

## Notes on the biology and Iberian distribution of *Aradus flavicornis* (Dalman, 1823) (Hemiptera, Heteroptera, Aradidae)

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### ABSTRACT

We present the first data compiled in the field that appear to confirm the pyrophily of *Aradus flavicornis*. A hypothesis on the life cycle of the species in the Mediterranean region is presented and the Iberian distribution is updated.

**Key words:** Hemiptera, Heteroptera, Aradidae, *Aradus flavicornis*, pyrophily, life cycle, Iberian distribution.

### RESUMEN

**Notas sobre la biología y distribución ibérica de *Aradus flavicornis* (Dalman, 1823) (Hemiptera, Heteroptera, Aradidae)**

Se presentan los primeros datos obtenidos en la naturaleza que confirman la pirofilia de *Aradus flavicornis*. Se emite una hipótesis sobre el posible ciclo de vida de la especie en la región mediterránea y se actualiza su distribución ibérica.

**Palabras clave:** Hemiptera, Heteroptera, Aradidae, *Aradus flavicornis*, pirofilia, ciclo de vida, distribución ibérica.

### INTRODUCTION

The genus *Aradus* Fabricius, 1803 is comprised of nearly 200 species that are distributed worldwide (HEISS & PÉRICART, 2007). About ten species in the genus are associated with trees that have been killed or da-

amaged by fire (LAPPALAINEN & SIMOLA, 1998; WYNIGER *et al.*, 2002; DEYRUP & MOSLEY, 2004; HJÄLTÉN *et al.*, 2006; JOHANNSSON *et al.*, 2009, SCHMITZ *et al.*, 2008, SCHMITZ *et al.*, 2010; VIIRI & EERIKÄINEN, 2012). Pyrophilous species of *Aradus* are known from Europe, North America and Australia (SCHMITZ *et al.*, 2008). Here, we present the first field data regarding the possible pyrophily of *Aradus flavicornis*, as well as an update of its Iberian distribution.

## MATERIAL AND METHODS

Larvae of *Aradus flavicornis* and soil with traces of burnt wood from the locality (San Roque, El Pino stream) were stored in a box under laboratory conditions. Humidity was provided by moistened kitchen paper with unchlorinated water, renewed every two to three days until all of the larvae had moulted.

The map showing the Iberian distribution of *A. flavicornis* was elaborated developed on Google Earth using bibliographic records, data obtained on the Internet and specimens in our collections.

## RESULTS

### About the pyrophily of *Aradus flavicornis*

*Aradus flavicornis* has a widespread distribution that comprises a large part of the Afrotropical region, around the Mediterranean region and some countries in Central Asia (HEISS & PÉRICART, 2007). In the Palaearctic region, the species has been recorded in the Canary Islands, North Africa, many Euromediterranean countries, the regions of Central Asia near the Caspian Sea and some countries around the Persian Gulf (HEISS & PÉRICART, 2007).

Little is known about its biology and a phytophagous diet such as that of *Aradus pallescens* Herrich-Schäffer, 1840 is suspected by HEISS & PÉRICART (2007). HEISS & ÖNDER (1991) found two specimens on *Olea europaea*. The species is attracted to light (HEISS & PÉRICART, 2007) and by the paint on cars during sunset (BAENA & ZUZARTE, 2012). The last nymphal instar has been described by HEISS & PÉRICART (2007). No other data about its biology and ecology are known.

SCHMITZ *et al.*, (2008) discovered that the prothorax of the Australian flat bugs *Aradus albicornis* (Walker, 1873) had several dome-shaped sensilla that were previously unknown in the family Aradidae. These structures have been considered to be photomechanic infrared receptors that the insects may use to detect forest fires, distinguish between hot and cool spots and help the flat bugs to find adequate sites to breed and establish new populations. The pyrophilous jewel beetles of the genus *Melanophila* have similar structures for similar purposes.

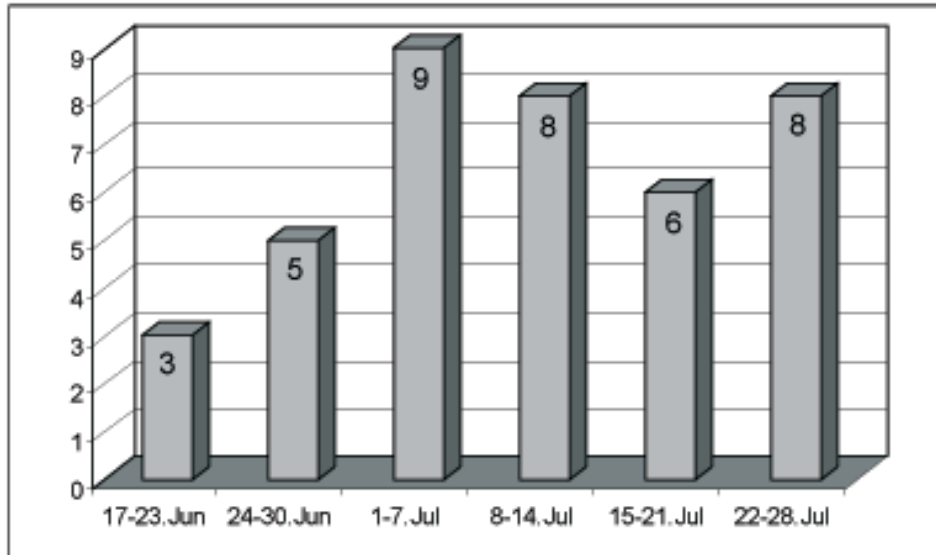
SCHMITZ *et al.*, (2010) studied the presence of infrared receptors in ten species of Palaearctic and Australian Aradidae and found these structures in three new species, the Australian *A. fuscicornis* Kormilev, 1966 and the Palaearctic *A. lugubris* Fallén 1867 and *A. flavicornis*. The pyrophilous behaviour of the first two species was previously known (SCHMITZ, 2010; WYNIGER, 2002) and based on its geographical distribution but without field observations, the pyrophily of *A. flavicornis* was hypothesised by them.

We present the first field observations of the pyrophily of *A. flavicornis* in two localities that are close to each other in southern Spain, confirming the hypothesis of SCHMITZ *et al.* Nymphs of *Aradus flavicornis* were collected at the following localities: Cádiz: La Línea de la Concepción, road from Estepona to Santa Margarita, Finca el Pavero, N 36° 12.014', W 005° 20.081, 23-II-2011, 2 larvae V under the bark of branches of *Pistacia lentiscus* that had burned the previous summer, J. L. Torres leg., moulted to adults 18-VI-2011; San Roque, El Pino stream, behind El Almendral, N 36° 12.962', W 005° 23.312', 28-IV-2013, 41 larvae V, under dead and burnt logs of *Populus nigra* that had burned the previous summer, J. L. Torres leg. 39 larvae moulted to adults from 18th of June to 25th July and two failed during the moult.

The emergence of adults, during the second half of June and the whole July (Fig. 1), is another argument that points towards the pyrophily of *A. flavicornis*: the life cycle of the species seems to be synchronized with a higher probability of fires in Southern Spain. Adults emerging in June and July may await the summer fires in order to exploit the abundance of resources offered by areas that are recently burned.

### Phenology of *Aradus flavicornis*

According to the data obtained from the literature (HEISS, 1990, 2006, HEISS & ÖNDER, 1991; RIBES, 1968, 1979; RIBES & RIBES, 2001) and our own data, the species has one generation per year. The adults are present



**Fig. 1.** Number of larvae V of *Aradus flavicornis* moult to adults in June and July.

**Fig. 1.** Número de larvas V de *Aradus flavicornis* que mudan a adultos en Junio y Julio.

from early June (HEISS & ÖNDER, 1991) to September (HEISS, 1990, 2006) and probably into October. The larvae are found from February to July. Figure 2 shows a hypothetical life cycle of the species in the Mediterranean region. In dry and warmer regions of the Palearctic region, such as Saudi Arabia and Lybia, the life cycle is displaced to the cooler months of the year (HEISS & PÉRICART, 2007).

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
				????	-----				???		
+++++										?????	++++
							???	?????	oooooooo		?????
Adults -----, Larvae +++++, Eggs oooo											

**Fig. 2.** Hypothetical life cycle of *Aradus flavicornis* in the Mediterranean region.

**Fig. 2.** Ciclo de vida hipotético de *Aradus flavicornis* en la región Mediterránea

### Iberian distribution of *Aradus flavicornis*

Fig. 3 shows that *A. flavicornis* has a typical Mediterranean distribution in the Iberian Peninsula.



Fig. 3. Iberian distribution of *Aradus flavicornis*.

Fig. 3. Distribución ibérica de *Aradus flavicornis*.

**Bibliographic records:** Andorra: Llorçs, (HEISS & PÉRICART, 2007); Spain: Balearic Islands: Mallorca, Cala Fornells, (HEISS & PÉRICART, 2007); Barcelona: (HEISS & PÉRICART, 2007); Castellar de N'Hug, (RIBES 1968); Barcelona, Cardedeu, Matadepera, Valldoreix, (RIBES & RIBES, 2001); Cádiz: Olvera, (HEISS & PÉRICART, 2007); San Roque, (RIBES, 1979); Córdoba, (HEISS & PÉRICART, 2007); Gerona: (HEISS & PÉRICART, 2007); Bell-lloc (RIBES, 1984); Lérida: (HEISS & PÉRICART, 2007); Coll de Nargó, (RIBES & RIBES, 2001); Madrid; Batres, El Escorial (HEISS & PÉRICART, 2007); Madrid, (BOLÍVAR & CHICOTE, 1879); Madrid, (GÓMEZ MENOR, 1956 b); Portugal: Douro Litoral, Leça de Palmeira, (SEABRA, 1926; SEABRA, 1931); ESTREMADURA: Ansião, Leiria, (BAENA & ZUZARTE, 2012).

**Internet records:** Castellón (SOLÉ, 2011); Valencia (MARTÍNEZ, 2013)

**Material studied:** Cádiz: Camila, Chiclana de la Frontera, 4-VII-2012, 1 ex., P. Coello leg. (Col. Baena): La Línea de la Concepción, road from Estepona to Santa Margarita, Finca el Pavero, 23-II-2011, 2 larvae V, under barks of burnt branches of

*Pistacia lentiscus* J.L. Torres leg., became adults 18-VI-2011; San Roque, El Pino stream, behind El Almendral, 41 larvae V, under dead and burnt logs of *Populus nigra* that had burned the previous summer, J.L. Torres leg. 39 larvae that moulted to adults from 18th of June to 25th July, with two failing their moults: Jaén: Puente de la Sierra, Urbanización Las Olivas. Km. 5,8, Carretera de Otfíñar, 9-VII-2013, 1 ex., at light, M. López leg. (col. Baena).

## DISCUSSION

The presence of infrared receptors in the prothorax of *A. flavicornis* and our field observations seem to confirm that this species uses burnt trees and shrubs to complete its life cycle. However, there are some unanswered questions in this matter:

a) Is pyrophily the only strategy of *Aradus flavicornis*, or only an adaptation to be able to exploit an abundant, temporary and unexploited resource?

b) If pyrophily is an alternative strategy, what are the typical habits of the species?

c) Is *A. flavicornis* a phytophagous species with cryptic habitat as suspected by HEISS & PÉRICART (2007), or does it have a similar way of life as other *Aradus* that feed on fungi?

d) What types of fungi could provide a food source for adults and larvae in dead and/or burned wood?

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