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Supplementary material

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Appendix:

Evaluation of the possible effect of collinearity between parasitism status and brood size (A);

Model analysing magpies' provisioning rates in a subset of nests with the most common brood sizes (B);

Model analysing magpies' breeding phenology in the following breeding season (C);

Results of full models including non-significant interactions (D);

Models explaining magpies' breeding phenology in the subsequent breeding season including the other member of the pair (E, see Methods).

A) Evaluation of the possible effect of collinearity between parasitism status and brood size

Table A1: Factors affecting provisioning rate in magpies. Model excluding parasitism status.

Fixed effects		β	Lower CI	Upper CI	Z	*p*-value
Intercept		**1.08**	**0.98**	**1.18**	**20.46**	**<0.001**
Brood size		**0.13**	**0.02**	**0.24**	**2.41**	**0.016**
Brood age		**0.14**	**0.02**	**0.26**	**2.26**	**0.023**
Nest volume		-0.10	-0.22	0.01	-1.73	0.083
Laying date		0.03	-0.08	0.15	0.55	0.585
Sex		-0.13	-0.31	0.06	-1.35	0.177
Year:	2009	-0.04	-0.45	0.37	-0.20	0.839
	2010	0.12	-0.18	0.42	0.77	0.440
	2011	0.23	-0.17	0.64	1.13	0.259
	2016	0.25	-0.12	0.62	1.30	0.192
Random effect		σ			LRT	*p*-value
Pair identity		0.09			0.15	0.70

Results of a GLMM (Poisson distribution, log link function) testing the effect of brood size, brood age, nest volume, laying date, sex, year and pair identity on provisioning visits in magpies. Significant estimates are highlighted in bold. 95% CI were calculated by the Wald approximation; parameter estimates were calculated by the Gauss-Hermite approximation to the log-likelihood with 25 quadrature points; *p*-values for fixed effects were calculated by a Wald Z test; *p*-value for year and the random effect was calculated by a likelihood ratio test. Marginal R^2 = 0.19; Conditional R^2 = 0.21 (calculated following Nakagawa and Schielzeth (2017); MuMIn package, version1.43.15, Bartoń (2019)).

B) Model analysing magpies' provisioning rates in a subset of nests with the most common brood sizes

Table A2: Factors affecting magpies' provisioning rates in a subset of nests with the most common brood sizes in parasitized nests (i.e., 1 or 2 cuckoo nestlings) and non-parasitized ones (i.e., 4 or more magpie nestlings) (N = 64 individuals, 32 nests).

Fixed effects	B	Lower CI	Upper CI	Z	*p*-value
Intercept	**1.09**	**0.96**	**1.22**	**16.97**	**<0.001**
Parasitism status	**-0.30**	**-0.56**	**-0.04**	**-2.29**	**0.022**

Brood age	0.06	-0.07	0.19	0.89	0.375
Nest volume	-0.10	-0.24	0.03	-1.53	0.127
Laying date	0.05	-0.08	0.18	0.74	0.457
Sex	-0.17	-0.38	0.04	-1.60	0.110
Random effect	Σ			LRT	*p*-value
Pair identity	0.18			1.56	0.211

Results of a GLMM (Poisson distribution, log link function) testing the effect of parasitism status, brood age, nest volume, laying date, sex and pair identity on individual provisioning rates. Significant estimates are highlighted in bold. 95% CI were calculated by the Wald approximation; parameter estimates were calculated by the Gauss-Hermite approximation to the log-likelihood with 25 quadrature points; *p*-values were calculated by a Wald Z test; *p*-value for random effect was calculated by a likelihood ratio test. Marginal $R^2 = 0.14$; Conditional $R^2 = 0.23$ (calculated following Nakagawa and Schielzeth (2013); MuMIn package, version 1.43.15, Bartoń (2019)).

C) Model analysing magpies' breeding phenology in the following breeding season

Table A3: Factors affecting magpies breeding phenology in the following breeding season (n = 23 individuals).

	β	Lower CI	Upper CI	df	F	*p*-value
Intercept	0	-0.32	0.32	1,19	0	1.000
Parasitism status in t	**0.72**	**0.01**	**1.44**	**1,19**	**4.48**	**0.048**
Provisioning rate in t	0.21	-0.16	0.58	1,19	1.38	0.255
Laying date in t	**0.62**	**0.27**	**0.97**	1,19	**13.44**	**0.002**

Results of a LM testing the effect of parasitism status, provisioning rates and laying date in year t on magpies' laying date in t + 1. Significant estimates are highlighted in bold. Multiple $R^2 = 0.52$; Adjusted $R^2 = 0.44$.

D) Results of full models including non-significant interactions

Table A4: Factors affecting provisioning rate in magpies (N = 78 individuals, 39 nests).

Fixed effects		β	Lower CI	Upper CI	Z	*p*-value
Intercept		**1.14**	**0.97**	**1.31**	**12.86**	**<0.001**
Parasitism status		0.23	-0.13	0.58	1.26	0.207
Brood size		**0.23**	**0.05**	**0.41**	**2.48**	**0.013**
Brood age		**0.13**	**0.02**	**0.25**	**2.23**	**0.026**
Nest volume		-0.10	-0.22	0.01	-1.76	0.079
Laying date		0.02	-0.10	0.14	0.36	0.715
Sex		-0.12	-0.31	0.07	-1.28	0.200
Year:	2009	-0.08	-0.51	0.35	-0.37	0.713
	2010	0.09	-0.23	0.41	0.54	0.589

2011	0.11	-0.34	0.55	0.48	0.633
2016	0.22	-0.15	0.60	1.17	0.242
Sex × Parasitism status	0.28	-0.10	0.66	1.42	0.154
Brood size × Parasitism status	0.19	-0.23	0.61	0.87	0.384
Random effect	σ			LRT	*p*-value
Pair identity	0.06			0.03	0.86

Results of a GLMM (Poisson distribution, log link function) testing the effect of parasitism status, brood size, brood age, nest volume, laying date, sex, year, sex in interaction with parasitism status, brood size in interaction with parasitism status and pair identity on provisioning rates in magpies . Significant estimates are highlighted in bold. 95% CI were calculated by the Wald approximation; parameter estimates were calculated by the Gauss-Hermite approximation to the log-likelihood with 25 quadrature points; *p*-values for fixed effects were calculated by a Wald Z test; *p*-value for the random effect was calculated by a likelihood ratio test. Marginal R^2: 0.21; Conditional R^2: 0.22 (calculated following Nakagawa and Schielzeth (2013); MuMIn package, version 1.43.15, Bartoń (2019)).

Table A5: Factors affecting magpies' provisioning rates in a subset of nests with the most common brood sizes in parasitized nests (i.e., 1 or 2 cuckoo nestlings) and non-parasitized ones (i.e., 4 or more magpie nestlings) (N = 64 individuals, 32 nests).

Fixed effects	β	Lower CI	Upper CI	Z	*p*-value
Intercept	**1.09**	**0.96**	**1.21**	**16.97**	**<0.001**
Parasitism status	**-0.30**	**-0.55**	**-0.04**	**-2.26**	**0.024**
Brood age	0.06	-0.07	0.19	0.89	0.375
Nest volume	-0.10	-0.24	0.03	-1.53	0.127
Laying date	0.05	-0.08	0.18	0.74	0.457
Sex	-0.16	-0.38	0.05	-1.51	0.131
Sex × Parasitism status	0.09	-0.34	0.53	0.43	0.670
Random effect	σ			LRT	*p*-value
Pair identity	0.18			1.56	0.211

Results of a GLMM (Poisson distribution, log link function) testing the effect of parasitism status, brood size, brood age, nest volume, laying date, sex, year, the interaction between sex and parasitism status and pair identity on individual provisioning rates in a subset of nests which contain 1 or 2 cuckoo nestlings and 4 or more magpie nestlings. Significant estimates are highlighted in bold. 95% CI were calculated by the Wald approximation; parameter estimates were calculated by the Gauss-Hermite approximation to the log-likelihood with 25 quadrature points; *p*-values were calculated by a Wald Z test; *p*-value for random effect was calculated by a likelihood ratio test. Marginal R^2: 0.14; Conditional R^2: 0.23 (calculated following Nakagawa and Schielzeth (2013); MuMIn package, version1.43.15, Bartoń (2019)).

Table A6: Factors affecting adults' presence in the following breeding season (t + 1) (n = 49 individuals, 39 nests).

Fixed effects	β	Lower CI	Upper CI	df	LRT	*p*-value
Intercept	0.48	-0.79	1.76	1	0.65	0.42
Parasitism status in t	0.86	-1.56	3.29	2	0.63	0.73
Brood size in t	1.11	-0.41	2.63	2	2.98	0.23
Provisioning rate in t	0.08	-0.63	0.79	1	0.05	0.82
Laying date in t	-0.68	-1.60	0.24	1	2.91	0.09

Sex	-0.59	-2.08	0.89	1	0.72	0.39
Brood size in t × Parasitism status in t	0.91	-1.93	3.75	1	0.42	0.52
Random effects	σ				LR	*p*-value
Pair identity	0.54				0.01	0.91

Results of a GLMM (Binomial distribution, logit link function) testing the effect of parasitism status, brood size, provisioning rate, laying date, sex, brood size in interaction with parasitism status and pair identity on the presence/absence of adult magpies in the subsequent breeding season. 95% CI were calculated by the Wald approximation; parameter estimates were calculated by the Gauss-Hermite approximation to the log-likelihood with 25 quadrature points; *p*-values for fixed and random effects were calculated by a likelihood ratio test. Marginal R^2: 0.23; Conditional R^2: 0.28 (calculated following Nakagawa and Schielzeth (2013); MuMIn package, version1.43.15, Bartoń (2019)).

Table A7: Factors affecting magpies' breeding phenology in the following breeding season (n = 23 individuals).

	β	Lower CI	Upper CI	df	F	*p*-value
Intercept	0.06	-0.27	0.40	1,17	0.16	0.690
Parasitism status in t	**0.70**	**0.01**	**1.40**	**1,17**	**4.47**	**0.049**
Provisioning rate in t	0.14	-0.23	0.52	1,17	0.65	0.431
Laying date in t	**0.52**	**0.16**	**0.89**	1,17	**9.04**	**0.008**
Parasitism status in t × Provisioning rate in t	0.10	-0.71	0.92	1,17	0.07	0.790
Parasitism status in t × Laying date in t	0.59	-0.14	1.31	1,17	2.93	0.105

Results of a LM testing the effect of parasitism status, provisioning rates, laying date and the interaction between brood parasitism and laying date in year t on magpies' laying date in t + 1 (N = 23). Significant estimates are highlighted in bold. Multiple R^2: 0.61; Adjusted R^2: 0.50.

Table A8: Factors affecting difference in laying dates between two consecutive breeding seasons in magpies (n = 23 individuals).

	β	Lower CI	Upper CI	df	F	*p*-value
Intercept	-0.03	-0.45	0.39	1,19	3.32	0.084
Parasitism status in t	**0.73**	**-0.02**	**1.48**	**1,19**	**4.61**	**0.045**
Provisioning rate in t	-0.02	-0.46	0.41	1,19	0.27	0.610
Parasitism status in t × Provisioning rate in t	-0.19	-0.96	0.59	1,19	0.22	0.640

Results of a LM fitted by GLS testing the effect of parasitism status and provisioning rate in year t on the differences in laying dates between year t and year t + 1. Significant estimates are highlighted in bold. $R^2 = 0.16$ (piecewiseSEM package, version 2.1.0, Lefcheck (2016)).

E) Models explaining magpies' breeding phenology in the subsequent breeding season including the other member of the pair.

Table A9: Factors affecting magpies' breeding phenology in the following breeding season. Model including the member of the pair excluded in Supplementary material, Appendix 1C, Table A3 (n = 23 individuals).

	β	Lower CI	Upper CI	df	F	*p*-value

Intercept	0.06	-0.27	0.41	1,17	0.18	0.675
Parasitism status in t	**0.93**	**0.24**	**1.64**	1,17	**7.95**	**0.012**
Provisioning rate in t	0.22	-0.15	0.60	1,17	1.59	0.224
Laying date in t	**0.42**	**0.06**	**0.78**	1,17	**5.93**	**0.026**
Parasitism status in t × Provisioning rate in t	0.32	-0.47	1.11	1,17	0.73	0.403
Parasitism status in t × Laying date in t	0.41	-0.32	1.14	1,17	1.43	0.249

Results of a LM testing the effect of parasitism status, provisioning rates, laying date and the interaction between brood parasitism and laying date in year t on magpies laying date in t + 1. Significant estimates are highlighted in bold. Multiple R^2: 0.59; Adjusted R^2: 0.47.

Table A10: Factors affecting the difference in laying dates between two consecutive breeding seasons in magpies. Model including the member of the pair excluded in Table 3 (n = 23 individuals).

	β	Lower CI	Upper CI	df	F	*p*-value
Intercept	0	-0.41	0.42	1,19	0.77	0.392
Parasitism status in t	**0.88**	**0.09**	**1.67**	**1,19**	**4.88**	**0.040**
Provisioning rate in t	0.06	-0.38	0.49	1,19	0.09	0.764
Parasitism status in t × Provisioning rate in t	0.02	-0.79	0.82	1,19	0.00	0.964

Results of a LM fitted by GLS testing the effect of parasitism status and provisioning rate in year t on the differences in laying dates between year t and year t + 1 (i.e., laying date in t+1 minus laying date in t). Significant estimates are highlighted in bold. $R^2 = 0.18$ (piecewiseSEM package, version 2.1.0, Lefcheck (2016)).