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## FIRST RECORD OF THE INVASIVE *SIPHONATROPHIA CUPRESSI* (SWAIN) (APHIDIDAE APHIDINI APHIDINA) IN THE IBERIAN PENINSULA

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Lumbierres B., Pérez Hidalgo N., Starý P., Pons X. – First record of the invasive *Siphonatrophia cupressi* (Swain) (Aphididae Aphidini Aphidina) in the Iberian peninsula.

*Siphonatrophia cupressi* Swain, 1918 has been caught for first time in the Iberian Peninsula in the Arboretum and Botanical Garden of Lleida. Small colonies with apterous and alate individuals were recorded on *Cupressus macrocarpa* Hartw. The aphid was mainly associated to the as native parasitoid *Lysiphlebus testaceipes* Cresson, which enhances the role of this parasitoid in potentially preventing outbreaks of the new immigrant aphid species.

KEY WORDS: *Siphonatrophia cupressi*, *Cupressus macrocarpa*, aphid, alien species, *Lysiphlebus testaceipes*, parasitoids.

### INTRODUCTION

The genus *Siphonatrophia* Swain, 1918 (Aphidinae: Aphidini: Aphidina) includes two species: *Siphonatrophia* (*S.*) *cupressi* (Swain, 1918) which is a nearctic species living on Cupressaceae in North and Central America and *Siphonatrophia* (*Lacusaphis*) *aetherelaca* Zhang & Zhang, 2002 living on unidentified Cruciferae in China (REMAUDIÈRE & MUÑOZ VIVEROS, 1991).

*Siphonatrophia cupressi* lives on tips of scale leaves of Cupressaceae (*Cupressus arizonica* Greene, *C. guadelupensis* S. Watson, *Cupressus macrocarpa* Hartw., *Juniperus scopulorum* Sarg., *Juniperus virginiana* L. and *Widdringtonia* sp. in Canada, USA, Mexico and Central America (Honduras, Costa Rica) (REMAUDIÈRE & MUÑOZ VIVEROS, 1991; Rabasse *et al.*, 2005; VILLALOBOS MULLER *et al.*, 2010; FOOTITT & RICHARDS, 1993; FOOTITT *et al.*, 2012; SANO & YOSHITOMI, 2012).

The species was recorded for first time in Europe in South France (Mougins, Alpes Maritimes) and Northern Italy (Pozzuolo del Friuli, Friuli-Venezia Giulia) (Rabasse *et al.*, 2005) and its expansion in Italy (Lombardia, Toscana and Sicilia) has been confirmed (BELLA & SQUARCINI, 2009). The aphid has also been recorded in Japan (SANO & YOSHITOMI, 2012).

We report here, the first record in the Iberian Peninsula of the species *S. cupressi* and we describe the aphid morphs recorded and natural enemies associated with the species, especially parasitoids and hyperparasitoids.

### RESULTS AND DISCUSSION

Catches were made in the Arboretum and Botanical Garden Pius Font i Quer of Lleida (Catalonia, Spain, 41°37'38.82"N and 0°36'01.76"E), a recently created botanical garden of 7 ha and more than 500 species of plants, mainly trees and shrubs (<http://arboretum.parcte->

lleida.es). Samples of aphids were collected in spring and summer of 2012 and 2013; spring, summer and autumn of 2014, and winter of 2015. When present, mummies were also collected. These mummies and the remnant aphids not used for identification were reared on 500 ml plastic cages, covered with mesh for aeration and maintained at 25°C until parasitoids or hyperparasitoids emerged.

Aphids were identified as belonging to the species *S. cupressi*. Only apterous and alatae viviparous females were found. Identifications were made following keys of BLACKMAN & EASTOP (2014) and the description of Swain (1918) and RABASSE *et al.* (2005). The slides (reference L843) are mainly deposited in the aphidological collection of the University of Leon and some other in the laboratory of Entomology of the University of Lleida (UdL).

The apterous viviparous females (Fig. I, 1, 2) are small aphids (1.0 to 1.7 mm), pale blue-green when alive, concolorous with the leaves of host and strongly domed dorsally and flattened against leaf ventrally (Fig. I, 1), with antennae of 5 or 6 antennal segments, processus terminalis similar in length to the basal part of the last joint segment (Fig. II, 1); rostrum reaching the middle coxae with its apical segment short (Fig. II, 3); abdomen dorsum membranous (Fig. I, 2), siphunculi pore-like on a small and slightly raised cone (Fig. II, 4) and cauda conspicuous with more of 10 setae (Fig. II, 5). The alate viviparous females are similar to the apterae but comparatively slender; with antennal segment with 3 to 8 small secondary sensoria (Fig. II, 2) and forewing with the median vein once (Fig. II, 7) or twice branched (Fig. II, 6).

The aphid was firstly recorded in May 2012 but very few individuals could be collected, although we collected some mummies. No more individuals were observed that year. Similar situation occurred in 2013. In 2014, the aphid was firstly recorded by the end of March and its abundance was higher than those of 2012 and 2013. So, small colonies were recorded in summer, autumn and winter 2014-2015.

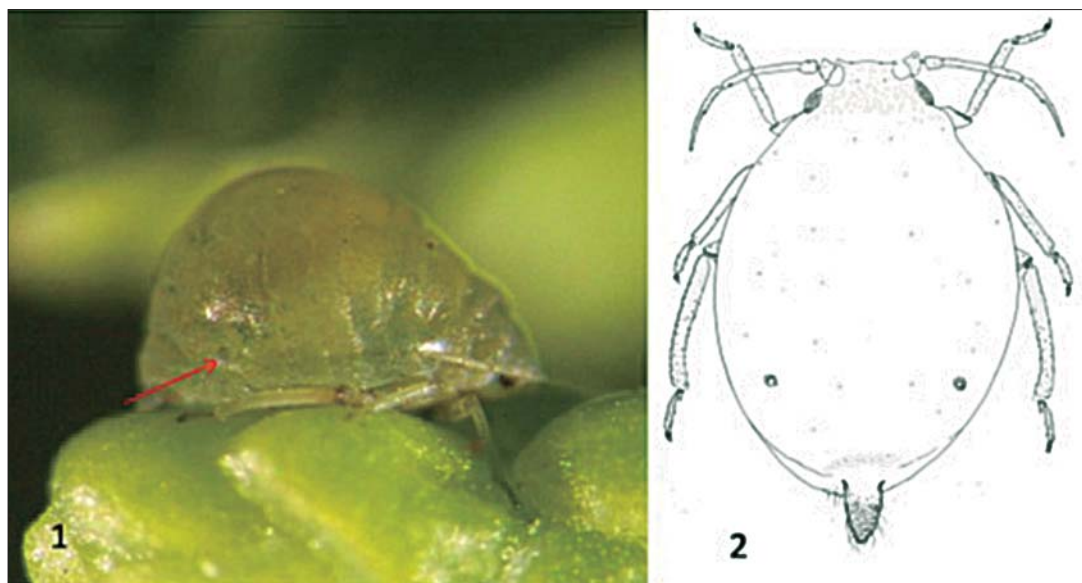


Fig. 1 – *Siphonatrophia cupressi*, apterous viviparous female, in nature (1) and habitus in (2). The red arrow shows the position of the siphunculus.

The aphid formed small colonies with scattered individuals dispersed on the tip of leaves of *C. macrocarpa* on 10 about 15 trees planted in 2009 in the Lleida's Botanical Garden. It was not recorded on other species of Cupressaceae present in the Lleida's Arboretum: *Cupressus sempervirens* L., *Juniperus communis* L., *J. oxycedrus* L., *J. phoenicea* L., *J. sabina* Fargon, *J. virginiana* L.) and species of *Chamaecyparis* and *Thuja*.

The first record of *S. cupressi* in the Iberian Peninsula is an indicator of the expansion of this species in Western Europe because it has been previously only reported in France and Italy (RABASSE *et al.*, 2005; BELLA & SQUARCINI, 2009). In Italy, where specimens of *S. cupressi* were already caught with a 12.2 m high suction trap during 1999-2002, colonies of the aphid have been reported on *C. sempervirens*, x *Cupressocyparis leylandi* (Dallim. & A.B. Jacks.) Dallim. & A.B. Jacks. and *Juniperus chinensis* L. The occurrence of *S. cupressi* on *C. macrocarpa* and not on other Cupressaceae in Lleida, suggests a recent invasion of this aphid in the Iberian Peninsula.

*Siphonatrophia cupressi* is a monoecious holocyclic species with oviparae apterous and males alate or apterous that can occur in October-November (PALMER, 1952). In Europe, in Italy (Toscana) and France (Alpes-Martimes) this species is found frequently from May to November-December with presence of apterae and alatae and may be associated with ants (BELLA & SQUARCINI, 2009). Our findings show that in Lleida, the aphid can be found earlier and first individuals are already on tips of branches by the end of March. Similarly to that reported in Italy and unlike what happens in France, where have been recorded oviparous (but not males), no sexual morphs could be recorded in Lleida. The record of alive adults and nymphs in February 2015 clearly outlines that *S. cupressi* develops parthenogenetically, the same that happens in southwestern Japan where the aphid has also been recorded and reported as an introduced species in this country (SANO & YOSHITOMI, 2012).

No damages on the infested trees were observed, because the density of the aphids was low. However, data recorded show that an increase of the density has

occurred from the first detection in 2012, and this suggests that the surveillance of the aphid is needed. Heavy infestations may produce discoloration of branch tips and aesthetic damages to the ornamental trees attacked. This alien aphid species is restricted at the moment to parks, gardens and city areas in which these trees have been planted but given the globalization and the use of the Cupressaceae in gardening (LÓPEZ LILLO & SÁNCHEZ DE LORENZO CÁCERES, 2001) it is very probably that *S. cupressi* could be introduced to other countries in Europe and Northern Africa in the next years.

The detection of aphid alien species in botanical gardens, as it has been the recently case of *Neophyllaphis podocarpi* Takahashi (PÉREZ HIDALGO *et al.*, 2015), indicates that these types of ecosystems, with a high diversification of vegetation and its origins, are important focus for the arrival and potential establishment of alien aphid species. On the other hand, the periodical surveillance of these ecosystems and the early detection could be a procedure for recognizing recent new potential problems and to identify the actions to prevent the spread of the alien species to other ecosystems.

Parasitoids were identified by P. Starý (Institute of Entomology, Czech Republic) and a voucher is in his personal collection and in the laboratory of Entomology of UdL, other vouchers were supplied to the Institute of Zoology, Belgrade for possible DNA analyses. Hyperparasitoids were identified following the Antoni Ribes' keys, available at the webpage <http://www.ponent.atspace.org/fauna/ins>. Two parasitoid species emerged from *S. cupressi*: *Ephedrus persicae* Froggatt and *Lysiphlebus testaceipes* (Cresson). Whereas *E. persicae* was only found in May 2012, *L. testaceipes* was the prevalent species there and the only one emerged in 2013 and 2014 (Table 1). A high proportion of mummies collected at the middle of December 2014 resulted in hyperparasitoids belonging to the species *Asaphes suspensus* (Nees), *Asaphes vulgaris* Walker and *Pachyneuron aphidis* (Bouché) (Table 1). No predators could be recorded to prey on aphids.

*Ephedrus persicae* and *L. testaceipes* are common aphid

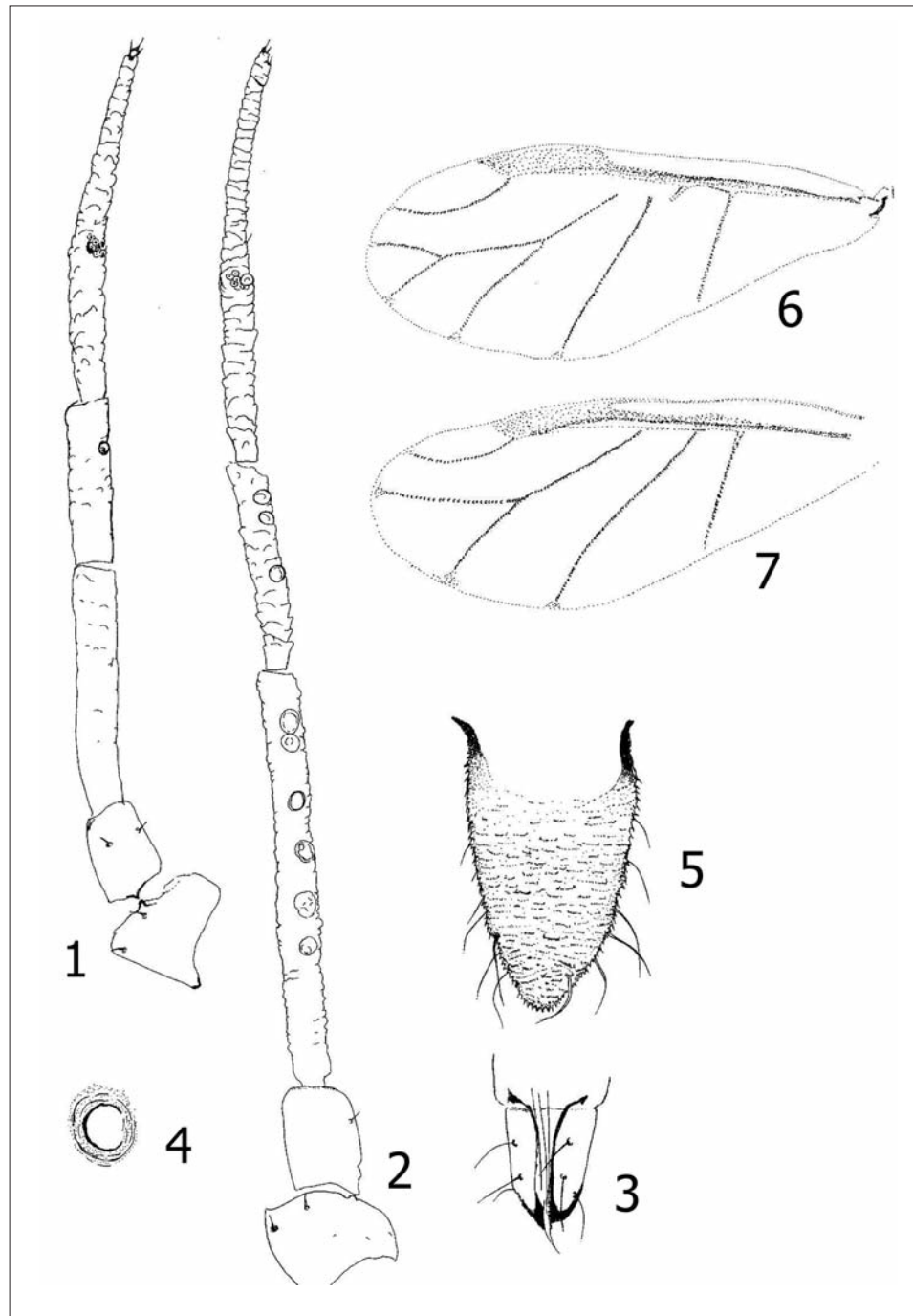


Fig. II – *Siphonatrophia cupressi*, apterous viviparous female antennae (1, 3, 4, 5), alata viviparous female (2, 6, 7); antennae without pigmentation (1, 2), apical rostral segment (3), siphunculi (4), cauda (5), and two different fore wings (6, 7).

Table 1 – Parasitoid and hyperparasitoid species emerged from *Siphonatrophia cupressi* on *Cupressus macrocarpa* in Lleida (Catalonia, Spain, NE Iberian Peninsula) during the period 2012-2014.

Date	Parasitoid species	Num. Specimens	Hyperparasitoid species	Num. specimens
17/5/2012	<i>Ephedrus persicae</i>	2	0	
17/5/2012	<i>Lysiphlebus testaceipes</i>	11	0	
21/5/2013	<i>Lysiphlebus testaceipes</i>	11	0	
3/12/2014	<i>Lysiphlebus testaceipes</i>	25	0	
16/12/2014	<i>Lysiphlebus testaceipes</i>	2	<i>Asaphes suspensus</i>	2
			<i>Asaphes vulgaris</i>	12
			<i>Pachyneuron aphidis</i>	1

parasitoids in NE Iberian Peninsula (LUMBIERRES *et al.*, 2005; PONS & LUMBIERRES, 2013) and its parasitism on *S. cupressi* seems to be a host adaptation of these parasitoids to this new aphid immigrant. *Lysiphlebus testaceipes* was able to parasitize the aphid from spring to the end of autumn and the new association can be classified as becoming established in the area. The rapid association of *L. testaceipes* to new aphid invaders points out the role of this as native species in Spain and in the Mediterranean (STARÝ *et al.*, 2004; LUMBIERRES *et al.*, 2005; MITROVIĆ *et al.*, 2013) in potentially preventing outbreaks of the new immigrants aphid species, as has recently been reported in the case of *Aphis illinoisensis* Shimer (HAVELKA *et al.*, 2011).

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#### REFERENCES

- BELLA S., SQUARCINI M., 2009 – *Si espande la diffusione in Italia dell'afide neartico del cipresso Siphonatrophia cupressi* (Swain 1918). – Boll. Zool. Agr. Bachic., Ser. II 41(1): 61-64.
- BLACKMAN R.L., EASTOP V.F., 2014 – *Aphids on the World's Plants – An online identification and information guide*. <http://www.aphidsonworldsplants.info/>
- FOOTITT R.G., MAW H.E.L., PIKE K.S., MESSING R.H., 2012 – *Aphids (Hemiptera: Aphididae and Adelgidae) of Hawaii: annotated list and key to species of an adventive Fauna*. – Pac. Sci., 66(1): 1-30.
- FOOTITT R.G., RICHARDS W.R., 1993 – The genera of aphids in Canada. Homoptera: Aphidoidea and Phylloxeroidea. Part 22 of the Insects and Arachnids of Canada. Centre for land and soil. Resources Research, Ottawa. 765 pp.
- HAVELKA J., SHUKSHUK A.H., GHALLIOW M.E., LAAMARI M., KAVALLIERATOS N.G., TOMANOVI Ž., RAKHSHANI E., PONS X., STARÝ P., 2011 – *Review of invasive grapevine aphid, Aphis illinoisensis Shimer, and native parasitoids in the Mediterranean (Hemiptera, Aphididae; Hymenoptera, Braconidae, Aphidiinae)*. – Arch. Biol.Sci., Belgrade, 63: 269-274.
- LÓPEZ LILLO A., SÁNCHEZ DE LORENZO CÁCERES J.M., 2001 – *Árboles en España. Manual de identificación (2ª edición)*. Ediciones Mundi-Prensa. Madrid. 153 pp.
- LUMBIERRES B., PONS X., STARÝ P., 2005 – *Parasitoids and predators of aphids associated with public green areas of Lleida (NE Iberian Peninsula)*. – Adv. Hortic. Sci., 19: 69-75.
- MITROVIĆ M., PETROVI A., KAVALLIERATOS N.G., STARÝ P., PETROVI-OBRADOVI O., TOMANOVI Ž., VORBURGER C., 2013 – *Geographic structure with no evidence for host-associated lineages in European populations of Lysiphlebus testaceipes, an introduced biological control agent*. – Biol. Control, 66: 150-158.
- PALMER M.A., 1952 – *Aphids of the Rocky Mountain Region*. Thomas Say Foundation, 5: 452 pp.
- PÉREZ HIDALGO N., HERNÁNDEZ-CASTELLANO C., GARCIA FIGUERES F., 2015 – *First record of Neophyllaphis podocarpi (Hemiptera: Aphididae) Takahashi in the Iberian Peninsula*. – EPPO Bulletin, 45: 1-3.
- PONS X., LUMBIERRES B., 2013 – *Control Integrado en espacios verdes urbanos*. In: 12º Symposium de sanidad vegetal: hacia la gestión integrada de plagas, Junta de Andalucía, Consejería de Agricultura, Pesca y Medio Ambiente Ed., Servicio de Publicaciones, Sevilla, España, pp. 145-164.
- RABASSE J.M., COCEANO P.G., BARBAGALLO S., 2005 – *On the presence in France and North Italy of Siphonatrophia cupressi (Homoptera, Aphididae), a new aphid of North American origin living on Cupressaceae*. – Boll. Zool. Agrar. Bachic., Ser. II, 37(2): 77-83.
- REMAUDIÈRE G., MUÑOZ VIVEROS A.L., 1991 – *Le genre américain Siphonatrophia Swain, 1918 (Homoptera, Aphididae)*. – Rev. Fr. Entomol., (N.S.), 13: 183-185.
- SANO M., YOSHITOMI H., 2012 – *First record of Siphonatrophia cupressi (Hemiptera, Aphididae) from Japan*. – Jpn. J. Syst. Entomol., 18(1): 101-103.
- STARÝ P., LUMBIERRES B., PONS X., 2004 – *Opportunistic changes in the host range of Lysiphlebus testaceipes (Cr.), an exotic aphid parasitoid expanding in the Iberian Peninsula*. – J. Pest Sci., 77: 139-144.
- SWAIN A.F., 1918 – *New Aphididae from California*. – Trans. Amer. Ent. Soc., 44: 1-23.
- VILLALOBOS MULLER W., PÉREZ HIDALGO N., MIER DURANTE M.P., NIETO NAFRÍA J.M., 2010 – *Aphididae (Hemiptera: Sternorhyncha) from Costa Rica, with new records for Central America*. – Bol. Asoc. Esp. Entomol., 34(1-2): 145-182.