Toxoptera citricidus (Kirkaldy, 1907) (Homoptera, Aphidoidea), the tropical citrus aphid in continental Portugal

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Toxoptera citricidus (Kirkaldy, 1907) (Homoptera, Aphidoidea), the tropical citrus aphid in continental Portugal

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Abstract. Surveys aiming to detect the presence of *T. citricidus* in Portugal mainland have been carried out since 1963. The aphid was detected for the first time in Madeira Island in 1994 and in the mainland in 2003, in the north western region. In the years that followed the aphid could be always detected, and in some places even in the winter months. The infested area is slowly enlarging. The preferred host is *C. lemon*. Predators and parasitoids are present in the period of population growth. A macroscopic key is presented for the identification of the economically important *Citrus* aphids in Portugal.

Keywords. Aphids – Citrus – Portugal – *Toxoptera citricidus* – Tristeza

***Toxoptera citrcidus* (Kirkaldy, 1907) (Homoptera, Aphidoidea), Le puceron tropical des agrumes dans le Portugal continental**

Résumé. *A partir de 1963, des enquêtes ont été réalisées afin de déceler le T. citricidus dans le Portugal continental. Ce puceron a été signalé pour la première fois sur l'île de Madère en 1994 et, en 2003, sur le territoire continental dans le nord-ouest. Ensuite, le puceron a continué d'être signalé et dans certains endroits, il a été mis en évidence aussi pendant l'hiver. La zone d'infestation s'étend progressivement et le C. lemon reste l'hôte préféré. Les prédateurs et parasitoïdes sont présents pendant toute la période de croissance de la population du puceron. Une clé macroscopique est proposée pour faciliter l'identification des pucerons des agrumes économiquement importants au Portugal.*

Mots-clés. *Pucerons – Agrumes – Portugal –Toxoptera citricidus – Tristeza.*

I – Historical review

1963 - 1993. The first survey on *T. citricidus* in Portugal was carried out in 1963, in the agricultural areas of Coimbra, Santarém, Setúbal, and Algarve (Neves, 1965) and, afterwards by Ilharco (1978), also in the Algarve province. On those occasions, the aphid was not found.

1994 - 2002. *T. citricidus* was reported in Madeira Island (Aguiar *et al.,* 1994). The efforts to eradicate it were unsuccessful due to its fast dissemination in the Citrus growing areas of the island and it was considered to constitute a potential threat to Citrus orchards in Continental Portugal. New search for the aphid in the mainland was carried out. Cruz de Boelpaepe and Ferreira (1998) conducted surveys in the Citrus growing areas from the Agricultural Regions of Entre Douro e Minho, Beira Litoral and Ribatejo and Oeste, in the Northern, central and central-southern area of Portugal, respectively. From 1997 to 1999 surveys of *T. citricidus* were done also in Algarve (Ramos *et al.*, 2000), without captures. The aphid was detected on neither occasions.

2003. *T. citricidus* was reported in North Western Portugal in the Entre Douro e Minho region and, in Spain, in Astúrias and Vigo (Ilharco *et al.,* 2005).

2004 - 2006. Various surveys were done to evaluate the dispersion of *T. citricidus* in continental Portugal in citrus and in other plant species and to check the action of their natural enemies.

Toxoptera citricidus was collected directly from the Citrus plants or by yellow water traps; small citrus orchards were inspected, along with single backyard plants or ornamental citrus in towns, other neighbouring plant species were also inspected. The aphid identification was made in the field, aided by magnifying lenses, or in the laboratory, if it was necessary. Samples caught by traps were identified under stereoscopic microscope and nominated vagrants.

In 2004, *Toxoptera citricidus* was caught in Valença, Monção, Vila Verde, Amares, Barcelos, Braga, Vila Nova de Famalicão, Guimarães, Fafe, Santo Tirso, Felgueiras, Celorico de Basto, Amarante, Penafiel, Marco de Canaveses and Santa Marta de Penaguião. In 2005, in Vila do Conde, Paços de Ferreira, Lousada, Vila Nova de Gaia, Espinho, Ovar and Ílhavo and in 2006, in Arcos de Valdevez, Viana do Castelo, Ponte de Lima, Ponte da Barca, Terras de Bouro, Esposende, Vieira do Minho, Póvoa de Lanhoso, Gondomar, Aveiro and Estarreja (Fig. 1).

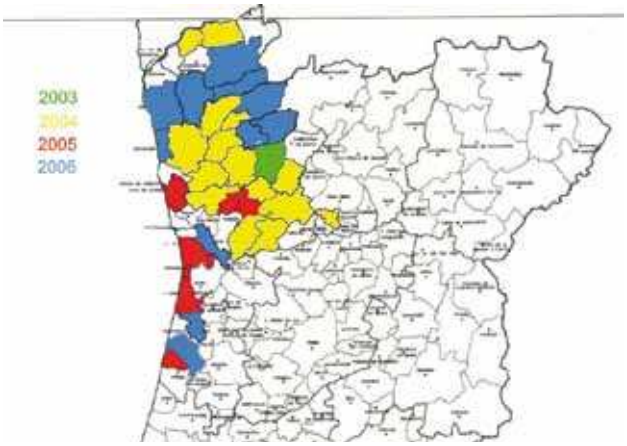


Figure1. Dispersion of *Toxoptera citricidus* (Kirkaldy), in Continental Portugal. The coloured areas on the map are related to the areas where the aphid was firstly designated.

In this period, the limits of *T. citricidus* dispersion in Continental Portugal are Valença and Monção in the north, Ílhavo in south, and Santa Marta de Penaguião in the east, and its presence was checked all over the year (Tab. 1). This shows the capacity to resist the thermal variations from winter to summer in the studied area. Blackman and Eastop (2000) have mentioned that although *T. citricidus* develops better in hot weather, it can, apparently, tolerate low temperatures better than *T. aurantii* (Boyer de Fonscolombe, 1841), which is a well-adapted species in Portugal.

Table 1. *Toxoptera citricidus* survey in the continental Portugal in the period 2004-2006.

Year/ Month	J	F	M	A	M	J	J	A	S	O	N	D
2004	-	-	-	-	x	x	x	x	x	x	x	x
2005	x	-	x	x	-	-	-	-	x	x	x	x
2006	x	x	0	x	x	x	x					

x: presence of *T. citricidus*
-: month without survey
0: absence of *T. citricidus*
J-D: January – December
May and June/2004: Samples caught by traps (vagrant aphids)

In 2005, from February to April only one apterous *T. citricidus* was caught on *Citrus aurantium* L., and one alate aphid on *Citrus sinensis* (L.) although it was observed that lemon trees had suitable foliage for the aphids all the year round in opposition to orange trees.

In 2006, during March and early April, no *T. citricidus* specimen was found. However, in the surveyed locations the plants had received phytosanitary treatments against aphids. In later April, 2006, in Guimarães region a large population was observed on a single lemon tree that had not received any phytosanitary treatment. This suggests that the isolated hosts can become a focus of aphid dispersion when weather and citrus foliage conditions ameliorate. This could explain the great amount of *T. citricidus* caught later in May, 2006, in the same areas where in the previous month the aphids were almost absent. Probably during February-April, the adverse conditions, plus the sanitary treatments, can be responsible for the decrease in the aphid populations in the studied areas. Particularly in the orange tree, the lack of suitable foliage is an additional factor affecting adversely the development of *T. citricidus* population. During the period of population growth some natural enemies, predators and parasitoids were observed (Fig. 2, 3). Michaud (1998) reports an extensive literature about this.

T. citricidus has been collected on Citrus only, particularly in *C. limon (*over 60% of the samples). When large populations develop the aphids may be observed also on the top twigs and flowers (Fig. 4).

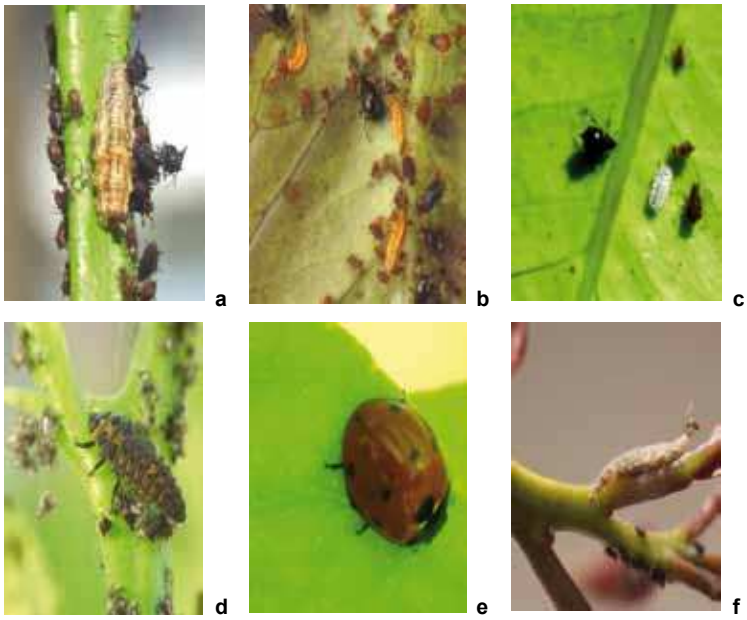


Figure 2. *T. citricidus* predators: a) Syrphids; b) Cecidomiids; c, d, e,) Coccinellids; f) Chrysopids *(Photographs by C. R. Sousa-Silva).*

Figure 3. Mummified *T. citrici dus.* *(Photographs by C. R. Sousa-Silva).*

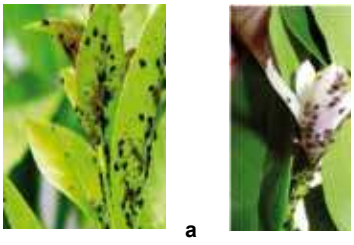


Figure 4. *T. citricidus* (Kirkaldy) on *Citrus limon*: a) along the veins; b) on the flowers. *(Photographs by C. R. Sousa-Silva).*

Based on Ilharco and Fonseca (1985) a macroscopic key is presented for the identification of the economically important *Citrus* aphids in Portugal:

Apterous forms:

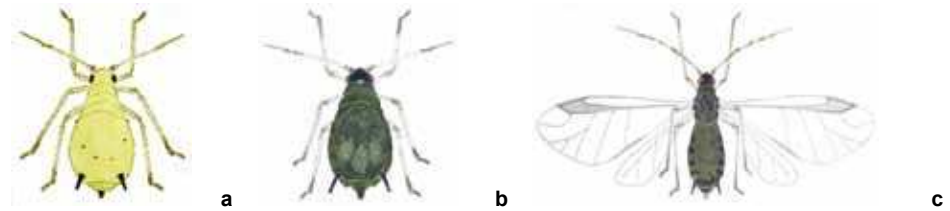
1	Body green, yellow- green or browned	2
	- Body dark reddish-brown or shining black	3
2	Body green to yellow-green. Cauda as dark as the siphunculi	*Aphis spiraecola* Patch (Fig. 5a)
	- Body green, yellow-green or browned. Cauda lighter than siphunculi	*Aphis gossypii* Glover (Fig. 6a, b)
	- Body light-yellow with some dorsal dark markings. Generally small insects	*Myzus ornatus* Laing (Fig. 7a)
3	Body dark-brown. Apex of antennal segments III, IV and V, the apical half of base of VI and some times also the apex of *processus terminalis* dark	*Toxoptera aurantii* (Boyer de Fonscolombe) (Fig. 8a)
	- Body reddish-brown or shining black. Antennal segment III and the basal part of IV pale, V and VI dark	*Toxoptera citricidus* (Kirkaldy) (Fig. 9a)

Alate forms:

1	Abdomen green, yellow-green or browned, with or without compact dorsal plate browned to black	2
	- Abdomen dark-browned, reddish-brown to dark or shining black	4
2	Abdomen light-green to pale-yellow with compact dorsal plate. Head and thorax browned	*Myzus ornatus* Laing (Fig. 7b)
	- Abdomen without dorsal plate	3
3	Abdomen green to yellow-green. Head and thorax black, cauda as dark as the siphunculi	*Aphis spiraecola* Patch (Fig. 5b)
	- Abdomen yellow-lighted to dark or browned green with a black stripe between the siphunculi. Cauda pale or lighted dark, lighter than the siphunculi	*Aphis gossypii* Glover (Fig.6c)
4	Abdomen dark-browned, fore wings with median vein almost always once branched, pterostigma black. Antennal segment III pale with black apex	*Toxoptera aurantii* (Boyer de Fonscolombe) (Fig. 8b)
	- Abdomen dark reddish-brown or shining black with smooth, polished, shining cuticular surface, fore wings with median vein usually twice branched, pterostigma pale, antennal segment III black, in contrast with basal half of segments IV and V, whicht are pale	*Toxoptera citricidus* (Kirkaldy) (Fig. 9b)

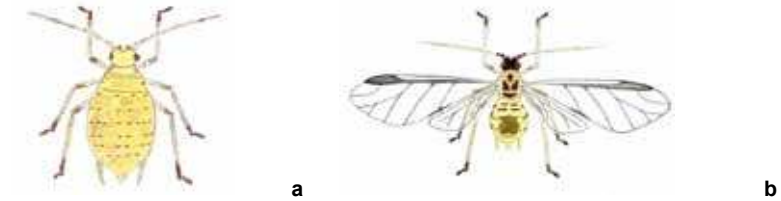
a b

Figure 5. *Aphis spiraecola*: a) apterous; b) alate.
(Ilharco and Fonseca, 1985).



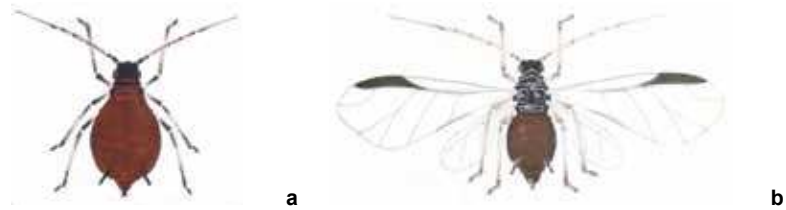
a b c

Figure 6. *A. gossypii*: a) apterous, summer form; b) apterous, winter form; c) alate.
(after Ilharco and Fonseca, 1985).



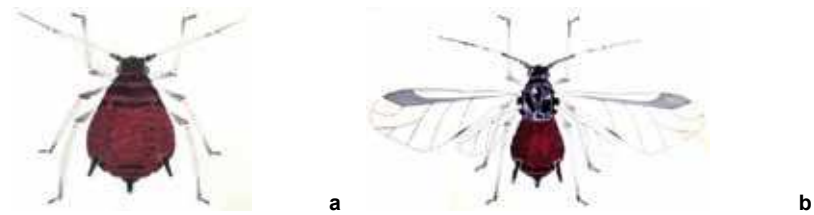
a b

Figure 7. *Myzus ornatus*: a) apterous; b) alate.
(Ilharco and Fonseca, 1985).



a b

Figure 8. *T. aurantii*: a) apterous; b) alate (Ilharco and Fonseca, 1985).



a b

Figure 9. *T. citricidus*: *a*) apterous; b) alate.
(Ilharco and Fonseca, 1985).

II – Conclusions

i. *T. citricidus* is already well established in the north of Continental Portugal, and has been collected all the year round.

ii. *Citrus limon* is there the preferential host of *T. citricidus.*

iii. *T. citricidus* was collected only on Citrus hosts.

iv. Single lemon trees that do not receive any sanitary treatment have an important role in maintaining *T. citricidus* populations during the winter period.

References

Aguiar A.M.F., Fernandes A., Ilharco F.A., 1994. On the sudden appearance and spread of the black citrus aphid Toxoptera citricidus (Kirkaldy), (Homoptera: Aphidoidea) on the Island of Madeira. Bocagiana 168: 1-7.

Blackman R.L. and Eastop V.F., 2000. Aphids on the World's Crops. An identification and information guide. 2nd ed. John Wiley and Sons, Chichester, 466 pp.

Cruz de Boelpaepe M. O., Ferreira M.O., 1998. Survey of the brown citrus aphid, Toxoptera citricidus, and other aphid vectors of citrus tristeza virus in Continental Portugal. Aphids in natural and managed ecosystems (Nieto Nafria, J.M. and Dixon, A.F.G. eds.), Universidade de Léon (Spain). 1998: 525-534.

Ilharco F.A., 1978. Prospecção de afídeos em citrinos no sul de Portugal (Homoptera: Aphidoidea). Agronomia Lusitana 38 (4): 271-274.

Ilharco F.A. and Fonseca P.A., 1985. Identificação de afídeos por via macroscópica. I. Afídeos dos citrinos. Instituto Nacional de Investigação Agrária e de Extensão Rural, Lisboa.

Ilharco F.A., Sousa-Silva C.R., Álvarez A.A., 2005. First report on *Toxoptera citricidus* (Kirkaldy) in Spain and Continental Portugal (Homoptera, Aphidoidea). Agronomia Lusitana 51 (1): 19-21.

Michaud J.P., 1998. A review of the literature on *Toxoptera citricidus* (Kirkaldy) (Homoptera: Aphididae). *Florida Entomologist* 81 (1): 37-61.

Neves M., 1965. Inquérito sobre Toxoptera citricidus (Kirkaldy) vector da grave doença dos citrinos denominada <tristeza>. Agricultura 25:14-27.

Ramos N., Fernandes J.E., Reis J., Nolasco G., 2000. Afídeos vectores do vírus-da-tristeza-dos-citrinos (CTV) no Algarve. *Livro de Actas do Congresso Nacional de Citricultura*, Faro, Nov. 2000: 167-183.