

INTRODUCTION OF THE MAIN PARASITOID OF *TRIOZA ERYTREA* INTO EUROPE

An option for the biological control of the “huanglongbing” disease



■ THE PROBLEM ADDRESSED

“Huanglongbing”: a threat to the citrus industry in Europe

The African citrus psyllid, *Trioza erytreae* (Del Guercio) (Hemiptera: Triozidae), is the most recent citrus pest introduced to the European mainland. It was detected in north-western Spain in 2014 (Cocuzza *et al.*, 2017), and since then it has spread along the Portuguese coast as far as Lisbon, infesting citrus trees in private gardens. This psyllid transmits the citrus greening or “huanglongbing” (HLB) disease, which is one of the most devastating citrus diseases in the world (Bové 2006). This disease is associated with three phloem α -proteobacteria: ‘*Candidatus Liberibacter asiaticus*’ (CLs), ‘*Ca. L. americanus*’ (CLam) and ‘*Ca. L. africanus*’ (CLaf). *Trioza erytreae* is a vector that transmits CLaf.

Although HLB has not been detected yet in mainland Europe (Cocuzza *et al.*, 2017), the mere presence of the psyllid is a major threat for the Mediterranean citrus industry. As an example of the economic impact of HLB, this disease caused losses of 4,554 million US dollars and more than 8,000 jobs directly or indirectly linked to the Florida citrus industry between 2005 and 2011 in the USA (Hodges and Spreen 2012).



- Asymptomatic (left) and symptomatic (centre and right) citrus trees infected by the “huanglongbing” (HLB) or greening. The disease is transmitted by the psyllids *Trioza erytreae* and *Diaphorina citri*. Photo by César Monzó.



■ THE PRACTICE/INNOVATION PROPOSED BY TROPICSAFE

A natural enemy to control the disease

One of the main aims of TROPICSAFE is to develop advanced and novel pest management strategies that provide a reduction in the environmental impact of plant protection approaches. Among these strategies, the classical biological control (i.e. the introduction of natural enemies from the area of origin of the target pest) is probably the most feasible and environmentally friendly strategy to manage *T. erytrae* in Europe (Cocuzza *et al.*, 2017).

TROPICSAFE has initiated a classical biological control program to introduce the parasitoid *Tamarixia dryi* (= *Tetrastichus dryi*) (Waterston) (Hymenoptera, Eulophidae) from its area of origin (South Africa). This parasitoid is the most abundant and effective biological control agent of *T. erytrae* in sub-Saharan Africa. This solitary ectoparasitoid has already been successfully introduced to Reunion Island and Mauritius in the 1980s, where *T. dryi* regulated the populations of the psyllid (Aubert and Quilici 1986).

■ HOW IS TROPICSAFE IMPLEMENTING IT?

Collection and importation of the parasitoid

Taking into consideration the success of *Tamarixia dryi*, the Valencian Institute of Agrarian Research (IVIA) applied to obtain the legal permits to introduce this parasitoid into Europe. Once obtained, four citrus producing areas of South Africa (Western Cape, Mpumalanga, Limpopo and Gauteng) were sampled from September 21st to December 9th of 2017 with the collaboration of the Universities of Pretoria and Stellenbosch and the Citrus Research International (CRI) to obtain and establish several isolines of *T. dryi*. The parasitoid was identified by a combination of morphological and molecular characterization. During the survey, two other species of primary parasitoids were recovered, including a new species of the genus *Tamarixia* that is now under description by specialists at the University of Riverside (California, USA).

On December 2017, *T. dryi* isolines were sent to the Canarian Institut of Agrarian Research where a colony of the parasitoid was established. During 2018, several laboratory studies were conducted to: i) confirm that the imported parasitoids are not infested by 'Ca. L. africanus'; ii) determine the specificity of *T. dryi*; and iii) study its potential as a biological control agent. These studies are all required before it is released into the field.



- Collection of *Tamarixia dryi* in four citrus producing areas from South Africa in 2017. Details of the colony of *T. dryi* established under controlled conditions in Spain before it is released.



■ HOW IS IT WORKING?

A high potential to control *Trioza erytreae* in Europe

Laboratory experiments have demonstrated that *T. dryi* is a highly specific parasitoid and its release and establishment in Europe within the classical biological control program of *T. erytreae* should not affect native psyllid species. *T. dryi* did not parasitize any of the 11 non-target psyllids tested, including five species of genus *Trioza*. These psyllids were selected and tested for their phylogenetic proximity to *T. erytreae* as well as for ecological reasons.

Molecular techniques confirmed that the specimens of *T. dryi* were not infected by 'Ca. L. africanus'. Therefore, and taking into consideration the two latter results, no significant environmental impact is expected with the release of *T. dryi*.

Laboratory and field assays have also demonstrated that *T. dryi* has a high potential to control *T. erytreae* in Europe. Female parasitoids attack and parasitize *T. erytreae* nymphs from the 3rd to the 5th instar. The parasitoid can survive for more than 30 days when it feeds on the honeydew of its hosts. Its sex ratio in the colonies and field tends to be female biased (more females than males are produced). It tends to feed on hosts of different size. These characteristics highlight the potential of *T. dryi* for biological control of *T. erytreae*.



- Details of the parasitoid *Tamarixia dryi* when it attacks and parasitizes the psyllid *Trioza erytreae*, egg (red arrow), pupae (below *Trioza erytreae*) and adult of *T. dryi*; colony of *T. erytreae* parasitized by *T. dryi*.



KEYWORDS

Citrus, integrated pest management (IPM), biological control, parasitism

FURTHER INFORMATION

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