

Electronic supplementary materials

Wolbachia both aids and hampers the performance of spider mites on different host plants

Zéle, F., Santos, J., Godinho, D., Magalhães, S.

Figure S1. Status of infection by *Wolbachia*, *Cardinium* and *Rickettsia* of each of the 20 females tested for each *T. urticae* population collected on different host plants. Each graph represents a population, in which the rows correspond to individual mites and the columns to their infection status by W: *Wolbachia*; C: *Cardinium*; and R: *Rickettsia*. White cells: uninfected; Grey cells: infected.

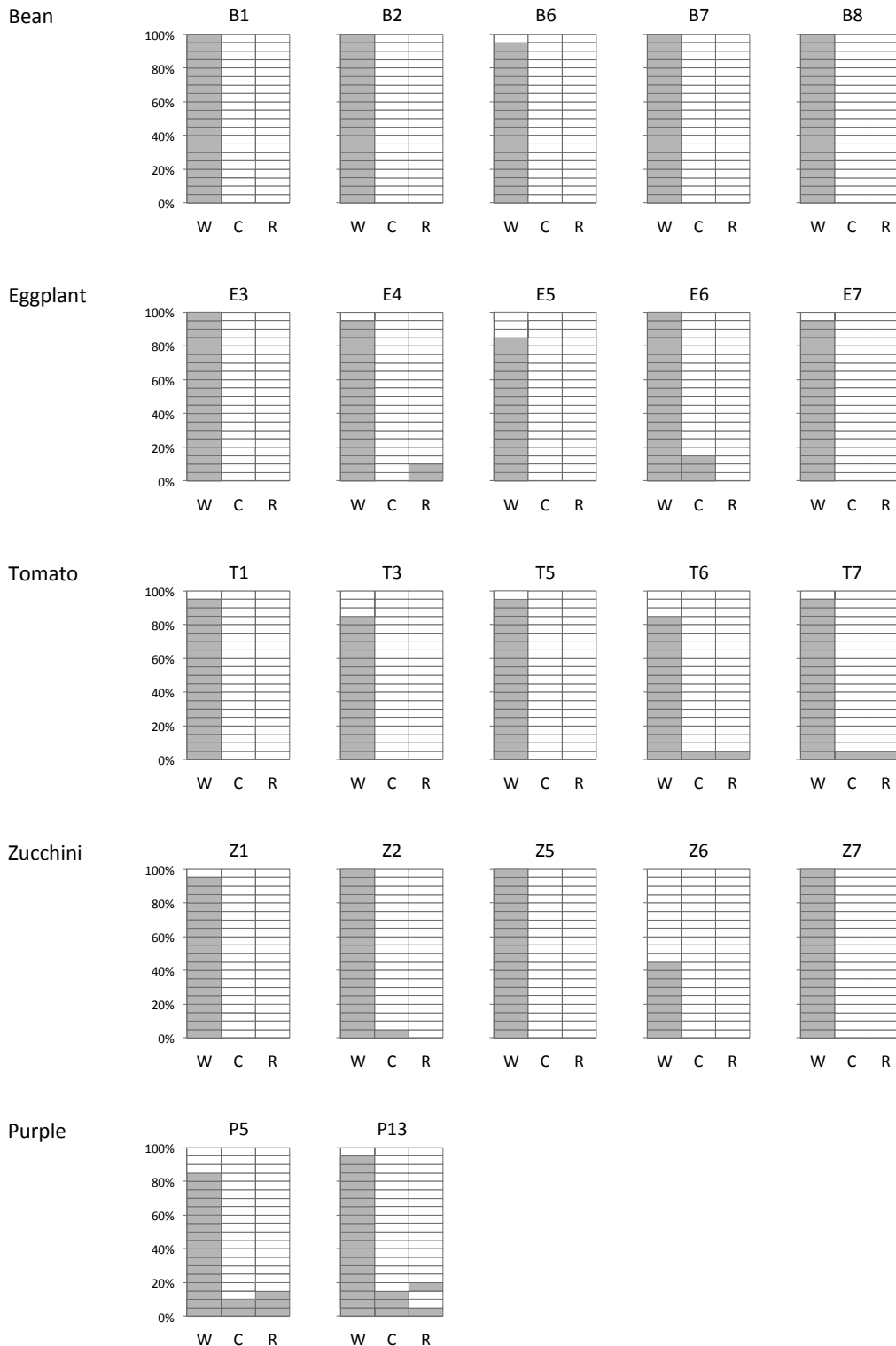


Figure S2. Effect of host plant and of *Wolbachia* on the survival of *T. urticae* females. Survival curves of tetracycline-treated (dashed lines) and *Wolbachia*-infected (solid lines) females placed on (a) bean, (b) purple, (c) zucchini and (d) eggplant leaf-discs during 6 days.

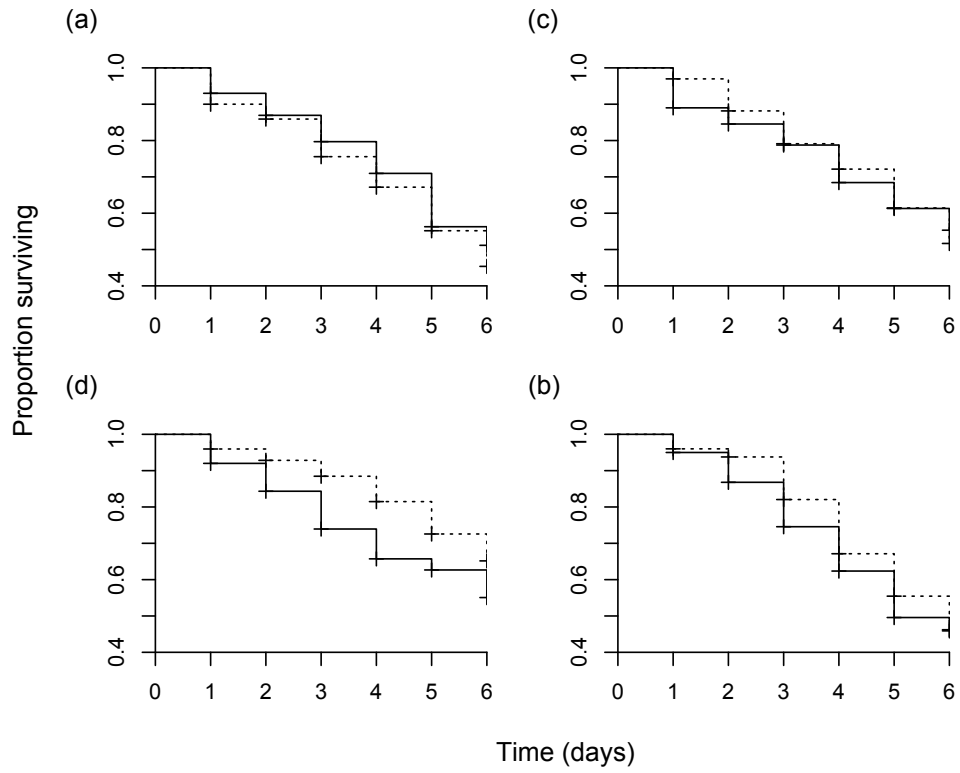


Table S1. Sampling locations of *Tetranychus* spider mites collected on bean, eggplant, purple, tomato and zucchini in June and July 2015. The table includes the information of the mite species: *T. urticae* red form (TuR), *T. urticae* green form (TuG) and *T. ludeni* (TI) infecting each plant. Unlike previous sampling events conducted in Portugal (Zélé et al. 2018a), none of the collected populations belonged to *T. evansi*.

Host Plant	Name	Date	Location	Coordinates	Mite species	
Bean <i>Phaseolus vulgaris</i>	B1 ¹	08-06-2015	Hortas da Cortesia, São João das Lampas	38.865278, -9.384006	TuR	
	B2 ¹	08-06-2015	Pêro Pinheiro	38.851900, -9.326903	TuR+TI	
	B3	09-06-2015	Quinta de Santo António, Pegões	38.686669, -8.591297	TuG+TuR+TI	
	B4	09-06-2015	Quinta do Poial, Galeotas	38.536103, -9.000375	TuR+TI	
	B5	09-06-2015	Quinta das Margaridas, Pegões	38.687033, -8.591386	TI	
	B6 ¹	10-06-2015	Correias	39.342914, -8.797936	TuG+TuR	
	B7 ¹	10-06-2015	Biofrade, Lourinhã	39.258314, -9.294675	TuR	
	B8 ¹	10-06-2015	Aromas do Outeiro, Carregado	39.026500, -8.982278	TuR	
Eggplant <i>Solanum melongena</i>	E1	09-06-2015	Quinta do Poial, Galeotas	38.536103, -9.000375	Tu+TI	
	E2	09-06-2015	Quinta de Santo António, Pegões	38.686669, -8.591297	TuG+TuR+TI	
	E3 ¹	10-06-2015	Aromas do Outeiro, Carregado	39.026500, -8.982278	TuR	
	E4 ¹	10-06-2015	Ribeira de Fráguas	39.366414, -8.851036	TuR	
	E5 ¹	10-06-2015	Biofrade, Lourinhã	39.258314, -9.294675	TuR+TI	
	E6 ¹	15-06-2015	Alvalade, Lisbon	38.755283, -9.147203	TuR+TI	
	E7 ¹	16-06-2015	Quinta Pedagógica dos Olivais, Lisbon	38.762897, -9.112419	TuR+TI	
Purple <i>Ipomoea purpurea</i>	P1	08-06-2015	Terrugem	38.840756, -9.374494	TI	
	P2	08-06-2015	Pêro Pinheiro	38.850744, -9.327011	TI	
	P3	08-06-2015	Alfouvar de Cima	38.868550, -9.284800	TI	
	P4	10-06-2015	Casal Vale do Medo	39.248450, -9.294550	TI	
	P5 ¹	14-06-2015	Alvalade, Lisbon	38.755283, -9.147203	TuR+TI	
	P6	14-06-2015	Alvalade, Lisbon	38.753250, -9.146356	TI	
	P7	25-06-2015	Sete Rios, Lisbon	38.740689, -9.166178	TI	
	P8	25-06-2015	Campolide	38.730769, -9.167833	TuR ² +TI	
	P9	28-06-2015	Coimbra	40.211700, -8.402106	TI	
	P11	02-07-2015	Jardim Botânico, Lisbon	38.717894, -9.149653	TI	
	P12	02-07-2015	Alcântara	38.707181, -9.175942	TI	
	P13 ¹	08-07-2015	Fernão Ferro	38.580006, -9.102147	TuR+TI	
	P14	08-07-2015	Vale de Gatos	38.630586, -9.136025	TI	
	P15	08-07-2015	Sesimbra	38.448725, -9.105550	TI	
	P17	08-07-2015	Venda Nova	38.483467, -9.104325	TI	
	P18	11-07-2015	Évora de Alcobaça	39.520042, -8.966897	TI	
	P19	11-07-2015	Chiqueda	39.542350, -8.953192	TI	
	P20	11-07-2015	Juncal	39.601828, -8.887736	TI	
	P21	11-07-2015	Aljubarrota	39.570606, -8.920497	TI	
	P22	11-07-2015	Cumeira	39.586336, -8.894306	TI	
	P23	11-07-2015	Cascais	38.717122, -9.433808	TI	
	P24	11-07-2015	Cascais	38.724636, -9.466950	TI	
	P25	11-07-2015	Cascais	38.701583, -9.424286	TI	
	P26	15-07-2015	Sintra	38.798969, -9.387533	TI	
	P27	18-07-2015	Tituarria	38.948611, -9.210114	TI	
	P28	18-07-2015	Roussada	38.944856, -9.219064	TI	
	P29	19-07-2015	Pederneira	39.588375, -9.067222	TI	
	P30	19-07-2015	Valado dos Frades	39.588642, -9.028781	TI	
	P31	25-07-2015	São Romão	39.733819, -8.794236	TI	
	P32	25-07-2015	Boa Vista	39.776908, -8.761403	TI	
	P33	25-07-2015	Machados	39.783811, -8.750742	TI	
	P34	25-07-2015	Planalto	39.757536, -8.786817	TI	
	P35	25-07-2015	Maceira	39.684822, -8.889311	TI	
	Tomato <i>Solanum lycopersicum</i>	T1 ¹	08-06-2015	Hortas da Cortesia, São João das Lampas	38.865278, -9.384006	TuR
		T2	09-06-2015	Quinta de Santo António, Pegões	38.686669, -8.591297	TuR ² +TI
T3 ¹		10-06-2015	Aromas do Outeiro, Carregado	39.026500, -8.982278	TuR+TI	
T4		10-06-2015	Correias	39.342914, -8.797936	TuR ²	
T5 ¹		13-06-2015	Campo Grande, Lisbon	38.755775, -9.156075	TuR	
T6 ¹		16-06-2015	Campo Pequeno, Lisbon	38.744336, -9.144289	TuR	
T7 ¹		16-06-2015	Quinta Pedagógica dos Olivais, Lisbon	38.762897, -9.112419	TuR	
Zucchini <i>Cucurbita pepo</i>	Z1 ¹	08-06-2015	Hortas da Cortesia, São João das Lampas	38.865278, -9.384006	TuR	
	Z2 ¹	09-06-2015	Quinta do Poial, Galeotas	38.536103, -9.000375	TuR	
	Z3	09-06-2015	Quinta de Santo António, Pegões	38.686669, -8.591297	TI	
	Z4	09-06-2015	Quinta das Margaridas, Pegões	38.687033, -8.591386	TuR+TI	
	Z5 ¹	10-06-2015	Correias	39.342914, -8.797936	TuR	
	Z6 ¹	10-06-2015	Ribeira de Fráguas	39.366414, -8.851036	TuR	
	Z7 ¹	10-06-2015	Aromas do Outeiro, Carregado	39.026500, -8.982278	TuR	

¹ populations selected to test the prevalence of endosymbionts.

² less than 10 individual mites found, so that population was excluded from further analyses.

Table S2. Description of the statistical models used in analysis of the prevalence of endosymbionts in field-collected mites on different host plants and of the effect of plants and of *Wolbachia* infection on *T. urticae* performance. Models with binomial error structure require either a binary response variable (e.g. drowned and infection) or a concatenated response variable binding together the number of successes and failures for a given outcome using the function 'cbind'. In the mixed model *bgfmer* procedure the prior for the fixed effects is a multivariate normal distribution with a diagonal variance-covariance matrix of 5x5 and a prior variance of each parameter of 7. In Cox proportional hazard models (*coxme*) response variables include censored individuals (whose death was considered accidental in this analyses: drowned in wet cotton or females still alive at the end of the experiment). Sampling size gives the number of female mites included in each analysis. "Maximal model" gives the complete set of explanatory variables (and their interactions) included in the model. "Minimal model" gives the model containing only the significant variables and their interactions. Round brackets indicate that the variables were fitted as a random factor with the second nested within the first. Square brackets indicate the error structure used (n: normal, b: binomial, nb: negative binomial, zib: zero-inflated binomial, zinb: zero-inflated negative binomial, *coxme* does not do predictions). infection: infection status of field-collected females by *Wolbachia*, *Cardinium*, or *Rickettsia* (1: infected or 0: uninfected), plant: host plant used to test the performance of the mites or from which mites have been collected in the field, death: day of the females death, drowned: females that escaped the leaf discs and were found dead in wet cotton, eggs: number of eggs laid by each female, (un)hatch: number of (un)hatched eggs, dead/alive: number of dead/alive juveniles, daughters/sons: number of adult daughters/sons, adult: number of juveniles that became adults (=daughters + sons), W: *Wolbachia*-infection status of the females (Wi: infected or Wu: uninfected).

	Variable of interest	Response variable	Model Nb.	Sampling size	Maximal model	Minimal model	R subroutine [err struct.]
Prevalence	<i>Wolbachia</i>	infection	1	440 ¹	plant + (1 location)	plant + (1 location)	bgfmer [b]
	<i>Cardinium</i>	infection	2	440 ¹	plant + (1 location)	1 + (1 location)	bgfmer [b]
	<i>Rickettsia</i>	infection	3	440 ¹	plant + (1 location)	plant + (1 location)	bgfmer [b]
Spider-mite performance	Female survival (S)	(death, censor)	4	798 ¹	plant*W + (1 block/day)	1 + (1 block/day)	coxme
	Proportion drowning (PD)	drowned	5	798 ¹	plant*W + (1 block/day)	plant + (1 block/day)	glmer [b]
	Daily fecundity (DF)	eggs/death	6	798 ¹	plant*W + (1 block/day)	plant + (1 block/day)	lmer [n]
	Hatching rate (HR)	cbind (hatch, unhatch)	7	708 ²	plant*W + (1 block/day)	plant*W + (1 block/day)	glmmadmb [zib]
	Juvenile mortality (JM)	cbind (dead, alive)	8	700 ³	plant*W + (1 block/day)	plant + (1 block/day)	glmmadmb [zib]
	Sex ratio (SR)	cbind (daughters, sons)	9	692 ⁴	plant*W + (1 block/day)	plant*W + (1 block/day)	glmmadmb [zib]
	Offspring viability (OV)	nb of adults	10	798 ¹	plant*W + (1 block/day)	plant + (1 block/day)	glmmadmb [zinb]

¹ Complete dataset

² Excludes females that did not produce a single egg

³ Excludes females that did not produce a single juvenile

⁴ Excludes females that did not produce a single adult offspring