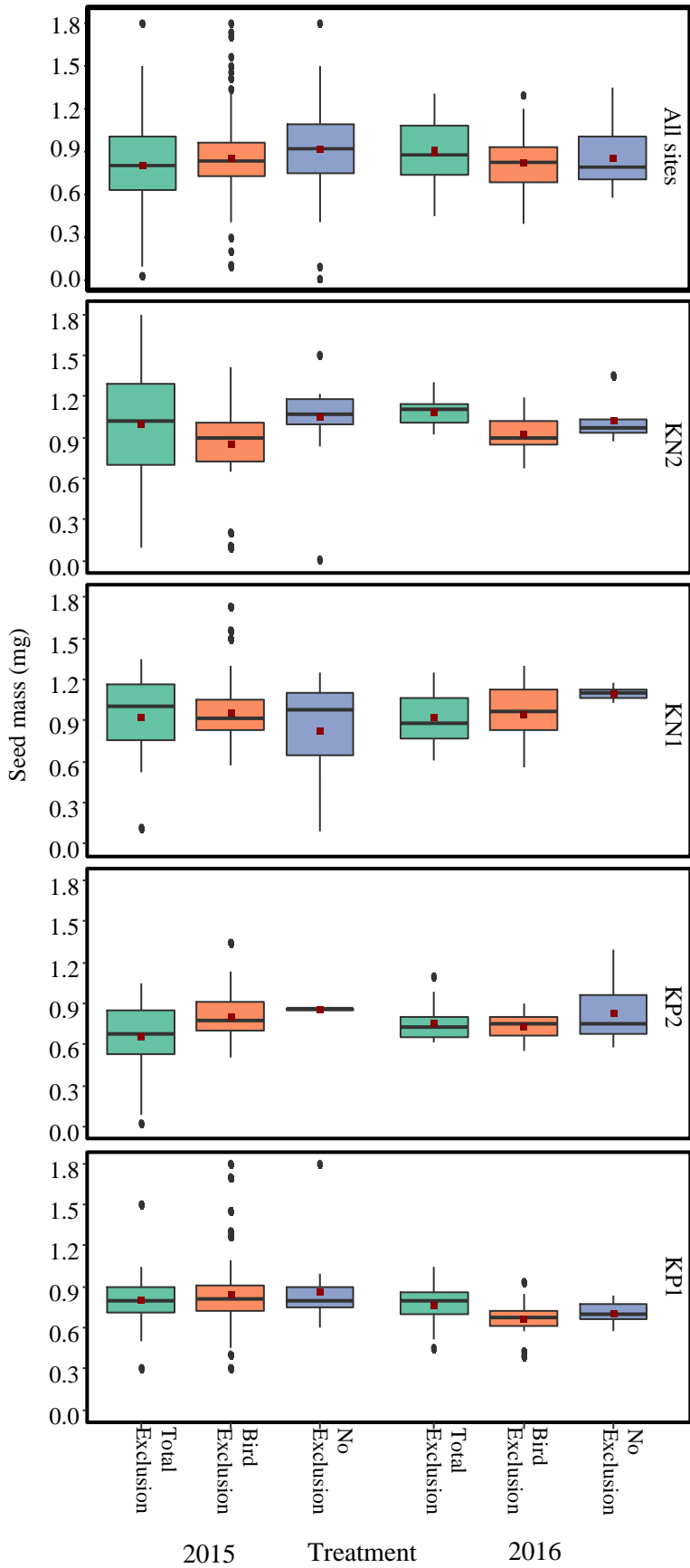


Fig. S2. Tukey's boxplots showing seed mass (mg) following pollinator exclusion treatments on *Anigozanthos manglesii* flowers across four sites and 2 years. 'Total Exclusion', flowers excluded from all pollinators; 'Bird Exclusion', flowers excluded from all bird pollinators; and 'No Exclusion', flowers that were left open and unmanipulated. Squares represent the mean, thick horizontal lines the median. The box represents the upper, median and lower quartiles and the whiskers indicate the 1.5× interquartile range. Black dots represent outliers. Letters indicate significance groupings with a $P < 0.05$ threshold. KN1, Korung National Park Site 1; KN2, Korung National Park Site 2; KP1, Kings Park Site 1; KP2, Kings Park Site 2.

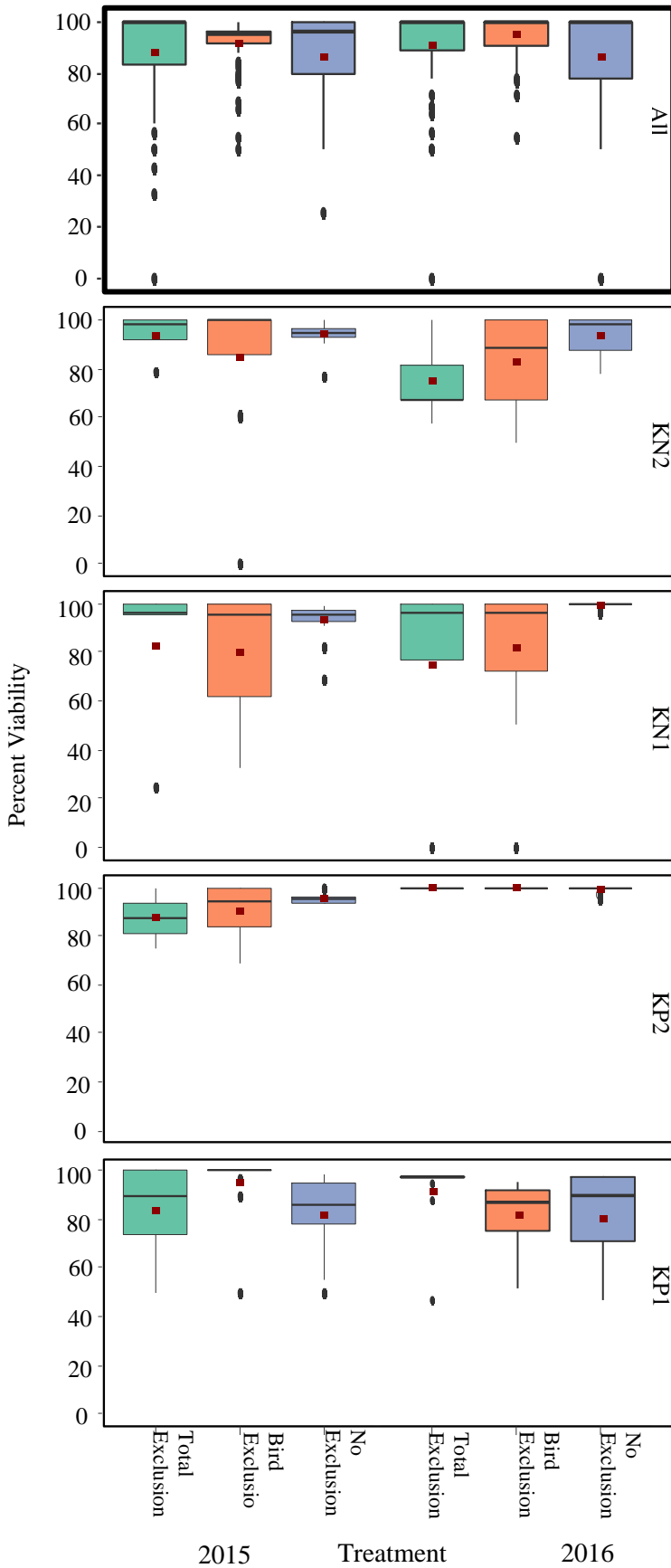


Fig. S3. Tukey’s boxplots showing seed viability following pollinator exclusion treatments on *Anigozanthos manglesii* flowers across four sites and 2 years. ‘Total Exclusion’, flowers excluded from all pollinators; ‘Bird Exclusion’, flowers excluded from all bird pollinators; and ‘No Exclusion’, flowers that were left open and unmanipulated. Squares represent the mean, thick horizontal lines the median. The box represents the upper, median and lower quartiles and the whiskers indicate the 1.5× interquartile range. Black dots represent outliers. Letters indicate significance groupings with a $P < 0.05$ threshold. KN1, Korung National Park Site 1; KN2, Korung National Park Site 2; KP1, Kings Park Site 1; KP2, Kings Park Site 2.

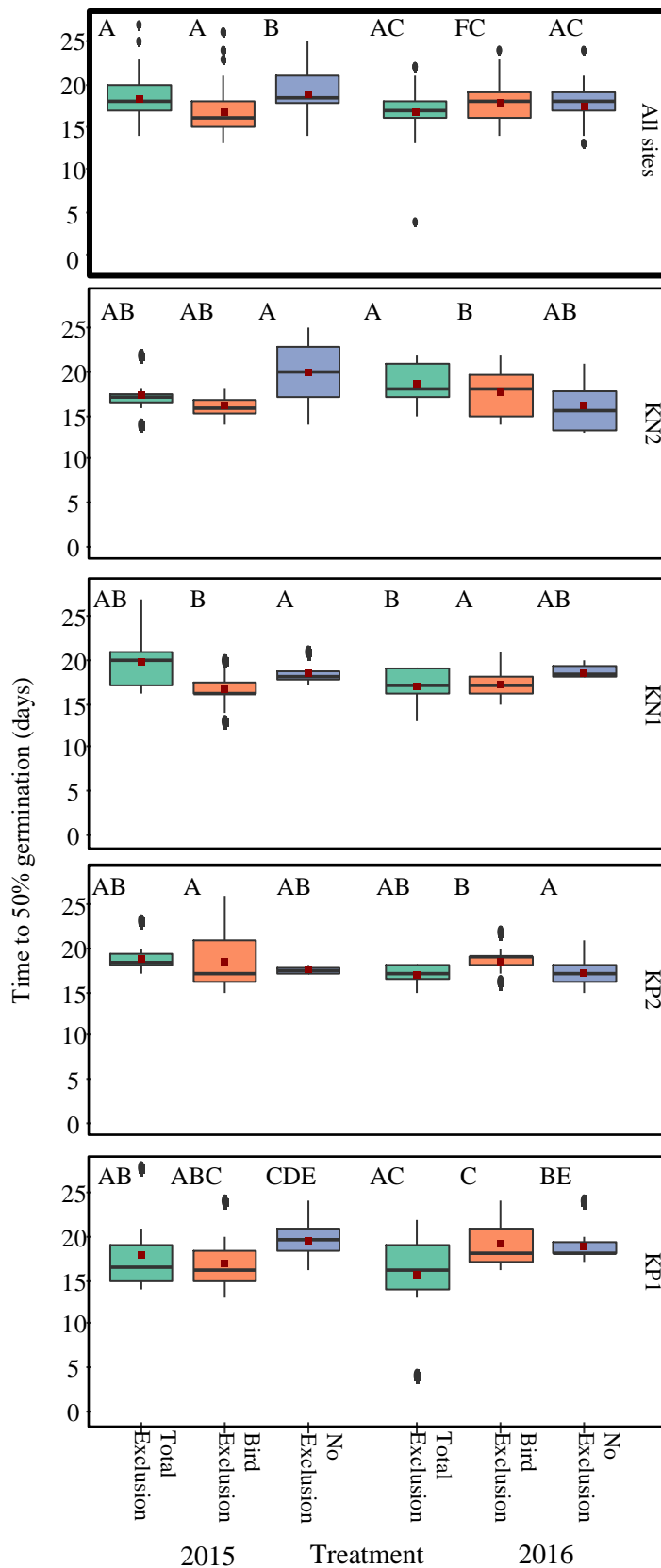


Fig. S4. Tukey's boxplots showing time to 50% germination following pollinator exclusion treatments on *Anigozanthos manglesii* flowers across four sites and 2 years. 'Total Exclusion', flowers excluded from all pollinators; 'Bird Exclusion', flowers excluded from all bird pollinators; and 'No Exclusion', flowers that were left open and unmanipulated. Squares represent the mean, thick horizontal lines the median. The box represents the upper, median and lower quartiles and the whiskers indicate the 1.5× interquartile range. Black dots represent outliers. Letters indicate significance groupings with a $P < 0.05$ threshold. KN1, Korung National Park Site 1; KN2, Korung National Park Site 2; KP1, Kings Park Site 1; KP2, Kings Park Site 2.