Observations on the potential of spiders as natural enemies of *Trioza erytreae* (del Guercio, 1918; Hemiptera: Triozidae) in the citrus agroecosystem in Portugal

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Introduction

The "citrus greening disease" or huanglongbing is caused by the Gram-negative bacterium *Candidatus* liberibacter spp. One vector of HLB, the African citrus psyllid *Trioza erytreae* (del Guercio, 1918), was recorded for the first time in 2014 in mainland Spain and since then it spread throughout the Iberian Peninsula. Measures against *T. erytreae* include chemical treatments and quarantine although eradication programmes have been mostly of limited success or even failed. The biological control of *T. erytreae* has been little developed yet. Among natural enemies, spiders may encompass a promising group of predators. The **objective** of this work was to investigate the potential of spiders as natural enemies of *T. erytreae*.

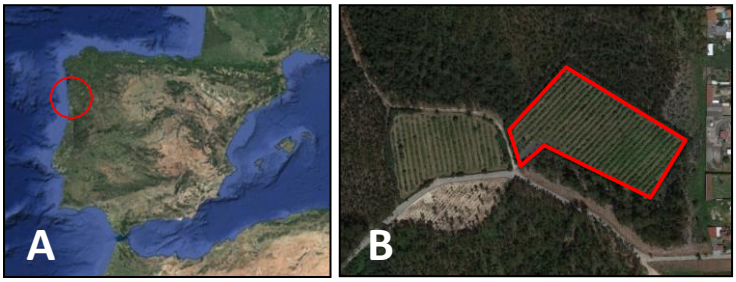

Figure 1. A: Study area. B: Aerial view of the selected citrus lemon orchard.

Material and methods

- A Citrus lemon orchard was selected in northwestern Portugal in the area colonized by *T. erytreae*. A total of 100 webs (50 above and 50 below 1.5m) were visually inspected throughout the orchard in August 2020 (**Fig. 1**).
- The family of spider, web size, number of adults of *T. erytreae* captured by each web, and the temperature and humidity were registered (**Fig. 2 & 3**).

Results

- ✓ Temperature and humidity did not significantly differ between the two vertical strata. Web size was significantly higher in the lower strata (**Fig. 4**).
- ✓ The number of captured adults *of T. erytreae* was significantly higher in the upper strata (**Table 1**; **Fig. 4**).

Figure 3. Detail of a spider web holding several captured adults (red arrows) of *T. erytreae* in the canopy of a citrus orchard in northwestern Portugal.

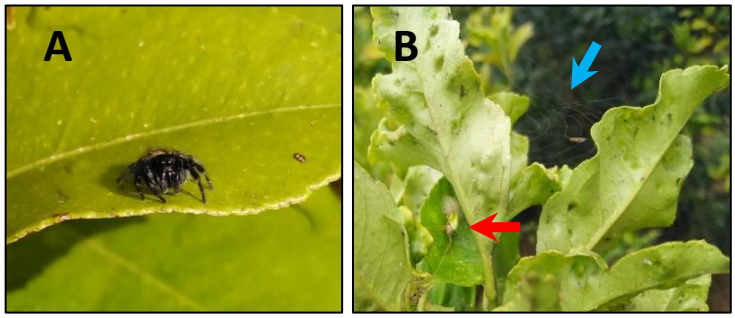

Figure 2. Example of spiders inhabiting the orchard. A: Salticidae; B: Araneidae. Red arrow indicates the spider. Blue arrow indicates the orb-web.

Table 1. Functional group, family, number of webs inspected, and total number of adults of *T. erytreae* captured per family of spiders in a citrus orchard in northwestern Portugal at two vertical strata (above and below than 1.5 m).

Functional group	Family	Height > 1.5m		Height < 1.5m	
		Number of webs inspected (N)	Number of adults of *T. erytreae* captured (N)	Number of webs inspected (N)	Number of adults of *T. erytreae* captured (N)
Ambushers	Thomisidae	1	0	0	0
Foliage runners	Anyphaenidae	1	0	0	0
Orb-weavers	Araneidae	11	4	16	2
Space web builders	Theridiidae	32	68	0	0
Stalkers	Salticidae	5	3	0	0
Wandering sheet/tangle weavers	Linyphiidae	0	0	34	28
Total		50	75	50	30

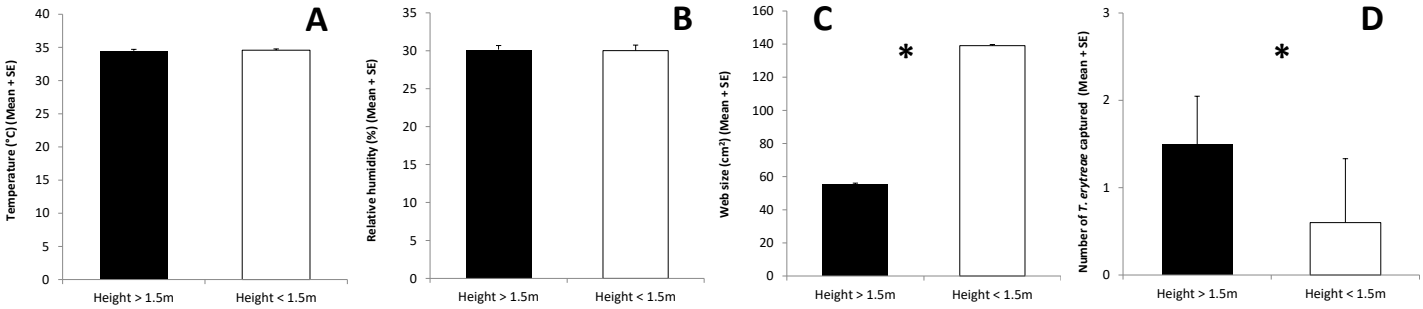

Figure 4. Temperature (A), humidity (B), web size (C), and number of adults of *T. erytreae* captured by spider webs (D) registered in a citrus orchard in northwestern Portugal at two vertical strata (above and below than 1.5 m). An asterisk indicates significant differences between strata (P < 0.05).

Conclusions

Our results suggest that web architecture was the only factor driving the number of captured adults of *T. erytreae*. Thus, space web builders could be the most successful natural enemies of *T. erytreae* among aerial web builders.

Acknowledgements

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